LMC INTERNATIONAL

EVALUATION OF MEASURES APPLIED UNDER THE COMMON AGRICULTURAL POLICY TO THE PROTEIN CROP SECTOR

Case Study Monographs

November 2009

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French Protein Crop Sector

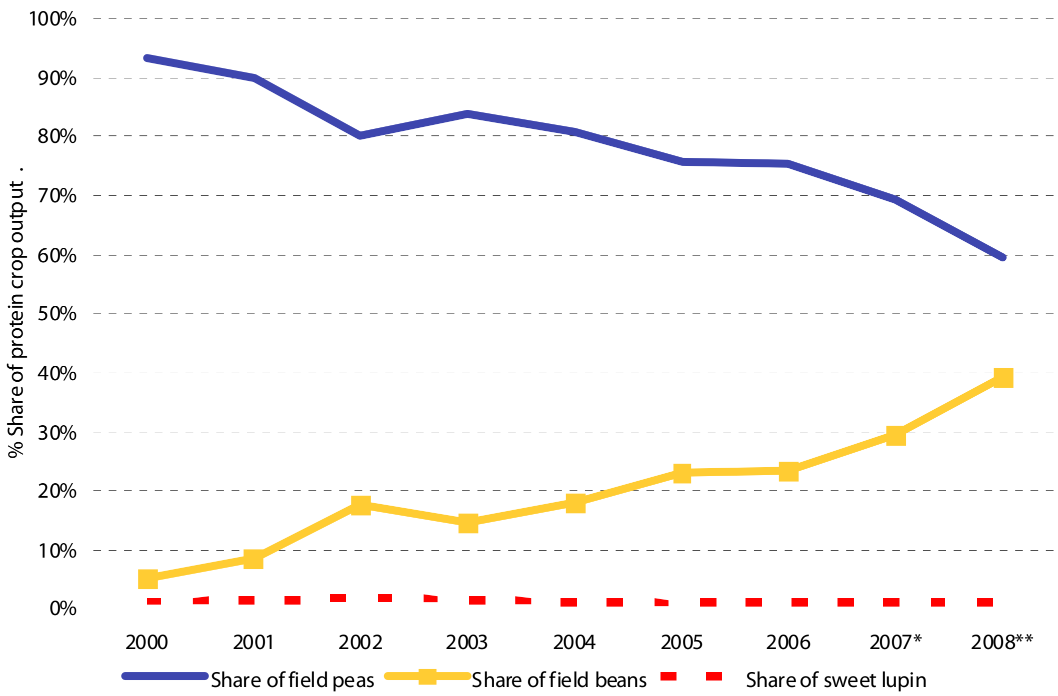
This monograph has the following structure.

- We consider, first, the development of the protein crop sector within France
- Then, we review the development of alternative cereals, oilseed and protein (COP) crop production within the country.
- We describe the main production systems applied to protein crops, notably as regards crop rotations.
- We then analyse gross margins on protein crops vs. those on alternative COP crops.
- We present analysis from the FADN database of the significance of protein crops in French farm incomes.
- We review the development of the local feed compounding sector and its attitudes towards the use of protein crops in their feed mixtures.
- We summarise the evidence collected during the fieldwork. The main tools of investigation consisted of questionnaires administered to protein crop farmers and interviews with feed compounders.
- We conclude with a discussion of the impact of the CAP measures upon the local protein crop sector.

1. The development of the protein crop sector

Among protein crops in France, field peas are the one that has consistently accounted for the largest share of both area and production. They are followed by field beans, and sweet lupins account for a very small share of the area and production. Since 2000, the areas and output of the three protein crops traced out quite different patterns, as may be seen from Diagram FR.1. The share of field peas in protein crop production fell from 93.3% in 2000 to 59.6% in 2008, while the share of field beans rose from 5.4% to 39.3%. The share of sweet lupins remained fairly stable at around 1.5%.

Diagram FR.1: Protein Crops: composition of production, 2000-2008



Source: UNIP & Agreste. * Provisional; ** Estimated

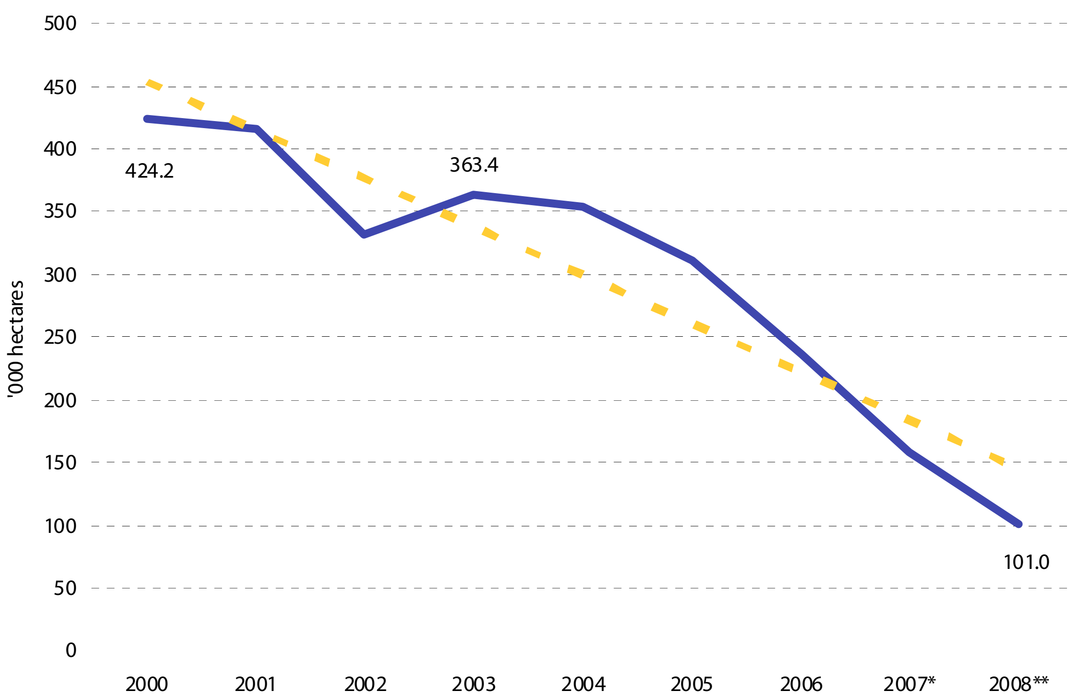
- The most striking change has been the sharp reduction in the area planted to field peas, which declined from 424,000 hectares in 2000 to an estimated 101,000 hectares in 2008 (Diagram FR.2).
- Over the same eight years, the area under field beans (Diagram FR.4) rose from 26,000 to 61,000 hectares.
- In terms of yields, Diagram FR.3 reveals that field pea yields have remained fairly stable, close to 45 quintals per hectare over the period under review.
- Yields of field beans traced out an upward trend from approximately 40 to approximately 50 quintals per hectare (see Diagram FR.5).
- The area of sweet lupins declined appreciably (Diagram FR.6). It dropped from 11,000 to 3,000 hectares. At the same time, lupin yields tended to rise between 2000 and 2008 (Diagram FR.7).

Tables FR.1 to FR.3 present the national data separately for each protein crop, covering areas, production and yields. The tables also provide estimates of the volumes sold, and the volumes used for seed and those destined for on-farm use. Aggregate information for all three crops combined is listed in Table FR.4.

In terms of on-farm use, the tables indicate that a minority of field pea and field bean production is consumed on farm (estimated at less than 25% for both crops over the period since 2000). In contrast, the on-farm use of sweet lupins is high, exceeding 80% of total production by 2007 and 2008.

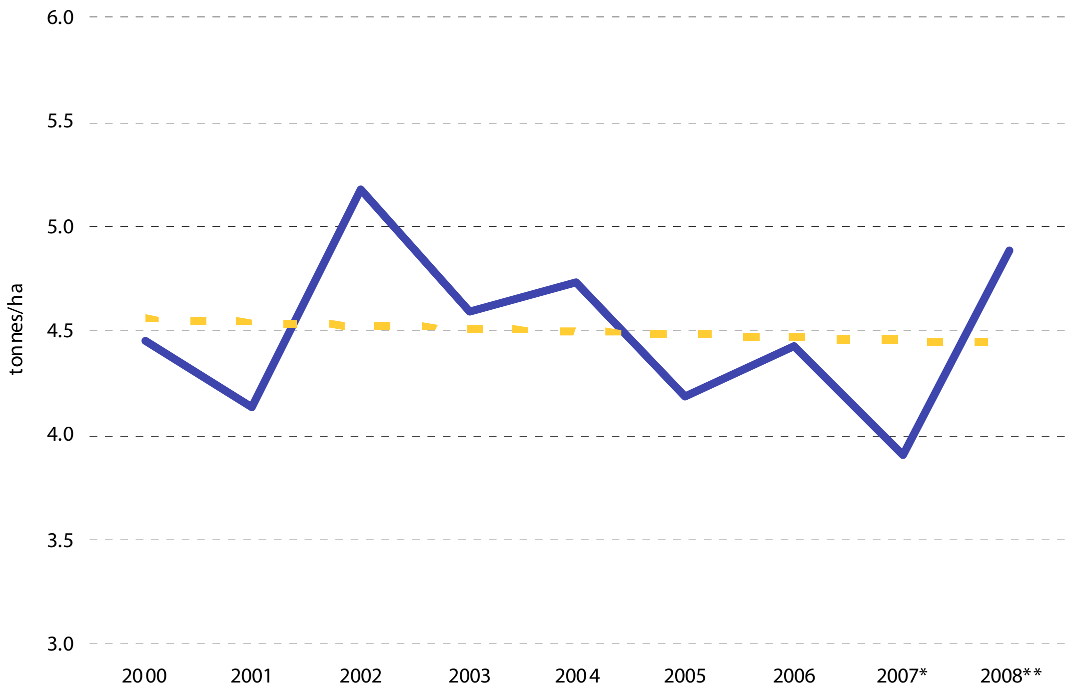
This analysis suggests that the virtual disappearance of sweet lupins from the French wholesale market in recent years can be explained by the slump in the volumes sold to traders and end-users over the same period.

Diagram FR.2: Area planted to field peas in France, 2000-2008



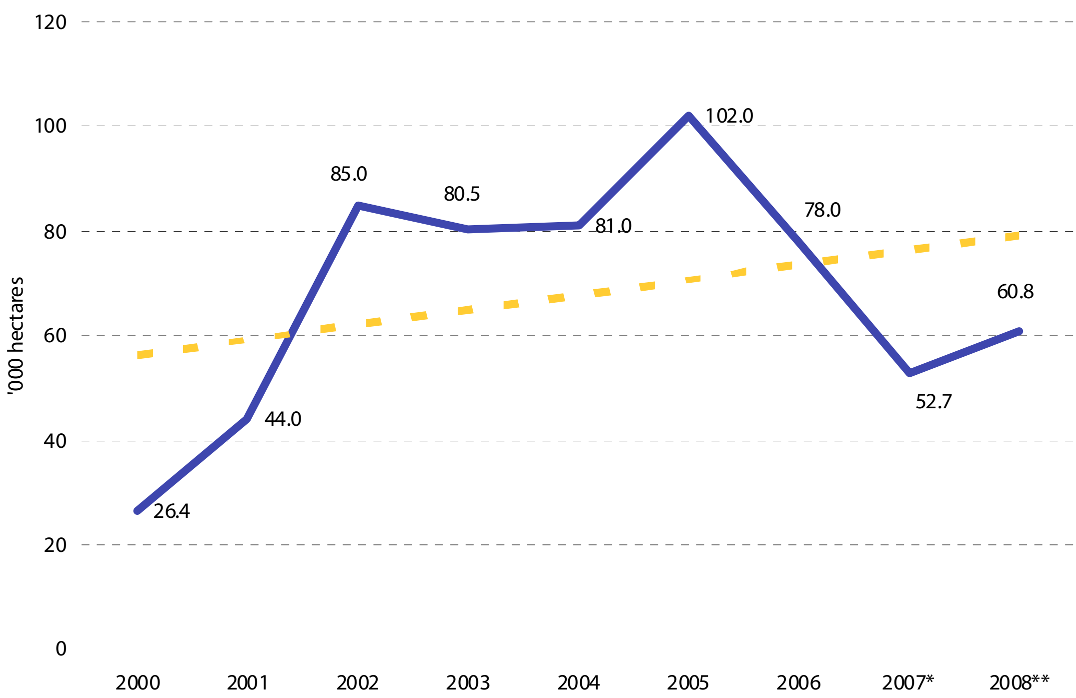
Source: UNIP & Agreste. * Provisional; ** Estimated

Diagram FR.3: Field pea yields in France, 2000-2008



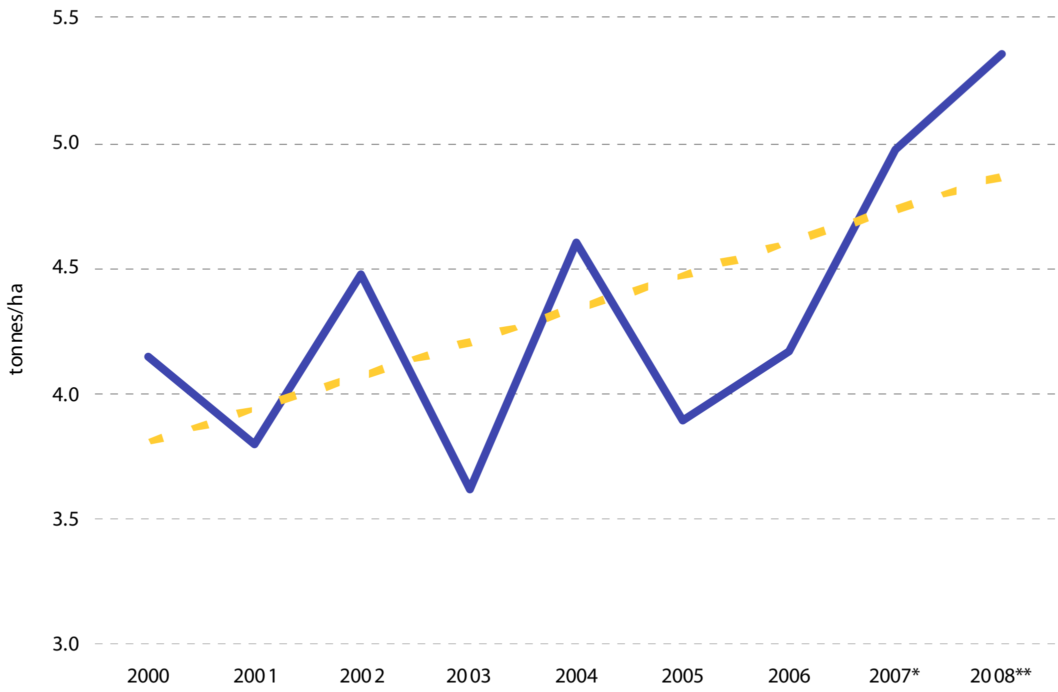
Source: UNIP & Agreste. * Provisional; ** Estimated

Diagram FR.4: Area planted to field beans in France, 2000-2008



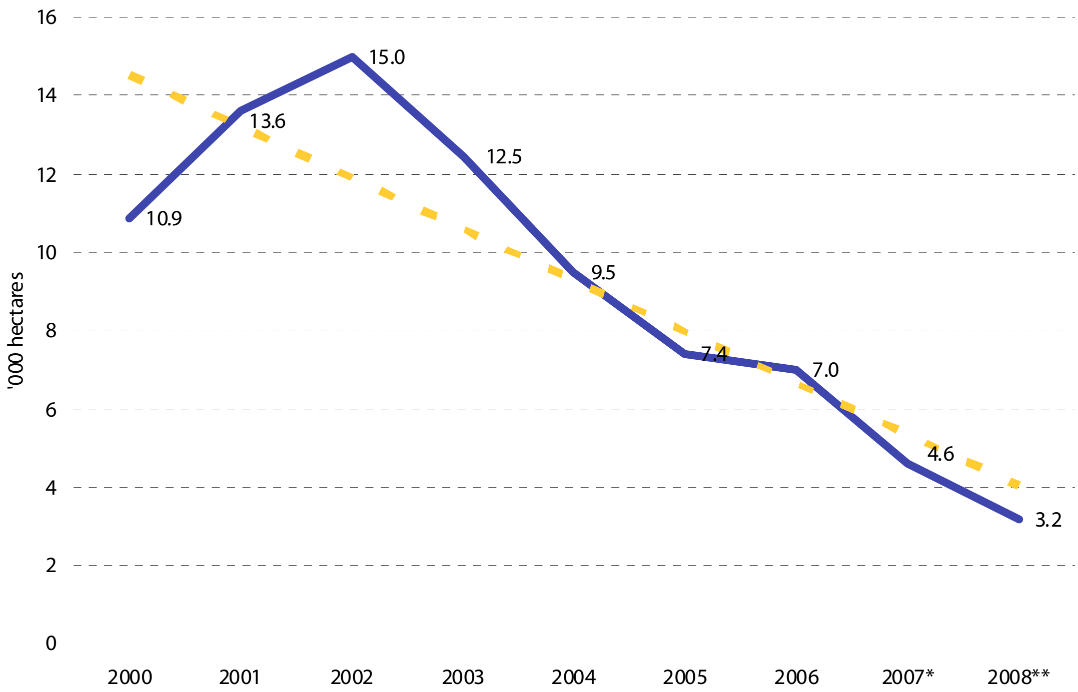
Source: UNIP & Agreste. * Provisional; ** Estimated

Diagram FR.5: Field bean yields in France, 2000-2008



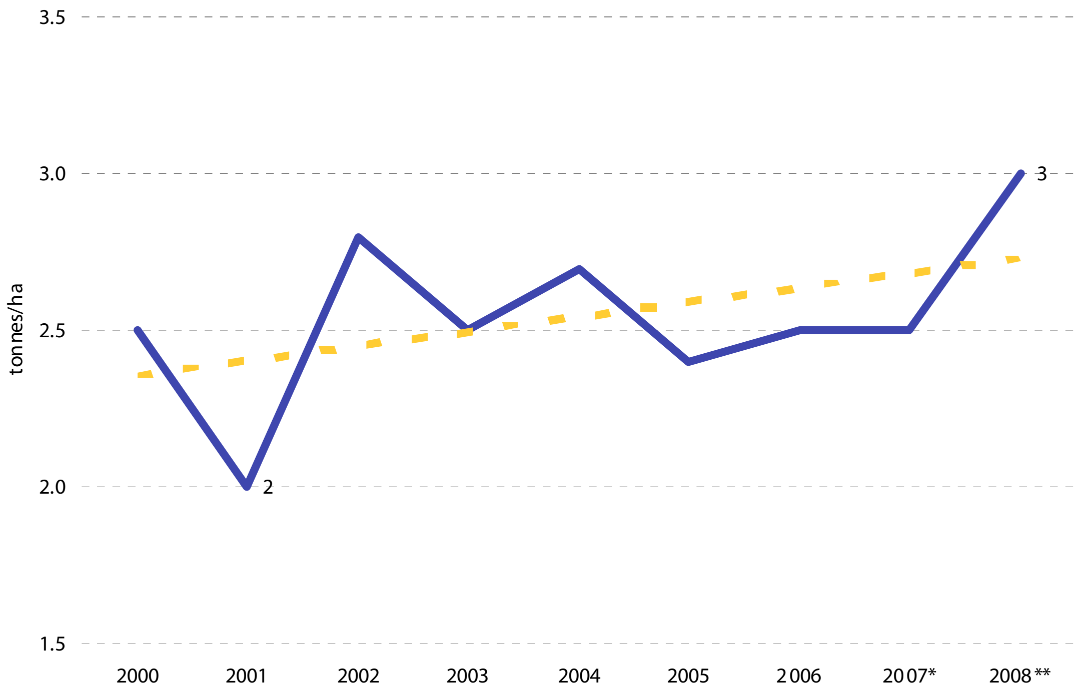
Source: UNIP & Agreste. * Provisional; ** Estimated

Diagram FR.6: Area planted to sweet lupins in France, 2000-2008



Source: UNIP & Agreste. * Provisional; ** Estimated

Diagram FR.7: Sweet lupin yields in France, 2000-2008



Source: UNIP & Agreste. * Provisional; ** Estimated

Table FR.4 reveals that overall French production of protein crops experienced a substantial reduction from 2000 to 2008, falling from 2.03 million tonnes to 0.83 million tonnes. At the same time, volumes sold onto the market dropped from 1.73 million to 0.60 million tonnes.

Field pea output and sales have been very weak (Table FR.5). Sales in 2008 were less than 22% of their 2000 volume. While production has fallen by almost 75%, imports remained modest, while exports remain close to half national output in many years (trade data are provided in Table FR.7). Among reasons for the slump in output were attacks of a fungal root disease, *aphanomyces*. This was known to be a potential problem in the 1980s, but its prevalence and intensity were considered by producers and their associations to have increased in impact, and the associated financial consequences, in recent years, particularly in the northern regions, which are the main areas in which field peas are grown. Producers try to avoid land where the disease has already developed, as there are no cost-effective means of fighting it. Growers are also increasingly reluctant to plant the crop on land free of the disease, as they fear that a new field pea crop could attract this pest.

Tables FR.6 and FR.7 demonstrate that a large proportion of field bean production (over two thirds in the latest two crop years) is exported. Since 2002, most of these exports have gone to Egypt, where it is popular as a foodstuff.

Table FR.1: Field peas planted areas, yields, production, and sales

		2000	2001	2002	2003	2004	2005	2006	2007*	2008**
Planted area	*hectares*	424,200	416,100	331,400	363,400	354,000	311,000	235,700	158,000	101,000
Yield	*tonnes/ha*	4.5	4.1	5.2	4.6	4.7	4.2	4.4	3.9	4.9
Production	*tonnes*	1,890,000	1,720,000	1,715,000	1,670,000	1,675,000	1,300,000	1,040,000	618,000	493,000
Sales	*tonnes*	1,652,000	1,346,000	1,365,000	1,385,000	1,395,000	1,150,000	860,000	450,000	358,000
Seeds	*tonnes*	105,000	85,000	90,000	89,000	78,000	58,000	36,000	23,000	25,000
Apparent on-farm consumption	*tonnes*	133,000	289,000	260,000	196,000	202,000	92,000	144,000	145,000	110,000
As % of production		7%	17%	15%	12%	12%	7%	14%	23%	22%

Table FR.2: Field beans planted areas, yields, production, and sales

		2000	2001	2002	2003	2004	2005	2006	2007*	2008**
Planted area	*hectares*	26,350	44,000	85,000	80,500	81,000	102,000	78,000	52,700	60,800
Yield	*tonnes/ha*	4.2	3.8	4.5	3.6	4.6	3.9	4.2	5.0	5.4
Production	*tonnes*	109,000	167,000	381,000	291,000	373,000	397,000	325,000	262,000	325,000
Sales	*tonnes*	74,000	134,000	270,000	200,000	275,000	305,000	230,000	190,000	241,000
Seeds	*tonnes*	11,000	20,000	20,000	20,000	26,000	17,000	12,000	13,000	14,000
Apparent on-farm consumption	*tonnes*	24,000	13,000	91,000	71,000	72,000	75,000	83,000	59,000	70,000
As % of production		22%	8%	24%	24%	19%	19%	26%	23%	22%

Table FR.3: Sweet lupins planted areas, yields, production, and sales

		2000	2001	2002	2003	2004	2005	2006	2007*	2008**
Planted area	*hectares*	10,850	13,600	15,000	12,450	9,500	7,400	7,000	4,600	3,200
Yield	*tonnes/ha*	25.0	20.0	28.0	25.0	27.0	24.0	25.0	25.0	30.0
Production	*tonnes*	27,000	27,000	42,000	31,000	26,000	18,000	17,500	11,500	9,600
Sales	*tonnes*	8,900	5,700	5,200	4,850	3,200	3,200	3,800	1,500	600
Seeds	*tonnes*	2,720	3,000	2,490	1,900	1,480	1,400	920	640	1,000
Apparent on-farm consumption	*tonnes*	15,380	18,300	34,310	24,250	21,320	13,400	12,780	9,360	8,000
As % of production		57%	68%	82%	78%	82%	74%	73%	81%	83%

Source for all three Tables: UNIP and Agreste
Notes: *Provisional, ** Estimates

Table FR. 4: Protein crops planted areas, yields, production, and sales

		2000	2001	2002	2003	2004	2005	2006	2007*	2008**
Planted area	*hectares*	461,400	473,700	431,400	456,350	444,500	420,400	320,700	215,300	165,000
Yield	*tonnes/ha*	43.9	40.4	49.6	43.7	46.7	40.8	43.1	41.4	50.2
Production	*tonnes*	2,026,000	1,914,000	2,138,000	1,992,000	2,074,000	1,715,000	1,382,500	891,500	827,600
Sales	*tonnes*	1,734,900	1,485,700	1,640,200	1,589,850	1,673,200	1,458,200	1,093,800	641,500	599,600
Seeds	*tonnes*	118,720	108,000	112,490	110,900	105,480	76,400	48,920	36,640	40,000
Apparent on-farm consumption	*tonnes*	172,380	320,300	385,310	291,250	295,320	180,400	239,780	213,360	188,000
As % of production		9%	17%	18%	15%	14%	11%	17%	24%	23%

Source: UNIP and Agreste
Notes: * Provisional, ** Estimates

Table FR.5: Field peas: supply and demand balance ('000 tonnes)

1000 Tons	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/2008 Est.	2008/2009 Est.
SUPPLY										
Production	**2,708.0**	**1,937.0**	**1,659.0**	**1,658.0**	**1,680.0**	**1,620.0**	**1,290.0**	**986.0**	**582.0**	**465.3**
End-of-year stock	**268.0**	**260.2**	**305.0**	**181.0**	**268.0**	**181.0**	**142.0**	**123.0**	**77.0**	**54.0**
Sales (1)	**2,498.1**	**1,725.0**	**1,407.8**	**1,446.0**	**1,438.0**	**1,452.0**	**1,199.0**	**911.0**	**472.8**	**375.0**
of which seeds	*100.2*	*66.5*	*71.5*	*73.0*	*61.0*	*62.0*	*46.0*	*38.0*	*23.0*	*17.0*
Imports	**7.8**	**65.5**	**36.9**	**15.0**	**12.0**	**6.0**	**8.0**	**8.0**	**36.0**	**10.0**
*of which EU**	*5.5*	*16.0*	*15.6*	*12.0*	*8.0*	*5.0*	*6.0*	*5.0*	*6.3*	*5.0*
and to third countries	*2.3*	*49.5*	*21.3*	*3.0*	*3.0*	*1.0*	*2.0*	*3.0*	*29.7*	*5.0*
Total Supply	**2,773.9**	**2,050.7**	**1,749.7**	**1,642.0**	**1,718.0**	**1,640.0**	**1,349.0**	**1,042.0**	**585.8**	**439.0**
DEMAND										
Industrial use	**1,531.0**	**1,282.0**	**847.0**	**542.0**	**1,000.0**	**915.0**	**768.0**	**500.0**	**296.9**	**225.0**
Feed and other non-food industry	*1,463.0*	*1,050.0*	*627.0*	*352.0*	*763.0*	*710.0*	*580.0*	*340.0*	*111.9*	*70.0*
Other feed (2)		*160.0*	*150.0*	*110.0*	*170.0*	*140.0*	*125.0*	*100.0*	*40.0*	*20.0*
Food industry	*15.0*	*17.0*	*20.0*	*23.0*	*25.0*	*25.0*	*25.0*	*30.0*	*120.0*	*120.0*
Seeds	*53.0*	*55.0*	*50.0*	*57.0*	*42.0*	*40.0*	*38.0*	*30.0*	*25.0*	*15.0*
Exports	**1,085.6**	**476.8**	**642.5**	**795.0**	**537.0**	**583.0**	**458.0**	**465.0**	**245.4**	**185.0**
*of which EU**	*895.9*	*455.4*	*277.8*	*252.0*	*420.0*	*493.0*	*361.0*	*260.0*	*161.7*	*90.0*
and to third countries	*189.7*	*21.4*	*364.7*	*543.0*	*117.0*	*90.0*	*97.0*	*205.0*	*83.7*	*95.0*
Total Demand	**2,616.6**	**1,758.8**	**1,489.5**	**1,337.0**	**1,536.0**	**1,498.0**	**1,226.0**	**965.0**	**542.3**	**410.0**
End-of-year stock (end June)	**157.3**	**291.9**	**260.2**	**305.0**	**181.0**	**142.0**	**123.0**	**77.0**	**43.5**	**29.0**

* EU-25 since 2004/05, EU-15 before; EU-27 since 2007/08
(1) Seeds are included
(2) Direct purchases from traders by livestock farmers are included in "Other feed"
Source: ONIGC

Table FR.6: Field beans: supply and demand balance (tonnes)

Tons	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09*
SUPPLY										
Production	**61,000**	**109,000**	**167,000**	**381,000**	**291,000**	**373,000**	**397,000**	**325,000**	**262,000**	**325,000**
End-of-year stock	4,800	4,500	6,000	18,000	20,000	9,000	51,000	47,000	41,000	9,000
Imports	2,100	3,400	2,000	16,000	2,000	2,000	6,000	6,000	7,000	4,000
*of which EU**	*1,700*	*3,200*	*1,500*	*15,500*	*1,500*	-	*5,500*	*5,500*	*6,700*	-
and to third countries	*400*	*200*	*500*	*500*	*500*	-	*500*	*500*	*300*	-
Total Supply	**67,900**	**116,900**	**175,000**	**415,000**	**313,000**	**384,000**	**454,000**	**378,000**	**310,000**	**338,000**
DEMAND										
Domestic use	**28,200**	**69,800**	**88,000**	**217,000**	**135,000**	**127,000**	**155,000**	**146,000**	**93,000**	**91,000**
of which seeds	*6,500*	*11,000*	*21,000*	*20,000*	*20,000*	*26,000*	*17,000*	*12,000*	*13,000*	*14,000*
*Food**	*13,000*	*13,000*	*13,000*	*13,000*	*13,000*	*13,000*	*11,000*	*9,000*	*7,000*	*7,000*
*Feed***	*8,700*	*45,800*	*54,000*	*184,000*	*102,000*	*88,000*	*127,000*	*125,000*	*73,000*	*70,000*
Exports	**35,200**	**41,100**	**69,000**	**178,000**	**169,000**	**206,000**	**252,000**	**191,000**	**208,000**	**190,000**
*of which EU****	*34,700*	*34,600*	*68,000*	*44,000*	*25,000*	*26,000*	*70,000*	*49,000*	*25,000*	*30,000*
*and to third countries*****	*500*	*6,500*	*1,000*	*134,000*	*144,000*	*180,000*	*182,000*	*142,000*	*183,000*	*160,000*
End-of-year stock	*4,500*	*6,000*	*18,000*	*20,000*	*9,000*	*51,000*	*47,000*	*41,000*	*9,000*	*57,000*
Total Demand	**67,900**	**116,900**	**175,000**	**415,000**	**313,000**	**384,000**	**454,000**	**378,000**	**310,000**	**338,000**
% of exports	55.5%	37.1%	43.9%	45.1%	55.6%	61.9%	61.9%	56.7%	69.1%	67.6%

* Mostly milling industry
** Feed industry and on-farm feed use
*** Mostly for feed
**** Mostly to Egypt for food

Table FR.7: French Foreign Trade, Combining Intra- and Extra-EU Trade, in Protein Crops, 2000-2007 (tonnes)

	Field peas			Field beans			Sweet lupins		
	Exports	Imports	Net Exports	Exports	Imports	Net Exports	Exports	Imports	Net Exports
2000	765,807	54,953	710,854	35,917	3,420	32,497	413	149	263
2001	565,025	41,316	523,709	46,380	1,923	44,457	226	174	53
2002	835,857	17,856	818,001	134,789	7,707	127,082	340	86	254
2003	528,207	9,117	519,090	206,982	10,533	196,449	389	430	-41
2004	566,173	11,767	554,406	196,008	1,807	194,201	294	1,263	-969
2005	488,287	6,123	482,164	159,981	6,416	153,565	460	1,052	-592
2006	426,479	4,298	422,181	247,450	3,918	243,532	399	850	-451
2007	342,660	23,403	319,257	194,671	7,274	187,396	403	2,034	-1,631

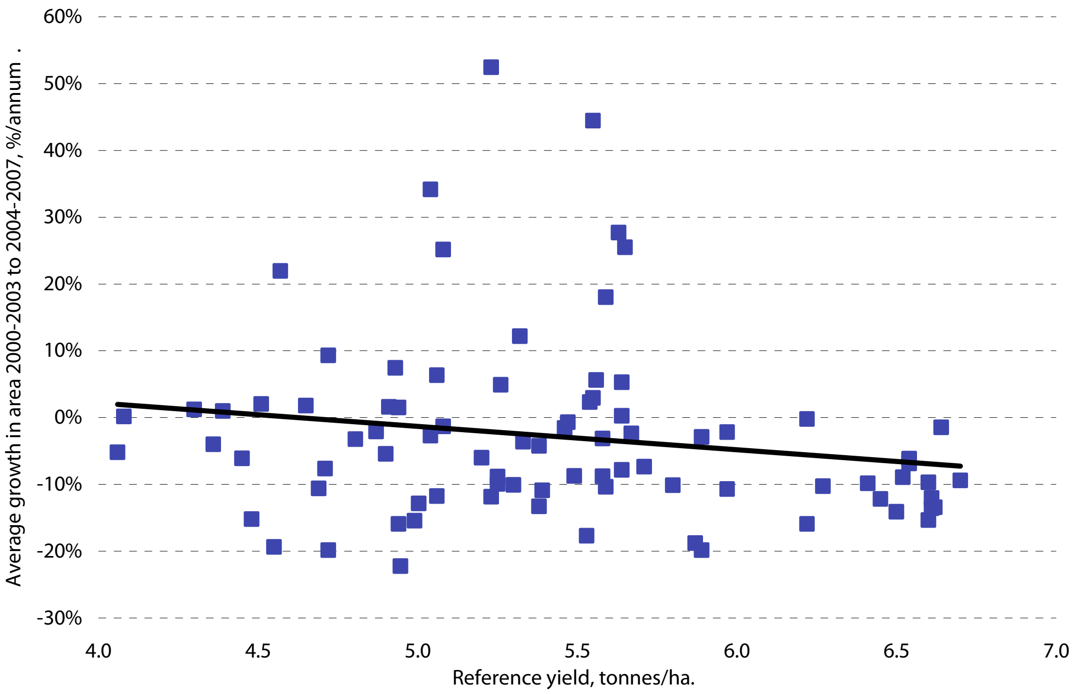
Source: FAO, COMEX

1.1 The regional distribution of production

The adoption of a uniform €55.57 special aid per hectare would be expected to generate different supply responses from producers in areas with low and high reference yields for "other cereal" (non-maize) crops prior to 2003. The former would be expected to have gained in protein crop revenues per hectare as a result of the reform, while the latter would be expected to have lost income. To test this assumption, we prepared Diagram FR.8, relating changes in field pea areas by *département* in France between 2003/04 and 2007/08 with the reference yields by *département* (where several reference yields apply to a *département*, a simple mean is applied).

Diagram FR.8 reveals that field pea areas rose faster (or fell more slowly) after 2003 in those regions with lower reference yields under regionalisation plans. Areas rose more slowly in regions with higher reference yields. This analysis does not take account of the impact of the 2003 reform on the profitability of alternative crops, nor the external factors, notably world market price movements, which would have affected plantings of such crops.

Diagram FR.8: Proportional growth in field pea areas, 2000-2003 to 2004-2007, vs. reference yields under the regionalisation plan by *département*, France



Source: SSP, Statistique Agricole Annuelle;

Tables FR.8 and FR.9 present details of the changes in field pea and field bean planted areas by administrative regions between 2000 and 2007.

It is evident that northern areas predominate in the production of both major protein crops, but the trends in area differed markedly by crop. In 2008, only two of France's 22 administrative regions (Picardie and Centre) planted more than 20,000 hectares of field peas. In 2000, eight regions planted more than 20,000 hectares.

Field bean areas moved, in general, in the opposite direction. In 2000, no region planted more than 6,000 hectares of field beans. In 2008, both Ile de France and Picardie planted over 14,000 hectares. Within the national picture, however, plantings increased significantly in Northern France, while it decreased in Southern France.

Sweet lupin areas tumbled almost 80% between 2002 and 2008. France, initially a small net exporter, became a growing, but still modest, net importer after 2002 (see Table FR.7).

Table FR.8: Field peas: change in planted areas by administrative regions (hectares)

	Change	2000	2001	2002	2003	2004	2005	2006	2007
Ile de France	↘↘	37,350	34,400	26,400	30,050	32,200	29,750	24,450	16,150
Champagne-Ardenne	↘↘	65,750	52,500	41,550	50,600	51,750	44,800	24,900	11,855
Picardie	↘↘	82,700	72,400	54,250	61,400	60,750	50,900	41,400	27,260
Haute Normandie	↘↘	39,700	40,900	29,300	31,300	28,450	24,000	18,290	12,975
Centre	↘↘	59,750	61,450	50,800	55,600	53,450	46,950	37,100	24,390
Basse Normandie	↘↘	26,700	28,600	20,700	23,600	20,550	17,050	12,900	9,785
Bourgogne	↘	11,870	11,850	11,900	13,160	14,080	12,950	10,470	7,845
Nord-Pas de Calais	↘↘	22,400	21,050	14,850	13,550	15,000	11,600	8,255	4,065
Lorraine	↗	1,175	2,730	2,435	3,175	4,705	4,265	2,805	1,848
Alsace		20	55	66	61	100	155	182	179
Franche-Comte		120	285	208	236	300	315	390	467
Pays de la Loire	↘↘	20,050	24,000	19,450	20,800	16,930	14,670	12,465	8,675
Bretagne	↘↘	9,170	10,500	6,500	6,200	4,355	4,335	3,715	2,500
Poitou-Charentes	↘↘	16,480	19,450	15,600	16,750	17,500	18,300	12,960	8,880
Aquitaine		1,750	3,075	2,595	2,425	1,865	2,160	1,904	1,339
Midi-Pyrenees	↘	15,440	18,850	19,350	19,100	17,250	16,320	13,465	12,500
Limousin		265	805	430	385	350	308	244	223
Rhone-Alpes	↘↘	7,970	7,050	6,290	6,085	6,515	5,535	3,845	2,560
Auvergne	↘↘	2,320	2,813	3,135	3,115	2,385	1,560	1,503	1,096
Languedoc-Roussillon	↗	1,300	1,830	3,590	3,608	3,250	2,830	2,305	1,940
Provence-Côte d'Azur	↘	1,920	1,505	2,000	2,200	2,265	2,235	2,150	1,467
Corse		0	2	1	0	0	11	2	0
FRANCE		**424,200**	**416,100**	**331,400**	**363,400**	**354,000**	**311,000**	**235,700**	**158,000**

Source: UNIP

Table FR.9: Field beans: change in planted areas by administrative regions (hectares)

	Change	2000	2001	2002	2003	2004	2005	2006	2007	2008*
Ile de France	↗↗	5,815	7,495	10,565	10,915	12,010	16,560	15,360	12,450	*14,540*
Champagne-Ardenne		3,085	7,200	12,960	9,620	9,115	10,780	7,075	2,980	*3,550*
Picardie	↗↗	3,410	6,000	12,160	15,210	22,150	32,550	20,600	14,515	*19,900*
Haute Normandie	↗	330	1,550	1,690	2,350	3,020	4,250	4,855	4,295	*5,400*
Centre		1,025	1,800	6,880	5,970	5,330	4,900	4,300	2,195	*1,990*
Basse Normandie	↗↗	525	720	1,980	2,270	2,025	2,310	2,735	2,140	*2,550*
Bourgogne		450	970	3,260	2,605	1,750	1,445	1,079	745	*810*
Nord-Pas de Calais	↗↗	880	1,100	2,000	3,550	5,250	9,190	6,920	3,580	*3,780*
Lorraine		360	1,100	2,125	1,850	1,450	1,217	804	510	*380*
Alsace		20	40	55	55	61	45	42	40	*35*
Franche-Comte		55	135	475	615	472	410	316	260	*165*
Pays de la Loire		1,120	2,450	3,990	3,945	2,685	2,480	2,825	1,965	*1,730*
Bretagne		750	1,100	1,620	1,635	1,155	1,055	1,012	698	*950*
Poitou-Charentes	↘	1,035	1,260	2,865	3,645	2,205	1,515	1,382	810	*740*
Aquitaine	↘	1,385	1,470	3,765	3,455	2,280	2,625	2,050	1,290	*1,000*
Midi-Pyrenees	↘	5,765	8,765	16,060	10,910	8,965	9,935	6,195	3,820	*2,835*
Limousin		35	40	200	165	146	140	110	110	*105*
Rhone-Alpes		45	335	1,055	885	380	172	89	91	*120*
Auvergne		195	375	645	335	275	210	171	118	*110*
Languedoc-Roussillon		60	90	545	445	150	125	49	47	*20*
Provence-Côte d'Azur		3	5	70	35	31	11	11	4	*10*
Corse		2	2	35	35	95	75	19	34	*35*
FRANCE		**26,350**	**44,000**	**85,000**	**80,500**	**81,000**	**102,000**	**78,000**	**52,700**	***60,755***

Source: UNIP
*estimates

1.2 Structure of protein crop production and price determination

According to the French protein sector inter-professional organisation, UNIP, the number of farmers growing protein crops fell over the past decade, from around 57,000 in 1998 to 43,000 in 2004, and the number is said to have fallen further since then. The 2004 figure corresponds to just under 10% of total French COP specialist holdings in 2004. On average, each French protein crop grower that year cultivated slightly less than 11 hectares of protein crops in 2004.

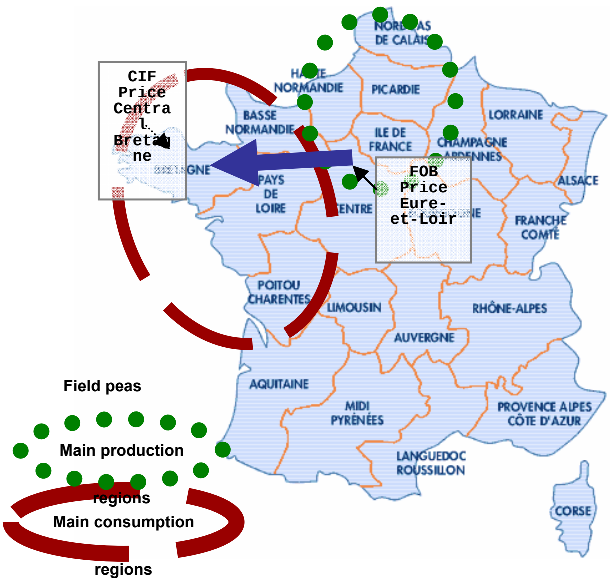
In terms of integration between production and use, for sweet lupins in particular, on-farm use represents a large share of total protein crop production, but on-farm use is also significant for field peas and field beans.

Retained seed use is an important element of on-farm consumption for all protein crops; seed use is identified in Tables FR.1 to FR.6. The latest survey published by the agriculture ministry, in 2006, estimated that 36% of the seeds used for planting field peas were certified. For sweet lupins, approximately 94% of farmers' seed requirements are met from their own production.

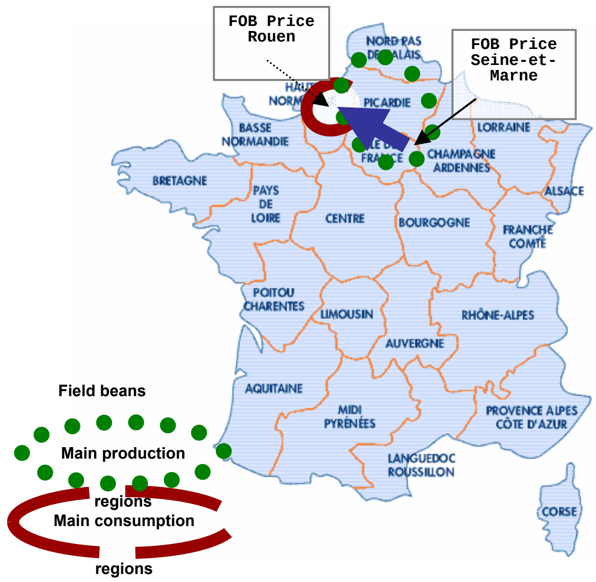
Following the large reduction in the quantities sold by farmers via commercial marketing channels and the structural changes that have occurred among licensed wholesalers (who are also often feed processors), the competitiveness of the protein crop *filière* seems to have suffered. Several interviews identified problems of critical mass within the sector today, with lack of scale a deterrent to research into improved varieties, to the development of chemical sprays to tackle problems such as *aphanomyces*, to the storage of protein crops by feed compounders for mixing throughout the year and to the aggregation of supplies for export.

Reference prices for protein crops throughout France and the wider EU are available for two main producing regions, North and North East of Paris (Aisne, Seine-et-Marne) and West of Paris (Eure-et-Loir); and for one main consumption region and one main export region, Bretagne and Rouen. The most important internal flows for field peas and field beans are depicted in Maps 3.1 and 3.2. There is also a sizeable export demand for peas and beans for feed in neighbouring Belgium and Germany.

Map FR.1: Reference prices for field peas
Major route



Map FR.2: Reference prices for field beans
Major route



2. The development of alternative crop production

Table FR.10 reveals the trends in the areas under each of the major cereals, oilseed and protein (COP) crops since 2000-01, i.e., since before the 2003 reform. The bottom rows of the table permit one to compare areas before and after the reform[1]. The main points to note are:

- The protein crop sector as a whole has contracted significantly in scale since 2004. Between the period from 2000-01 to 2003-04 to the period from 2004-05 to 2008-09, the total protein crop area declined by 29%, and the decline accelerated towards the last year, 2008-09.
- Within the sector, field peas suffered a 38% decline in area, comparing the same periods, averaging 240,000 hectares in the years 2004-05 to 2008-09.
- Field bean areas increased by 37% since 2004, when they were averaged 75,000 hectares. They peaked at 100,000 hectares in 2005-06, but were back down to 61,000 hectares in 2008-09.
- Sweet lupin areas fell at the fastest rate from among the protein crops after the reform, when they were on average 47% lower than in the pre-reform period. The planted areas declined further in recent years to stand at only 4,000 hectares in 2008-09.
- The other COP sectors that lost ground since 2004 were sunflower and maize, which both saw their areas drop by 10% since 2004.
- Among the more significant examples of increases in area among the COP crops were durum wheat (up 30% over the period 2004-05 to 2008-09) and rapeseed (up 23%).
- The most important single COP crop is common wheat. Its area was 4% higher over the years 2004-05 to 2008-09.

The total area under the major COP crops increased by just 1% since 2004. However, in 2008-09, when the compulsory set-aside was set at 0%, the combined area was at its highest level since the turn of the century.

[1] These are harvested areas, whereas those in the previous section are planted areas, which are consistently slightly larger.

Table FR.10: Harvested areas of the major cereals, oilseeds and protein crops in France, 2000-2008 ('000 hectares)

	Protein crop	*Field pea*	*Field bean*	*Sweet lupin*	Rapeseed	Sunflower	Common wheat	Barley	Maize	Durum wheat	Other cereals	Total Area
2000-01	458	429	18	11	1,225	710	4,929	1,573	*1,834*	*337*	*554*	11,620
2001-02	475	417	45	13	1,084	706	4,463	1,705	*1,914*	*306*	*529*	11,181
2002-03	428	338	77	13	1,036	615	4,895	1,643	*1,833*	*336*	*605*	11,392
2003-04	456	367	78	11	1,080	686	4,523	1,758	*1,685*	*353*	*611*	11,153
2004-05	445	357	79	9	1,116	634	4,840	1,626	*1,796*	*405*	*626*	11,488
2005-06	424	316	100	7	1,226	644	4,859	1,602	*1,663*	*421*	*614*	11,453
2006-07	323	239	78	7	1,402	644	4,799	1,670	*1,503*	*453*	*616*	11,410
2007-08	234	173	56	5	1,601	525	4,819	1,703	*1,492*	*458*	*589*	11,421
2008-09	179	114	61	4	1,442	626	5,058	1,797	*1,694*	*431*	*505*	11,732
Average pre-reform	454	388	55	12	1,106	679	4,703	1,670	1,817	333	575	11,336
Average post-reform	321	240	75	6	1,357	615	4,875	1,680	1,630	434	590	11,501
Percentage change	-29%	-38%	37%	-47%	23%	-10%	4%	1%	-10%	30%	3%	1%

Source: FAO, Eurostat. For 2008-09, the data have been derived from estimates prepared by COPA-COGECA.

Note 1: These are harvested areas, whereas the areas in Tables FR.1-FR.4 are planted areas. That explains why the protein crop areas are consistently slightly lower than those presented earlier. However, it should be noted that the data listed here are themselves slightly below the areas on which special aids were paid, where the difference is on average 1-2%.

Note 2: Pre-reform is the period from 2000-01 to 2003-04; post-reform is the period from 2004-05 to 2008-09

3. The production systems applied to protein crops

Protein crops tend to be sown in November and harvested in July. Spring plantings can also occur, in which case the crop is sown in February/March.

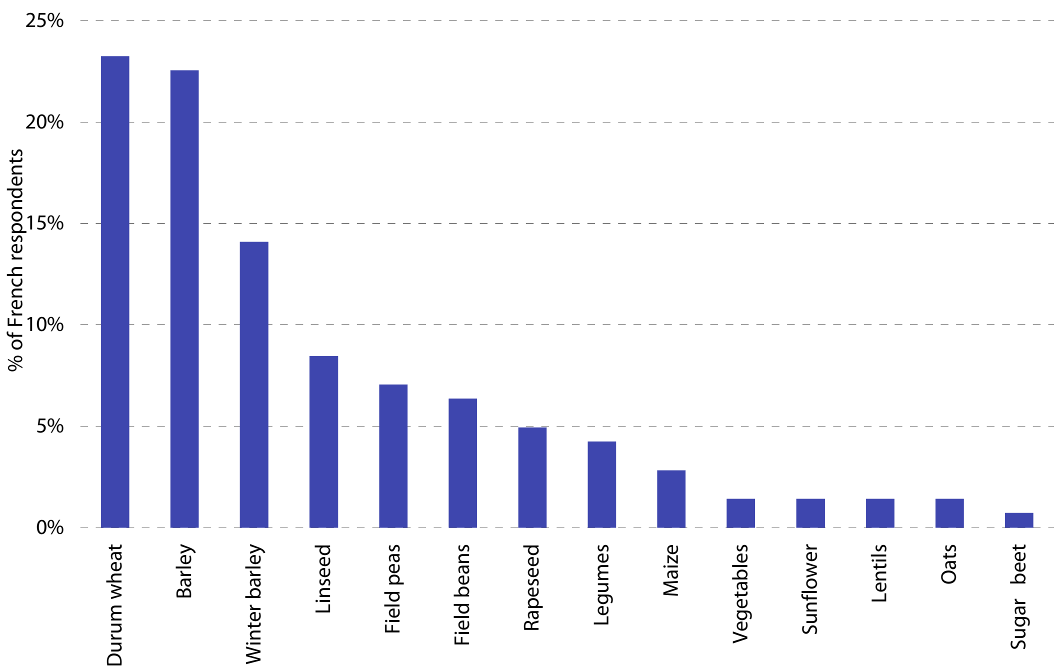
Diagrams FR.9 to FR.12 illustrate the role played by protein crops in the rotation for the sample of French protein crop farmers interviewed during the field work. Diagram FR.9 summarises the shares of each crop in a typical five year rotation by a protein crop producer, while Diagrams FR.10 -FR.12 distinguish between the crops adopted in each year.

- The diagrams reveal that cereal crops take the lion's share of the rotation, accounting for around 60% of the total land use. Protein crops (field peas and field beans for the farmers surveyed) account for around 13% of the rotation. This is consistent with evidence gathered during interviews with farmers, who indicated that field peas, the largest of the protein crops cultivated in France, tend to be planted one year in six to seven to minimise the risk of soil borne diseases and infestation by *aphanomyces*. Besides the protein crops, other break crops are linseed, rapeseed, legumes and lentils.

- Protein crops are mainly planted in the middle of a rotation, while cereals and oilseeds tend to be the crops of choice in the first two years.

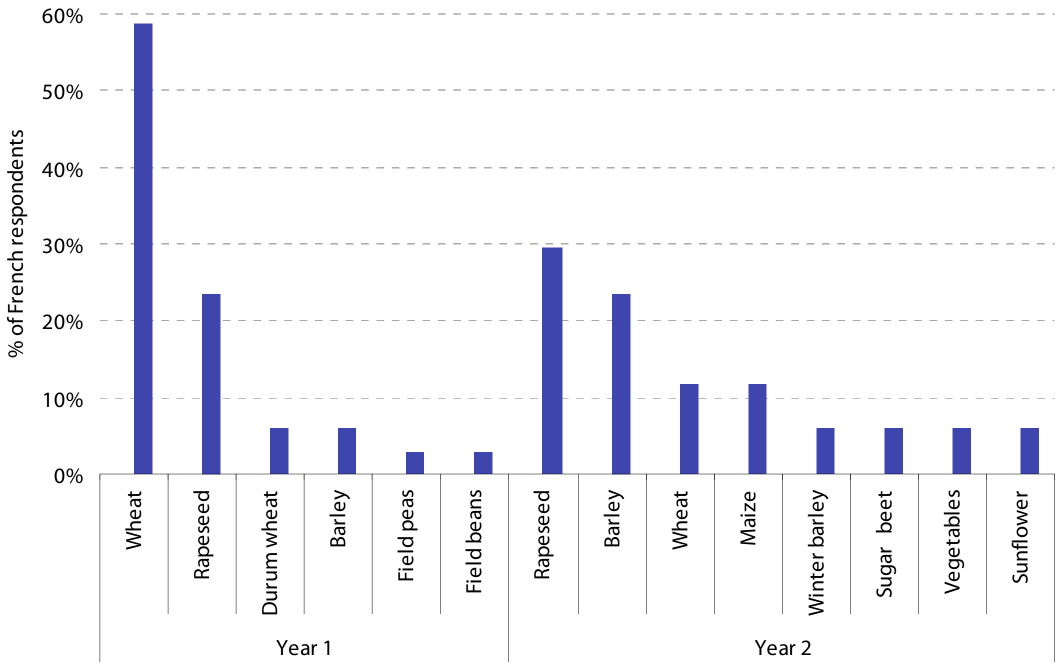
The main reasons cited by farmers for their cultivation of protein crops are listed in Diagram FR.13. Farmers recognise the key benefits offered by protein crops in terms of reduced input use in the following crop and the extra yields achieved in the following cereal crops. The advantages offered by cultivation of protein crops *per se* are also quite important. Another relevant reason is the ability of protein crops to fit into the structure of farming in general, in terms of elements such as the organisation of labour or by providing feed for on-farm use.

Diagram FR.9: Share of arable crops in protein farmers' rotations



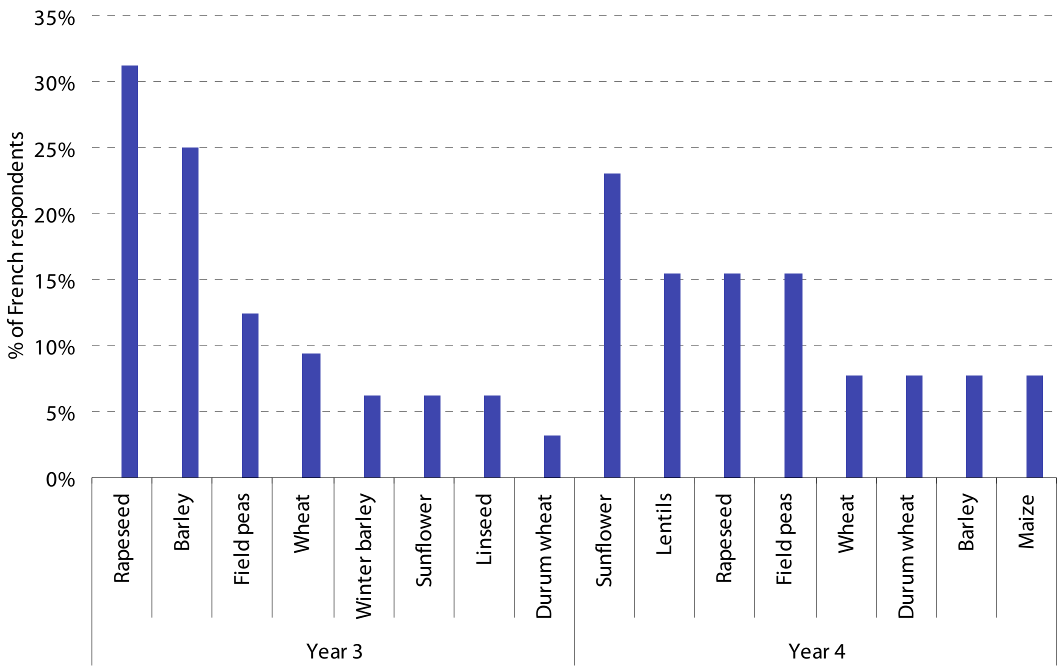
Source: Analysis of producer questionnaires

Diagram FR.10: Share of arable crops in protein farmers' rotation, years 1 and 2



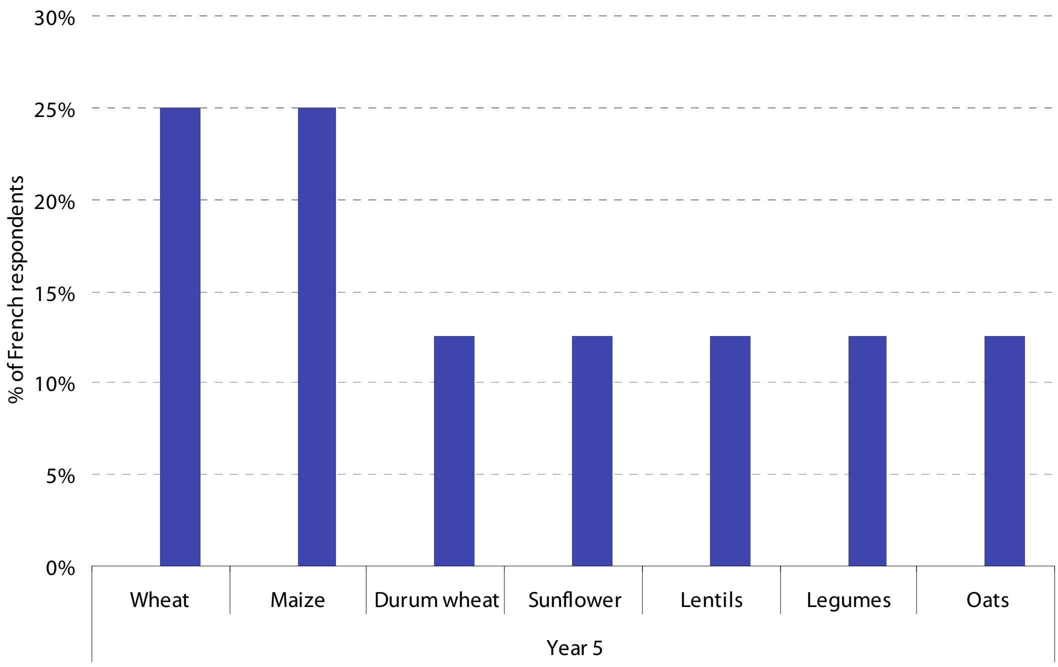
Source: Analysis of producer questionnaires

Diagram FR.11: Share of arable crops in protein farmers' rotation, years 3 and 4



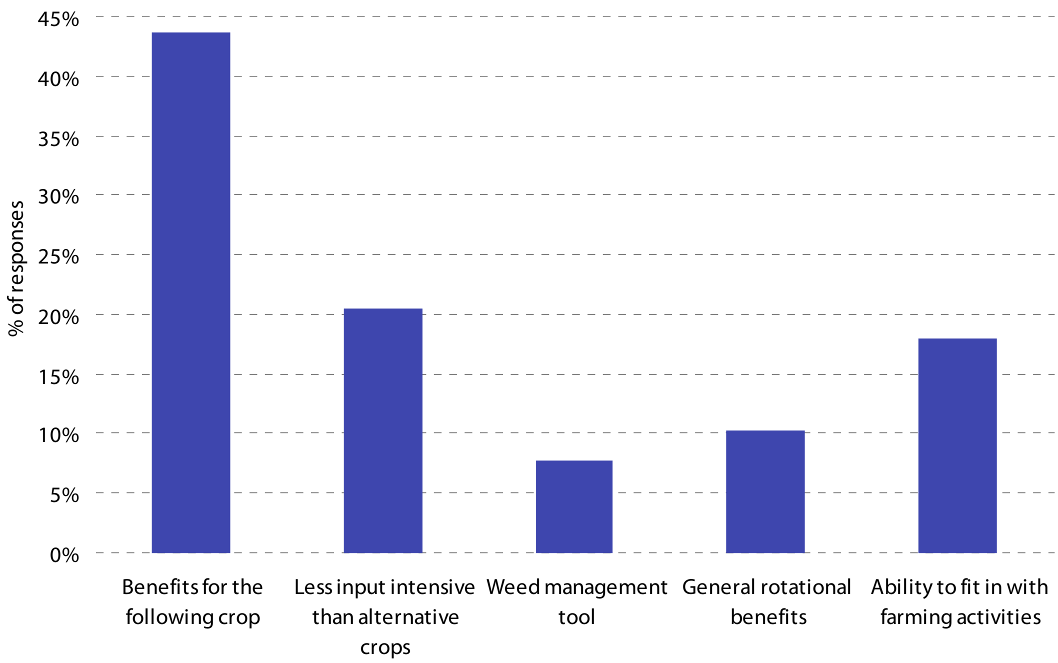
Source: Analysis of producer questionnaires

Diagram FR.12: Share of arable crops in protein farmers' rotation, year 5



Source: Analysis of producer questionnaires

Diagram FR.13: Reasons for the use of protein crops in the rotation cycle



Source: Analysis of producer questionnaires

4. The gross margins on protein crops vs. alternative crops

In this section we analyse regional data on the revenues and margins on protein crops.

4.1 Field pea revenues and costs

Tables FR.11 and FR.12 present details of the revenues (including coupled payments) and variable costs associated with farming field peas in two different regions, Eure-et-Loir and Seine Maritime. The data on yields, prices and the components of costs have been obtained via UNIP. The coupled payment data are derived from analysis of the FADN data for the regions (Centre and Haute Normandie) within which the *Départements* of Eure et Loir and Seine Maritime lie. They are the average coupled payments per hectare of protein crops of those producers in the database who produced protein crops. Estimates of decoupled aid for 2007 are assumed to be the same as that of 2006 as official FADN data for 2007 were not available at the time of writing.

The changes in the regime were implemented in two stages: first the introduction of special protein crop aids of €55.57 per hectare in 2004, and then the application of a 25% retained coupled arable aid when SPS was adopted in France in 2006. The tables reveal that:

- These changes meant that coupled payments were reduced substantially within total field pea revenues from 2006. Modulation reduced the coupled payments further.
- Variable costs were fairly stable for much of the evaluation period, at around €300 per hectare, but increased in the last year, in response to sharply higher costs of inputs, such as fertilisers.
- Field pea gross margins declined from an average of just below €800 per hectare in the period 2000-03 to just below €480 per hectare in the period 2004-08.

Table FR.11: Eure-et-Loir (Centre), revenues and variable costs of field pea production on non-irrigated areas, 2000-2008 (€/hectare)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Yield (t/ha)	4.9	3.3	5.1	4.4	3.9	4.3	4.2	4.0	4.9
Field Pea Price per tonne	135	142	158	141	100	110	135	142	129
Protein Crop Arable Aid (€/ha)	428	441	469	450	372	362	95	95	95
Protein Crop Special Aid (€/ha)					56	54	53	53	53
Return per ha									
Sales at Field Pea Price	658	476	807	620	388	472	567	567	631
Coupled Payment	428	441	469	450	427	416	148	148	148
Total Revenue	1,086	917	1,276	1,071	816	888	714	715	779
Variable Costs									
Seed	105	106	89	79	82	70	63	78	96
Fertiliser	46	46	42	41	41	43	50	52	87
Crop Protection	139	122	153	151	168	141	137	172	181
Other (e.g. irrigation, drying)	14	15	12	13	15	13	12	12	12
Total variable costs	**303**	**288**	**296**	**284**	**306**	**267**	**262**	**314**	**376**
Gross margins	**783**	**628**	**980**	**787**	**510**	**621**	**452**	**401**	**403**

Source: Analysis of UNIP data; FADN database for estimates of coupled support.

The data from Eure-et-Loir cover a longer time period than those for Seine Maritime, but the latter extend over a sufficiently long period to allow a comparison of revenues, costs and, hence, gross margins immediately prior to the reform, in 2003, until after the introduction of single farm payments. Because the data do not extend as far as 2008, the effect of rising input costs in that year is not evident in the table.

For both these regions, we have prepared similar breakdowns of revenues and variable costs for the main alternative crops, which in both these two regions are cereals and oilseeds. These data provide the basis for a comparison of gross margins for the different crops before and after the two phases of implementation of the reform, namely the application of the special aid of €55.57 per hectare for all protein crops from 2004, and the introduction of the SPS, which was undertaken from 2006 in France, but which retained as a coupled payment 25% of the cereal arable aids.

Table FR.12: Seine Maritime (Haute Normandie), revenue and variable costs of field pea production, 2003-2007 (€/ha)

	2003	2004	2005	2006	2007
Yield (t/ha)	5.4	6.1	5.0	5.0	4.3
Field Pea Price per tonne	129	111	113	129	229
Protein Crop Arable Aid (€/ha)	454	393	376	94	94
Protein Crop Special Aid (€/ha)		56	54	53	53
Return per ha					
Field Pea Price	698	678	565	645	985
Coupled Payment	454	448	430	148	147
Total Revenue	**1,152**	**1,126**	**995**	**793**	**1,132**
Variable costs					
Seed	98	101	91	96	107
Fertiliser	54	54	65	71	65
Crop Protection	98	101	91	96	107
Other (e.g. irrigation, drying)	155	172	176	172	199
Total variable costs	**405**	**428**	**423**	**435**	**478**
Gross margins	**747**	**698**	**572**	**358**	**654**

Source: Analysis of UNIP data; FADN database for estimates of coupled support.

4.2 Field pea gross margins in relation to those for alternative crops

The evolution of gross margins for field peas in comparison to the three main alternative crops, common wheat, feed barley and rapeseed, over the period covered in the two preceding tables is depicted in Diagrams FR.14-FR.16 for Eure-et-Loir and Diagrams FR.17 FR.19 for Seine Maritime, respectively. The data underpinning the gross margin estimates for the three main alternative crops are presented in Tables FR.13 to FR.18.

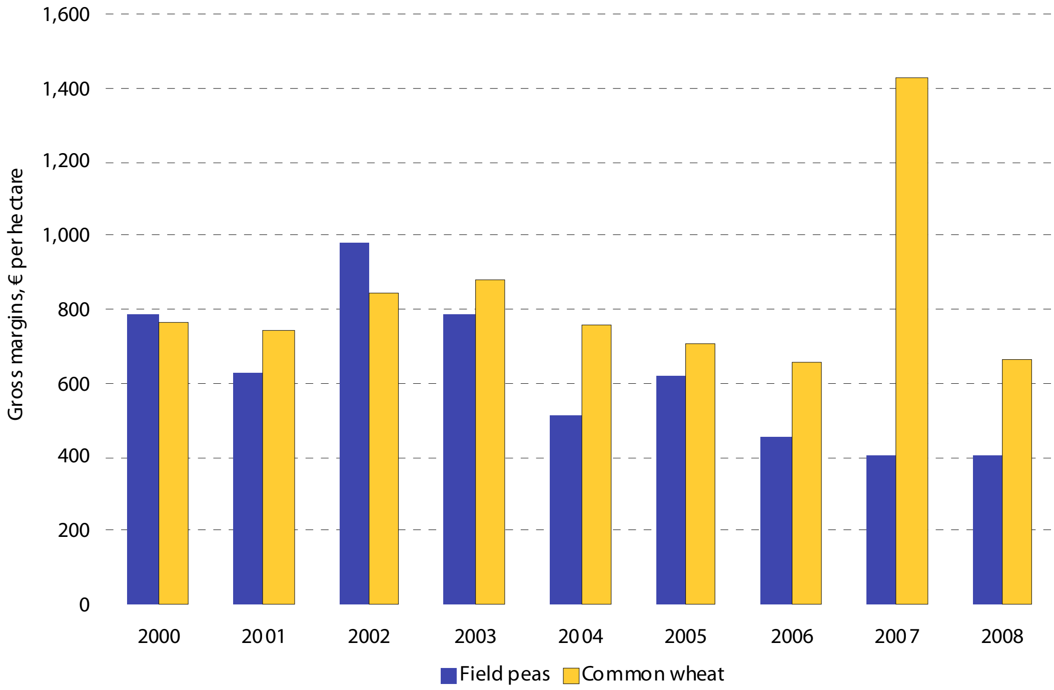
The diagrams reveal that:

- For both of the cereal crops, the gross margins earned from cereal farming were consistently greater than those earned on field peas during the period after the reform took effect.
- In Eure-et-Loir, which has the longer time series of gross margin data, field peas often generated higher gross margins than the cereal crops prior to the reform.
- When field pea gross margins are compared with those from rapeseed, the comparison is made somewhat complicated by the cultivation of rapeseed for industrial uses on set-aside land.
- In the case of Eure-et-Loir, the gross margins are calculated explicitly for rapeseed grown as a food crop, and the evidence is that the gross margin from rapeseed was considerably higher than that on field peas in both 2007 and 2008.
- In Seine Maritime, the data are available only for rapeseed as a whole, without any distinction between rapeseed grown as a food crop (in which case it competes for land

with protein crops) and that which is grown on set-aside land (where protein crops are not a major alternative).

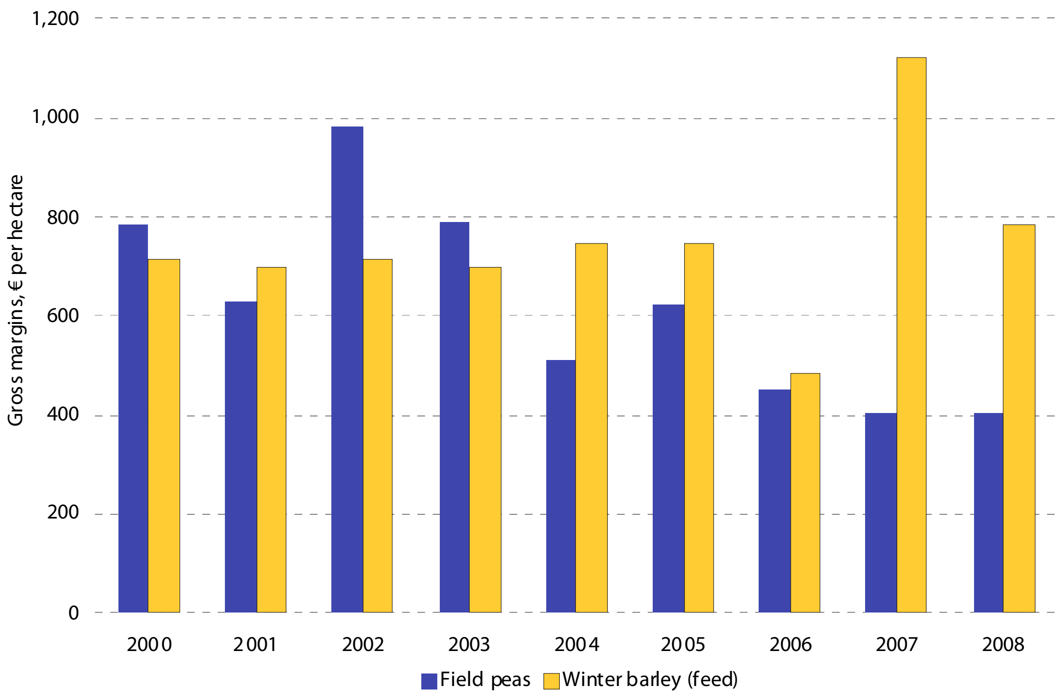
- In 2007, the Seine Maritime data depicted in Diagram FR.19 reveal that, on average, field peas earned a slightly larger gross margin than rapeseed, when the production for industrial uses on set-aside land is included.

Diagram FR.14: Eure-et-Loir, gross margins of field peas vs. common wheat, 2000-2008



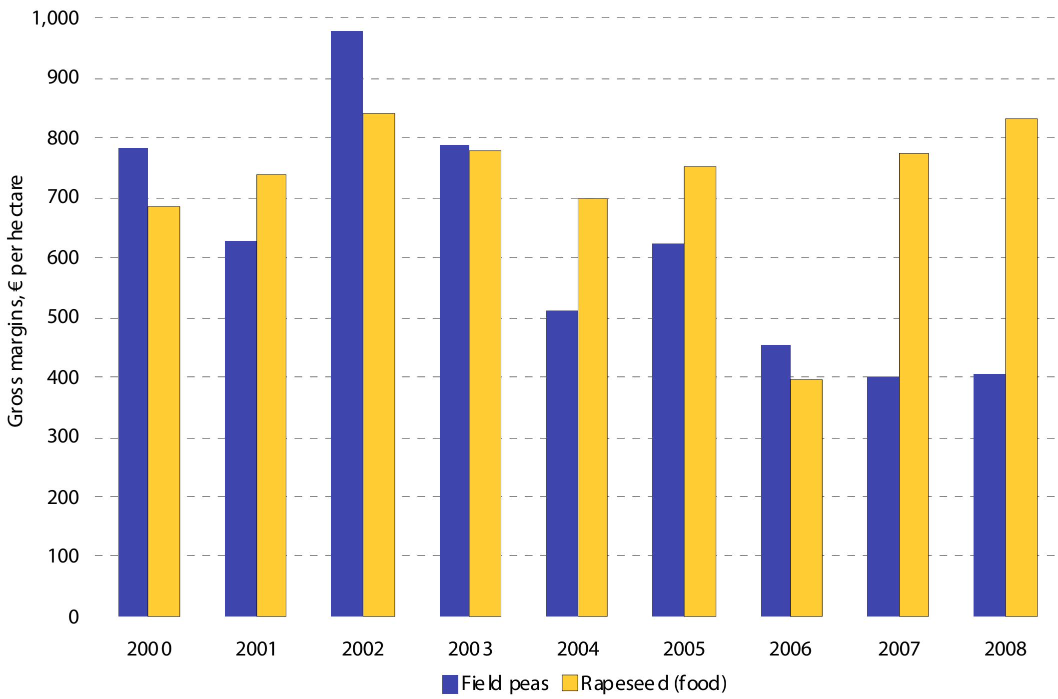
Source: UNIP

Diagram FR.15: Eure-et-Loir, gross margins of field peas vs. winter barley (for feed), 2000-2008



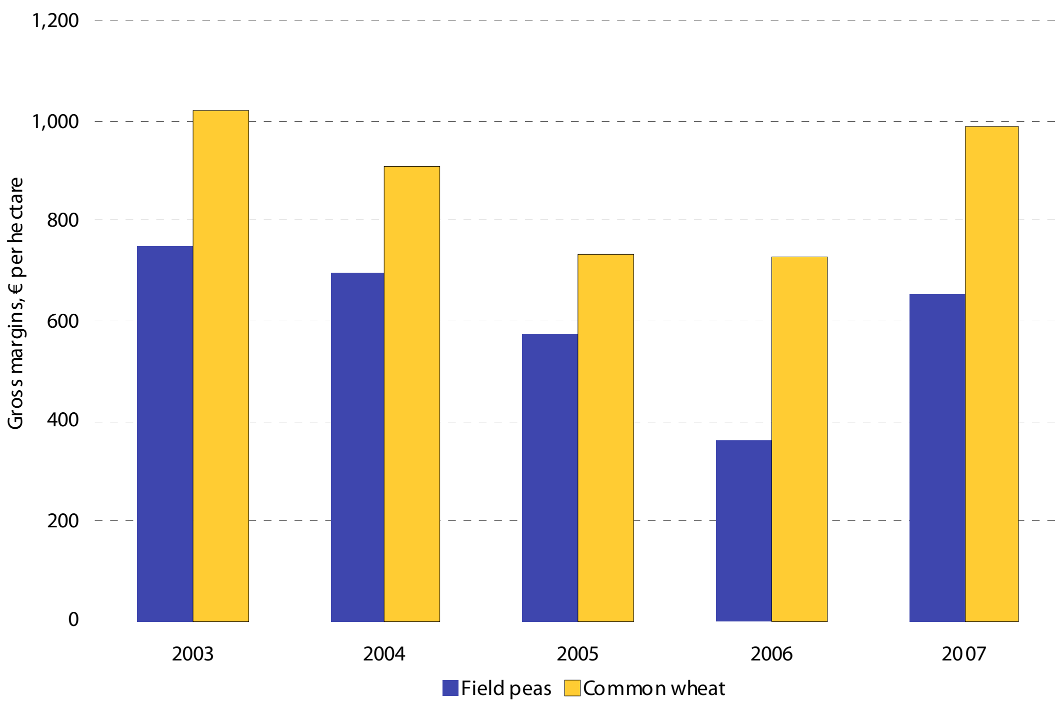
Source: UNIP

Diagram FR.16: Eure-et-Loir, gross margins of field peas vs. rapeseed (for food uses), 2000-2008



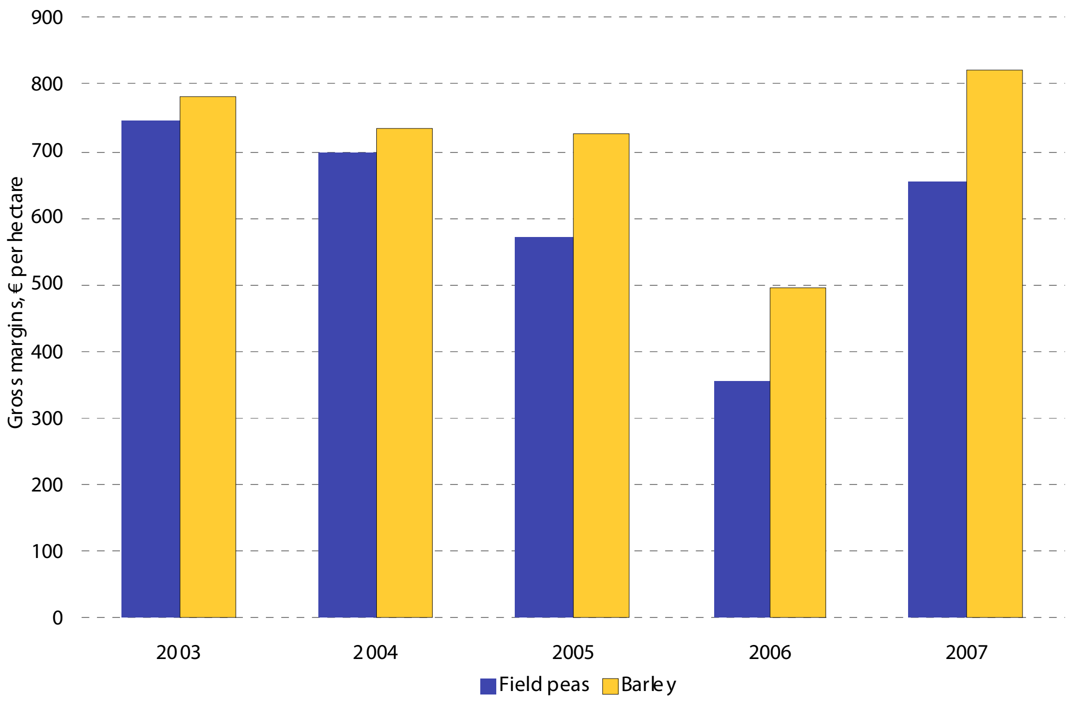
Source: UNIP

Diagram FR.17: Seine Maritime, gross margins of field peas vs. common wheat, 2003-2007



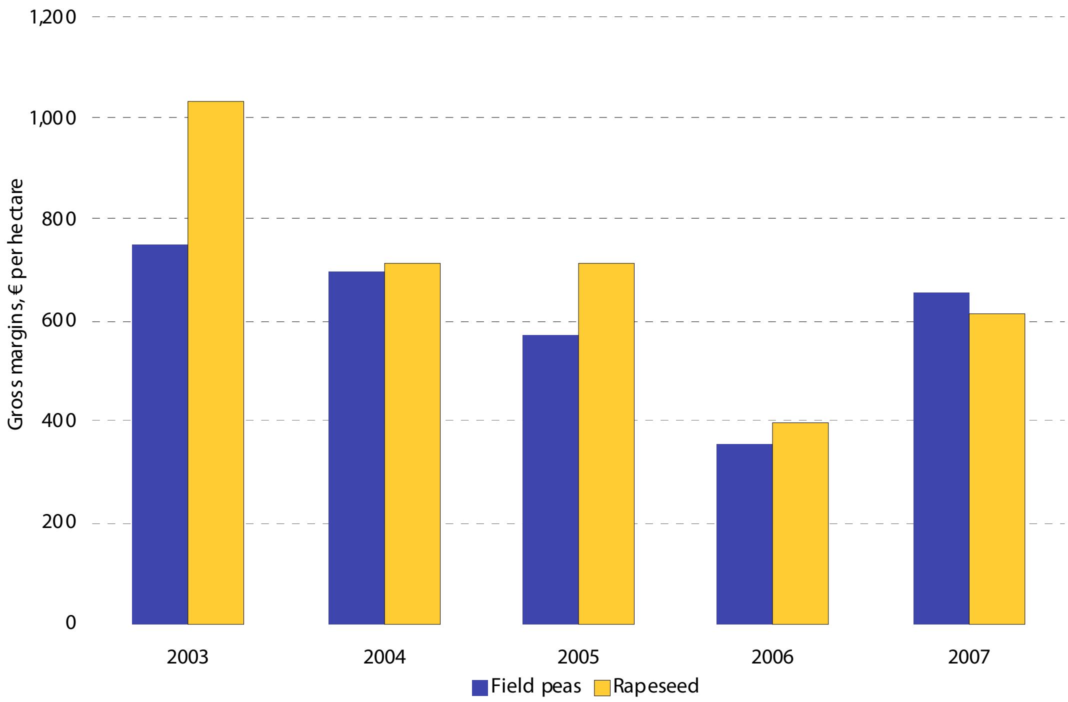
Source: UNIP

Diagram FR.18: Seine Maritime, gross margins of field peas vs. barley, 2003-2007



Source: UNIP

Diagram FR.19: Seine Maritime, gross margins of field peas vs. rapeseed, 2003-2007



Source: UNIP

Table FR.13: Eure et Loir, revenue and variable costs of common wheat production, 2000-2007 (€ per hectare)

	2000	2001	2002	2003	2004	2005	2006	2007
Return per ha								
Yield (t/ha)	8.1	7.5	8.7	6.4	8.2	7.7	7.4	7.8
Price per tonne	99	101	91	126	88	90	123	220
Sales	799	759	793	808	725	693	912	1,716
CAP Support	327	359	381	377	379	364	90	89
Total Revenue	1,126	1,119	1,173	1,185	1,103	1,057	1,002	1,805
Variable Costs								
Seed	48	51	44	46	46	44	45	47
Fertiliser	144	157	136	133	137	155	166	184
Crop Protection	155	152	134	111	147	138	123	128
Other	16	17	16	13	16	15	12	14
Total variable costs	**363**	**377**	**330**	**303**	**346**	**352**	**346**	**373**
Gross margins	**763**	**742**	**843**	**882**	**757**	**705**	**656**	**1,432**

Source: Data provided by UNIP. Estimates of CAP support derived from the FADN database for protein crop farms in the region of Centre.

Table FR.14: Eure et Loir, tevenue and variable costs of winter barley production, 2000-2007 (€ per hectare)

	2000	2001	2002	2003	2004	2005	2006	2007
Return per ha								
Yield (t/ha)	7.6	7.4	7.9	6.0	8.3	8.4	7.6	7.6
Price per tonne	98	94	83	100	85	87	99	184
Sales	746	697	658	600	705	731	752	1,398
CAP Support	327	359	381	377	379	364	90	89
Total Revenue	1,073	1,056	1,039	977	1,083	1,095	843	1,488
Variable Costs								
Seed	58	55	49	50	52	50	53	50
Fertiliser	130	135	119	117	117	136	154	162
Crop Protection	142	144	131	101	137	129	126	125
Other	31	26	26	12	29	34	29	29
Total variable costs	**361**	**359**	**325**	**280**	**335**	**349**	**362**	**366**
Gross margins	**712**	**697**	**714**	**697**	**748**	**746**	**481**	**1,122**

Source: Data provided by UNIP. Estimates of CAP support derived from the FADN database for protein crop farms in the region of Centre.

Table FR.15: Eure et Loir, revenue and variable costs of winter barley production, 2000-2007 (€ per hectare)

	2000	2001	2002	2003	2004	2005	2006	2007
Return per ha								
Yield (t/ha)	3.3	3.3	3.6	3.4	3.8	4.2	3.0	3.4
Price per tonne	178	222	227	225	187	189	229	314
Sales	587	721	819	766	710	793	687	1,068
CAP Support	459	397	365	363	365	347	86	85
Total Revenue	1,046	1,118	1,184	1,128	1,075	1,140	773	1,153
Variable Costs								
Seed	36	38	38	36	40	42	35	30
Fertiliser	167	171	147	148	148	164	157	168
Crop Protection	122	136	125	138	157	157	158	156
Other	35	35	32	28	30	27	27	26
Total variable costs	**360**	**379**	**342**	**350**	**375**	**390**	**377**	**380**
Gross margins	**686**	**739**	**842**	**778**	**700**	**750**	**396**	**773**

Source: Data provided by UNIP. Estimates of CAP support derived from the FADN database for protein crop farms in the region of Centre

Table FR.16: Seine Maritime, revenue and variable costs of common wheat production, 2000-2007 (€ per hectare)

	2003	2004	2005	2006	2007
Return per ha					
Yield (t/ha)	8.9	9.8	8.0	8.2	7.6
Price per tonne	110	91	92	121	170
Sales	976	894	736	992	1,292
CAP Support	395	394	376	95	94
Total Revenue	1,371	1,287	1,112	1,087	1,386
Variable Costs					
Seed	52	57	51	48	51
Fertiliser	123	130	135	133	155
Crop Protection	161	177	182	177	184
Other	12	12	9	2	9
Total variable costs	348	376	377	360	399
Gross margins	1,023	911	735	727	987

Source: Data provided by UNIP. Estimates of CAP support derived from the FADN database for protein crop farms in the region of Centre

Table FR.17: Seine Maritime, revenue and variable costs of barley production, 2000-2007 (€ per hectare)

	2003	2004	2005	2006	2007
Return per ha					
Yield (t/ha)	7.8	8.3	7.6	7.0	6.9
Price per tonne	92	85	92	109	161
Sales	719	702	699	763	1,111
CAP Support	395	394	376	95	94
Total Revenue	**1,114**	**1,096**	**1,075**	**858**	**1,204**
Variable Costs					
Seed	60	67	56	57	27
Fertiliser	124	135	127	140	148
Crop Protection	145	154	160	160	199
Other	5	6	5	5	7
Total variable costs	**334**	**362**	**348**	**362**	**381**
Gross margins	**780**	**734**	**727**	**496**	**823**

Source: Data provided by UNIP. Estimates of coupled support derived from the FADN database for protein crop producers in the region of Haute Normandie.

Table FR.18: Seine Maritime, revenue and variable costs of rapeseed production, 2000-2007 (€ per hectare)

	2003	2004	2005	2006	2007
Return per ha					
Yield (t/ha)	4.4	3.7	3.7	3.1	3.3
Price per tonne	221	192	194	230	280
Sales	974	712	718	713	924
CAP Support	395	394	376	94	93
Total Revenue	**1,370**	**1,106**	**1,094**	**807**	**1,017**
Variable Costs					
Seed	33	33	35	31	29
Fertiliser	145	154	160	159	155
Crop Protection	145	196	183	210	209
Other	14	8	3	10	10
Total variable costs	**337**	**391**	**381**	**410**	**403**
Gross margins	**1,033**	**715**	**713**	**397**	**614**

Source: Data provided by UNIP. Estimates of coupled support derived from the FADN database for protein crop producers in the region of Haute Normandie.

4.3 Relationship between changes in relative gross margins and changes in area

Among the main questions that emerge from the preceding analysis of gross margins are the following:

- Could the decline in protein crop areas be explained by a relatively weak price increase for these crops after 2002/03? To provide an answer, a simulation was undertaken to assess how the relativities between gross margins would have changed if field pea prices had moved in parallel with those of the strongest of the COP crops, namely common wheat.

- Malting barley cannot always command a malting premium, since in years of surplus output the product has to be sold for feed. Therefore, a simulation was prepared of the impact upon relative barley and field pea margins if malting barley planted in the springtime had received only a feed barley price.

- How would relative rankings of gross margins have changed if there had been no coupled aids for protein crops?

- What is the implication of incorporating rotational benefits (via both reductions in nitrogen use in the following crops and high yields in the same crops) into the analysis?

The answers to the first two questions are similar, in that field peas still perform poorly in the gross margin comparison.

- A closer alignment of field pea and common wheat prices (with field pea prices assumed to change each year by exactly the same percentage as common wheat prices) would not have altered the relativities of the gross margins in the sense that field peas would still have yielded a lower gross margin per hectare.

- In a second simulation, in which malting barley was assumed to receive only the feed barley price, the barley crop would still have generated a higher gross margin per hectare than field peas.

- This implies that the poor competitiveness of field peas in comparisons of gross margins cannot be attributed to unfortunate price movements vs. common wheat or to the assumption that malting barley enjoys a premium over feed barley.

4.3.1 Analysis of data for Eure-et-Loir

Analysis of the impact of coupled aids for protein crops upon gross margins in Eure-et-Loir is provided in Diagram FR.20 in three periods: prior to reform, 2001-2003; in the early years of the reform in 2004-2005, before the application of the SPS and while producers were becoming accustomed to the new measures; and then finally from 2006, once the SPS was in effect and producers had become used to the new measures. This diagram contains one histogram alongside two curves.

- The histogram illustrates the average annual change in the share of field peas in the total area under the major COP crops one year after the dates indicated. Thus, a figure of -0.1%, for example, means that each year the field share of the total COP crop area decreased by an average of 0.1%, i.e., from say 2.1% to 2.0% in a typical year.

- The one year lag in the calculation of changes in the field pea share of COP crop areas means that the column headed “2001-2003” refers to area data for 2002-2004. The one year lag is applied because it is assumed that farmers behave adaptively, reacting in the following crop year to their experience regarding crop profitability in a given crop year.

- The upper line illustrates the average difference between the gross margins earned on field peas and a weighted average of those earned on common wheat, feed barley and rapeseed (for food). The weights used are the actual areas under these three crops; thus, the assumption is that a typical protein crop farmer will, on average, consider the actual cross-section of the alternative crops to be their alternative to field pea crops. The weighted average of gross margins on the main alternative crops over the period 2001-2007 is presented in Table FR.20.

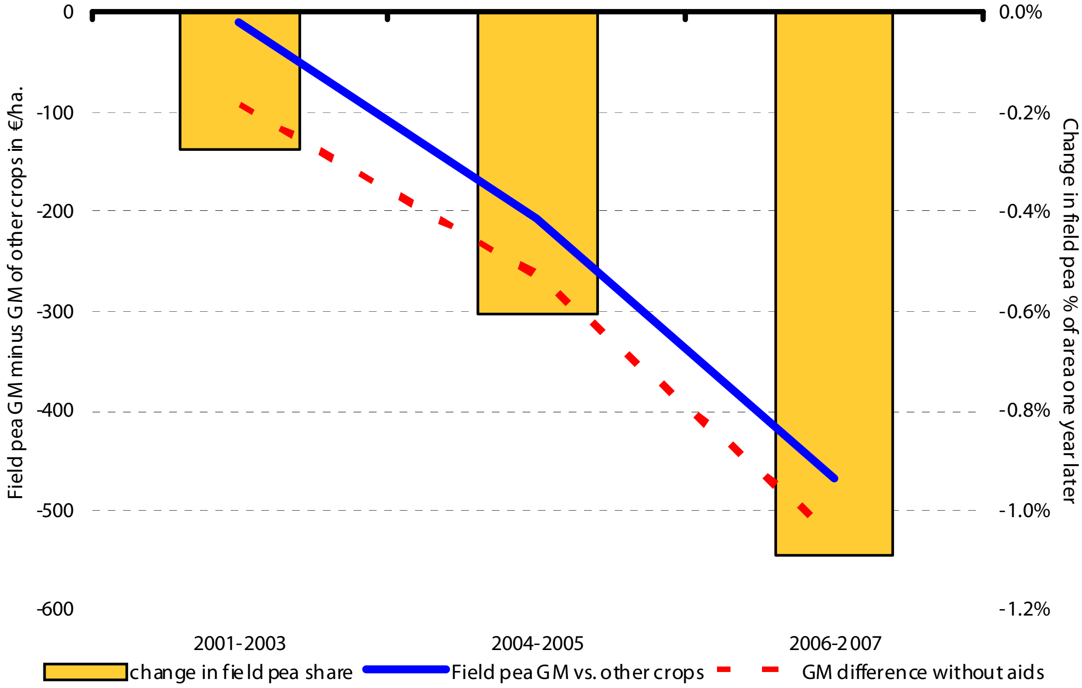
- It may be seen that the average disadvantage of field peas vs. the weighted average of the main alternative crops, in terms of gross margins, rose each succeeding period, going from €10 per hectare in 2001-2003 to €207 in 2004-2005 and €468 in 2006-2007.

- The lower line plots the behaviour of the average difference between field pea and other COP crop gross margins if all payments coupled specifically to protein crop farming had not existed in the past.

- The absence of coupled payments for protein crops would have worsened the relative competitiveness of protein crops in the manner described in Table FR.19, deteriorating from €93 per hectare in 2001-2003 to €264 in 2004-2005 and €526 in 2006-2007. The same table reveals that the decline in the field pea share of the COP crop area gathered pace over the same period (incorporating a one year lag, as explained above, in the producers' response).

- The rate at which the field pea share of the COP crop area changed went from an annual decline of 0.3% (in 2002-2004) in response to the gross margins observed in 2000-2003 to one of 0.6% in response to the gross margins experienced in 2004-2005 and to 1.1% in response to the outcomes in 2006-2007.

Diagram FR.20: Lagged annual changes in the field pea % of the area under major COP crops, 2000-07 vs. field pea gross margin relativities against the weighted average for other major COP crops, with and without special aids, in rain-fed areas of Eure-et-Loir



Source: Analysis of UNIP data

Note: The "with aids" calculations include the special aid of €55.57/ha. The "without aids" case excludes this aid. "Field pea GM vs. other crops" measures the difference between the gross margin on field peas and the weighted average gross margin on the other major COP crops, where the weights are the areas under the different crops. The average annual percentage area changes relate to the period one year after that in the gross margin calculations.

Table FR.19: Difference between gross margins on field peas and the weighted average gross margins on other COP crops vs. annual changes in the following crop year in the field pea share of the combined area of major COP crops, Eure-et-Loir, 2001-2007

	2001-2003	2004-2005	2006-2007
GM difference, field peas vs. other COP crops, € per hectare	-10	-207	-468
GM difference without extra coupled aids for protein crops	-93	-264	-526
Annual % change in field pea area as share of COP crop area	-0.3%	-0.6%	-1.1%

Sources: Gross margin data derived from Table FR.13. Area data provided by Eurostat.

Table FR.20: Weighted average of gross margins on alternative crops, including special aids (€/ha)

2001	2002	2003	2004	2005	2006	2007
747	838	840	785	761	573	1,214

Sources: Table FR.13, Eurostat..

4.3.2 Analysis of data for Seine Maritime

We have also prepared an analysis of gross margins in Seine Maritime in the Haute Normandie region over the shorter period for which comparative data are available on the gross margins for field peas and the main alternative COP crops. Table FR.21 and Diagram FR.21 are the counterparts to Table FR.20 and Diagram FR.20 presented above for Eure-et-Loir.

They compare the gross margins on field peas with the weighted average gross margins on common wheat, barley, rapeseed from 2003/04 to 2007/08, allocating the values to three periods: the first, prior to the reform (in this case, the data refer solely to 2003); the second, immediately after the reform (2004-2005); and the third, after the reform was complete, including the adoption of the SPS (from 2006).

The table and diagram contrast the differences in average gross margins between field peas and the major COP crops as a group with the annual change in the proportion of field peas in total COP crop areas one year later, with the lag reflecting the adaptive expectations of farmers responding to the outcome of the previous harvest.

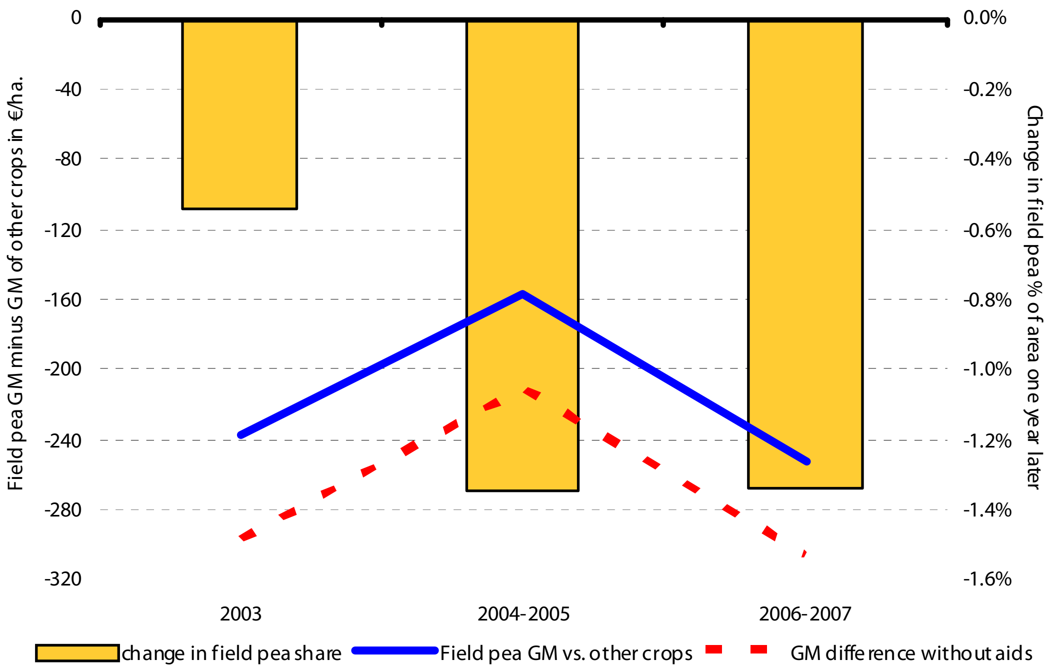
Table FR.21: Difference between gross margins on field peas and the weighted average gross margins on other COP crops vs. annual changes in the following crop year in the field pea share of the combined area of major COP crops, Seine Maritime, 2003-2007

	2003	2004-2005	2006-2007
GM difference, field peas vs. other COP crops, € per hectare	-237	-156	-252
GM difference without extra coupled aids for protein crops	-297	-210	-306
Annual % change in field pea area as share of COP crop area	-0.5%	-1.3%	-1.3%

Sources: Gross margin data derived from Table FR.14. Area data provided by Eurostat.

Note: For this département, the first column includes data only for 2003. The corresponding analysis for Eure-et-Loir covered the period from 2000 to 2003 in the first column.

Diagram FR.21: Annual changes in the field pea share of areas under major COP crops, 2003-07 vs. field pea gross margin competitiveness in relation to the weighted average for other major COP crops, with and without protein crop coupled aids, Seine Maritime



Source: Analysis of UNIP data

Note: The "with aids" calculations include the special aid of €55.57/ha. The "without aids" case excludes this aid. "Field pea GM vs. other crops" measures the difference between the gross margin on field peas and the weighted average gross margin on the other major COP crops, where the weights are the areas under the different crops. The average percentage area changes relate to the period one year after the gross margin calculations.

- The average disadvantage of field peas vs. the weighted average of the main alternative crops, in terms of gross margins, fluctuated from one period to another. It went from €237 per hectare in 2003 to €156 in 2004-2005 but rose to €252 in 2006-2007.

- The absence of coupled payments for protein crops would have worsened the relative competitiveness of protein crops.

- The competitive disadvantage for field peas would have been €297 per hectare in 2003. The disadvantage would then have improved to €210 in 2004-2005, before deteriorating to €306 in 2006-2007.

- Table FR.21 describes the decline in the field pea share of the COP crop area over the same period.

- The annual pace of decline went from 0.5 % (in 2004) in response to the gross margins observed in 2003 to one of 1.3% in response to the gross margins experienced in 2004-2005 and remained at 1.3% in response to the outcomes of the harvests in 2006-2007.

4.4 The quantification of the advantages of protein crops in a crop rotation

The reality of gross margin comparisons is more complex than these figures would seem to suggest. For sound agronomic reasons, rotations should be followed to provide a break crop (or alternatively a producer may opt to leave a field fallow), which improves soil texture, reduces the build-up of pests and diseases and, in the case of legumes, such as protein crops, supplies nitrogen to the following crop.

The main alternative rotation crops in a farming system based upon cereals are oilseeds, notably rapeseed, and protein crops. With rapeseed, the growth in demand for the oil for biodiesel and food has led many farmers to plant rapeseed as often as one year in three in a rotation, although good practice is considered to be a one year in four rotation, and producers practising a one in three rotation face higher chemical costs and this is said to be behind some of the most recent declines in rapeseed plantings in parts of the EU.

For protein crops, the maximum frequency of planting in a rotation is recommended to be one year in five.

In Table FR.22, two popular rotations are compared for Eure-et-Loir. The quality of this data means that we have only been able to carry out this analysis for France. One is a wheat-wheat-rapeseed cycle; the other is a wheat-wheat-field pea-wheat-wheat- rapeseed cycle.

The benefits from protein crops are enjoyed by the wheat crop immediately following the protein crop in the rotation. It receives a yield increase, which in the case of the data analysed in this table averaged almost 10%; it also receives some nitrogen, which reduces the need for nitrogenous fertiliser in the year following the protein crop. The nitrogen saving is estimated to be the equivalent of 50 kgs of usable nitrogen (the nitrogen actually fixed by the protein crops is much higher than this, but a great deal is lost by leaching into the soil or to the atmosphere before the following crop can benefit. The nitrogen saving is valued at the producer's purchasing price of urea (adapted to reflect the 47% nitrogen content of urea).

The nitrogen saving is received only in the year immediately after the protein crop. In a six year rotation (which is assumed in this calculation), with protein crops planted just once during the rotation, this means that the nitrogen savings for the following crop have to be divided by six, to average them over the full cycle.

From 2004 to 2008, the average benefit from this nitrogen saving was equivalent to €6 per hectare per annum. In other words, the immediate saving in the crop following directly after the protein crop was six times as large, with an average monetary value of €36 per hectare.

The benefits of higher yields and nitrogen savings in the following crops and of the coupled payments for protein crops are all included in Table FR. 22.

In this particular example, computed with assistance from local agricultural extension officers, it is evident that the average gross margins over the full cycle for the alternative rotations are slightly lower for the six year cycle that includes both field peas and rapeseed once than they are for the cycle that includes no field peas, but has rapeseed planted once every three years. The difference averaged just €5 per hectare per annum over the full eight years.

These differences in gross margins over the full cycle do not appear to be large enough to explain the rapid decline in interest in the cultivation of protein crops in Eure-et-Loir.

Table FR.22: Comparison of gross margins (GM) over full rotations with common wheat, rapeseed and field peas, 2001-2008, Eure-et-Loir, France

		2001	2002	2003	2004	2005	2006	2007	2008
Wheat yield - after rotation	tonnes/ha.	7.84	9.04	6.95	8.45	8.05	7.75	7.95	8.50
Wheat yield - after wheat	tonnes/ha.	7.15	8.35	6.20	7.90	7.30	6.90	7.40	7.80
N fertiliser savings in rotation	€/ha.	3	3	3	4	5	5	6	9
Wheat/wheat/rapeseed/wheat/wheat/rapeseed	GM, €/ha.	748	843	769	748	721	482	731	898
Wheat/wheat/field peas/wheat/wheat/rapeseed	GM, €/ha.	761	847	775	757	710	504	739	898
Difference	GM, €/ha.	-14	-3	-6	-9	11	-23	-8	0

Source: Derived from data provided by UNIP.

Note: The nitrogen savings and wheat yields after rotation both refer to a rotation with field peas.

5. The significance of protein crop production in farm incomes

In this section, we present four measures of profitability for protein crop farms and compare their values with the values of the same indicators for "other farms". These measures of profitability have been extracted from the FADN database; they are: gross farm income per hectare, farm net value added per annual working unit, farm family income per hectare and farm family income per farm working unit. We have classified protein crop farms on the basis of the share of farm UAA that is devoted to protein crops.

The aim of this analysis is to ascertain whether there are any structural differences in the profitability of farms that choose to grow protein farms relative to farms that do not grow these types of crops, *ceteris paribus,* i.e. when both sets of farms belong to the same type of farming.

When presenting data from the FADN database, a minimum number of 15 observations (farms) per year is required to ensure that the results presented meet a satisfactory degree of statistical precision. Within the FADN database of protein crop farms, the only UAA size category for which data for 15 or more farms are available is the category "Greater than 50 hectares". In this section, we show the results for this UAA size class only, distinguishing between the two types of farming most protein crops farm belong to: "COP specialists" and "Mixed crops and livestock".

For all the diagrams, the classes along the X-axis represent the proportions of the overall UAA that is devoted to the production of protein crops.

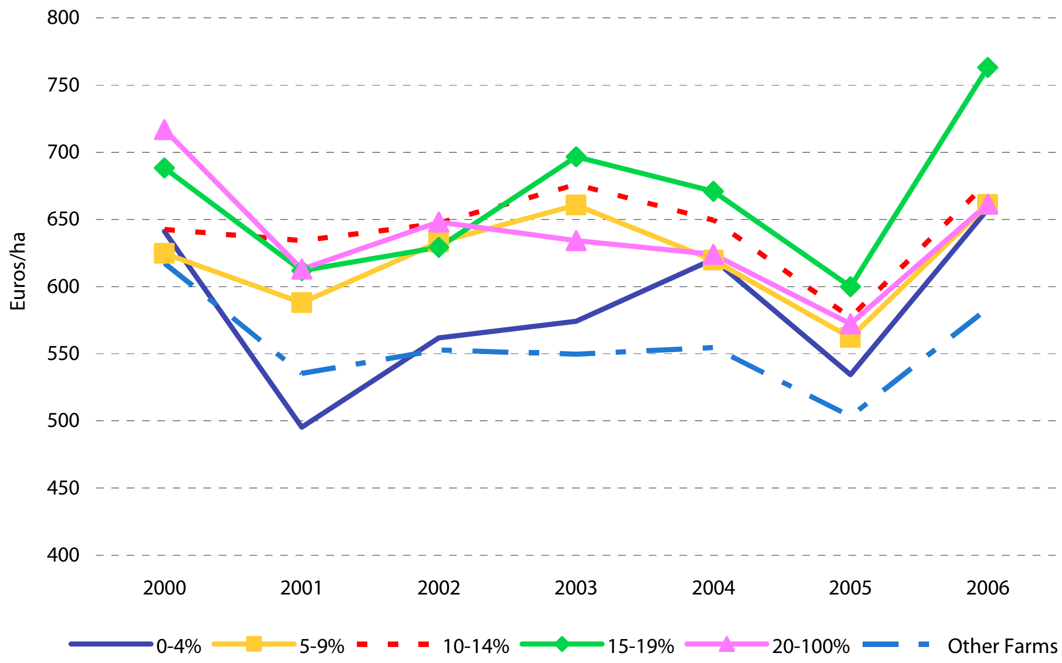
The results of this analysis are shown in Diagrams FR.22 to FR.37. They reveal that

- No clear pattern emerges with respect to the profitability of farms growing protein crops relative to "other" holdings for the different measures of income covered in our assessment.
- There are no clear indications that the size of the share of area devoted to protein crops is linked to increasing (decreasing) returns in any consistent fashion.

5.1 Cereals, oilseeds and protein crop (COP) specialists

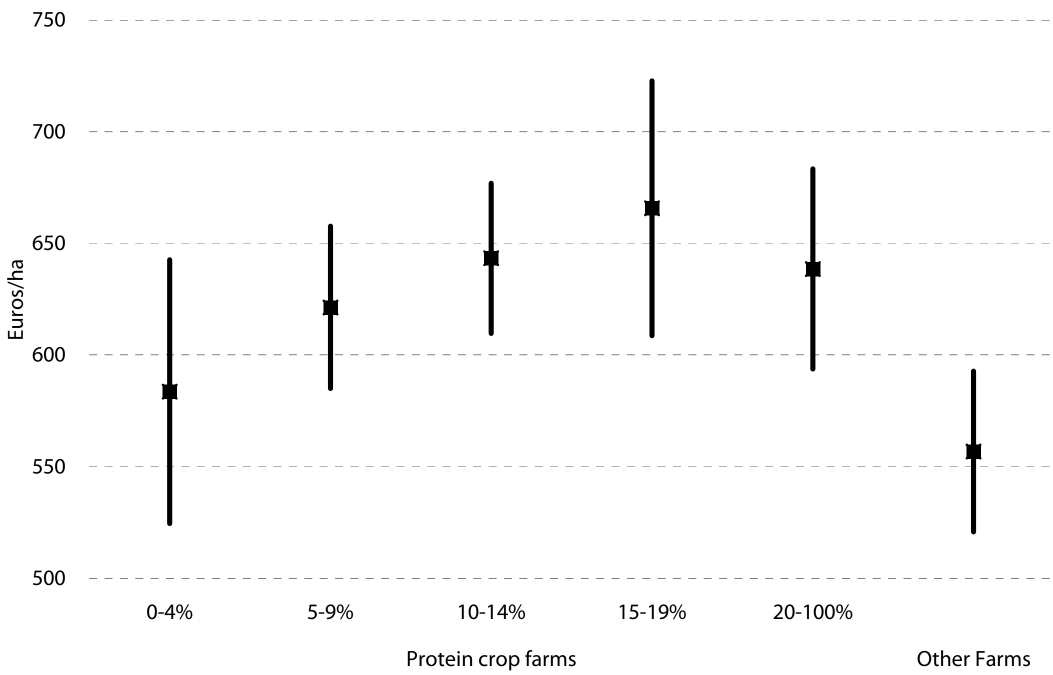
5.1.1 Gross farm income per hectare for COP specialists

Diagram FR.22: Gross farm income per hectare, 2000-2006



Source: Analysis of FADN database

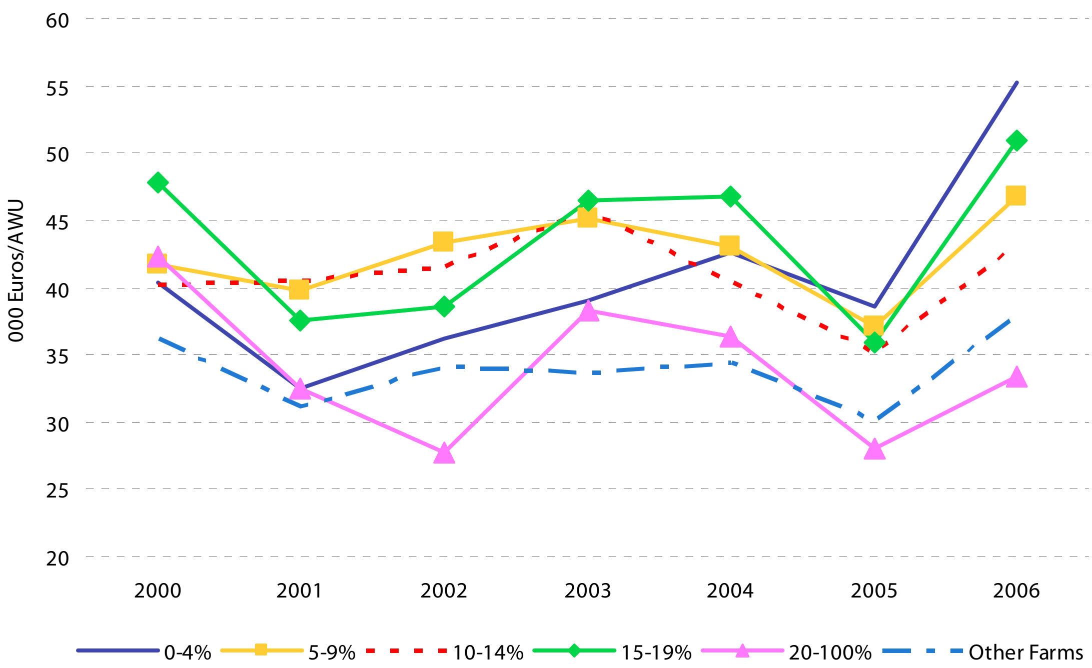
Diagram FR.23: Mean (plus and minus one standard deviation) of gross farm income per hectare, 2000-2006



Source: Analysis of FADN database

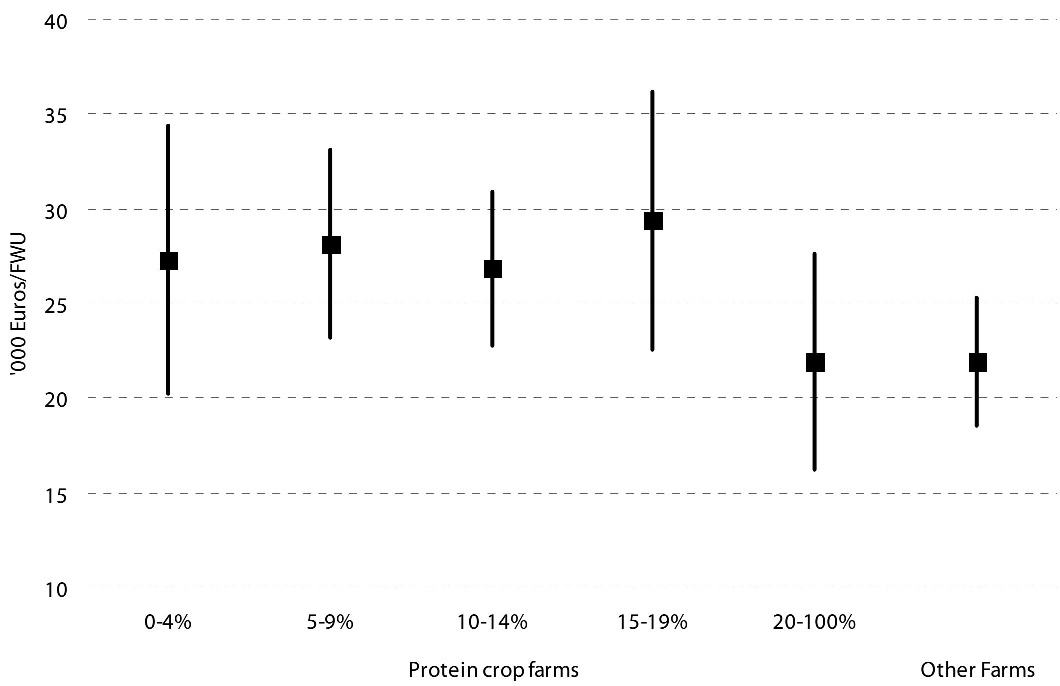
5.1.2 Farm net value added per annual work unit for COP specialists

Diagram FR.24: Farm net value added per annual work unit, 2000-2006



Source: Analysis of FADN database

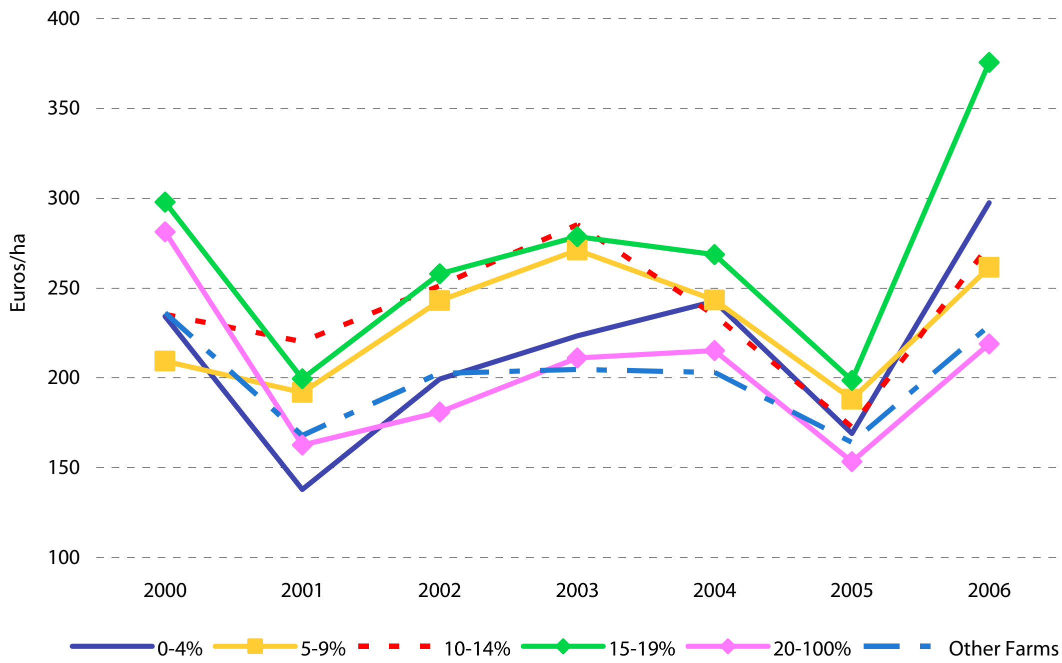
Diagram FR.25: France: Mean (plus and minus one standard deviation) of farm net value added per annual work unit, 2000-2006



Source: Analysis of FADN database

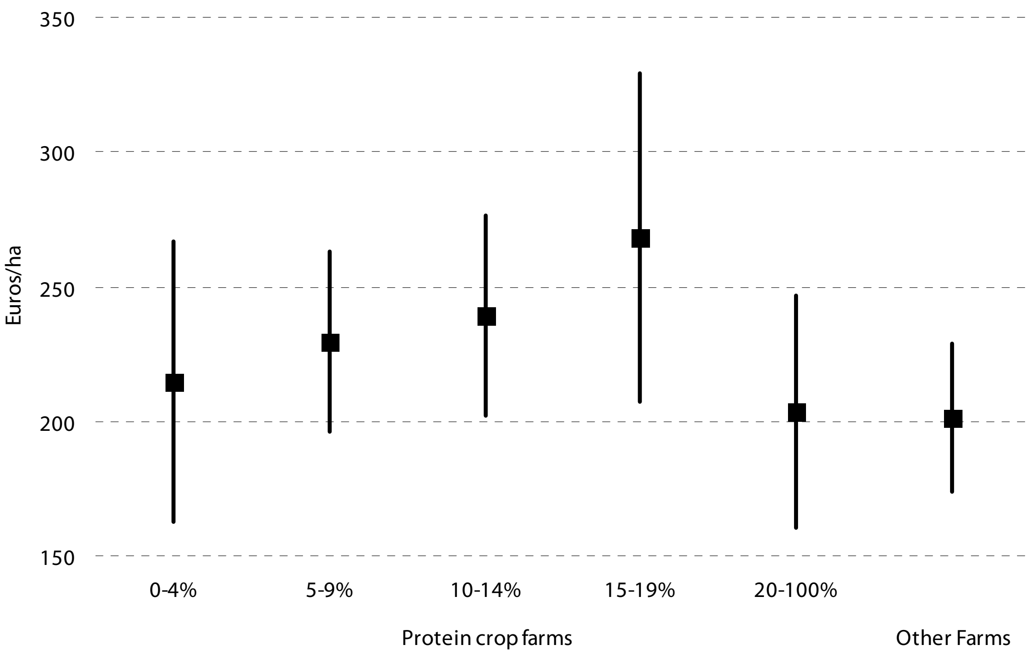
5.1.3 Family farm income per hectare for COP specialists

Diagram FR.26: Family farm income per hectare, 2000-2006



Source: Analysis of FADN database

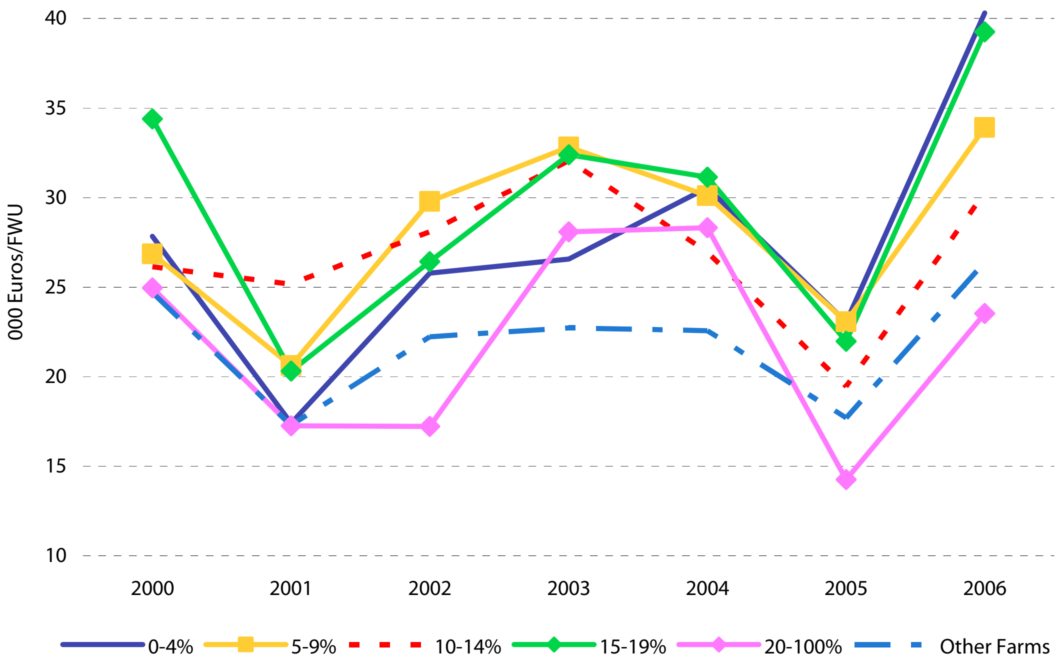
Diagram FR.27: Mean (plus and minus one standard deviation) of family farm income per hectare, 2000-2006



Source: Analysis of FADN database

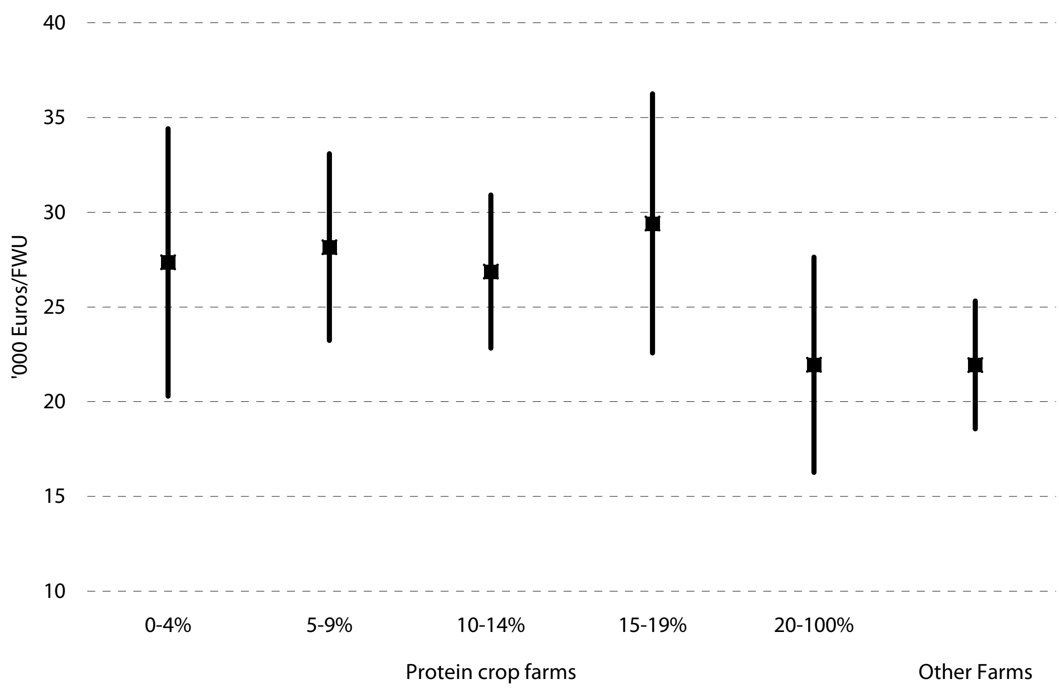
5.1.4 Family farm income per family work unit for COP specialists

Diagram FR.28: Family farm income per family work unit, 2000-2006



Source: Analysis of FADN database

Diagram FR.29: Mean (plus and minus one standard deviation) of family farm income per family work unit, 2000-2006

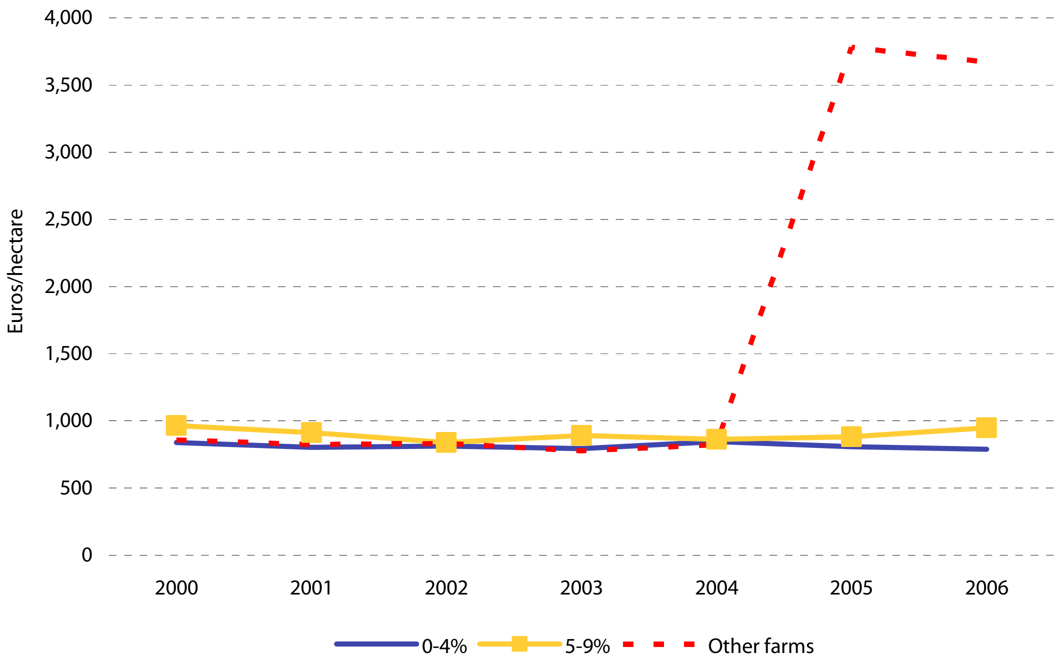


Source: Analysis of FADN database

5.2 Mixed crops and livestock specialists

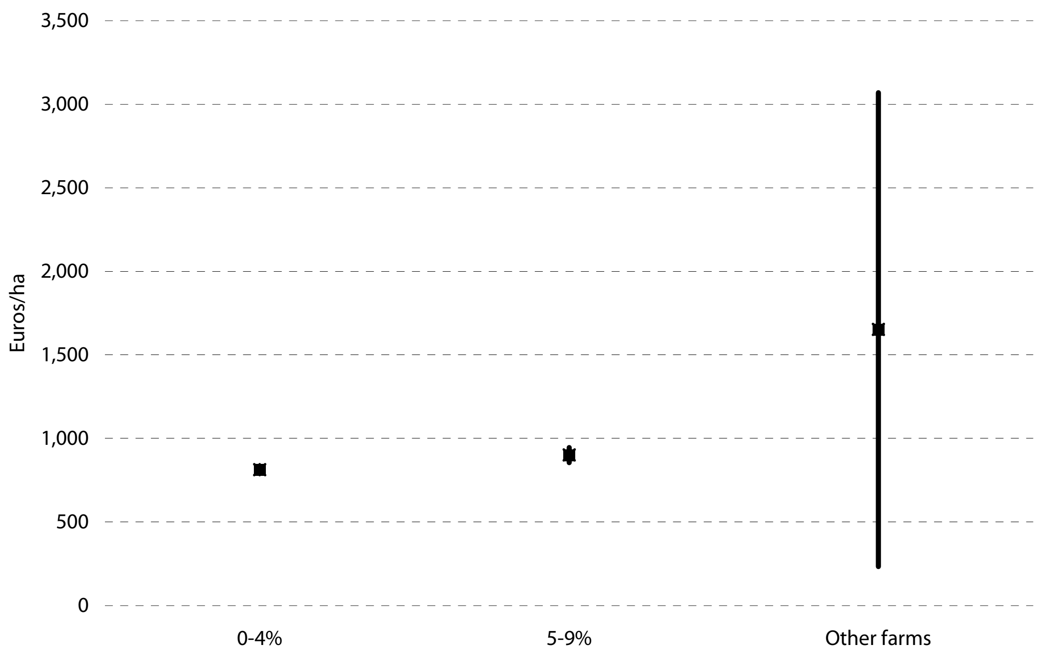
5.2.1 Gross farm income per hectare for mixed crops and livestock specialists

Diagram FR.30: Gross farm income per hectare, 2000-2006



Source: Analysis of FADN database

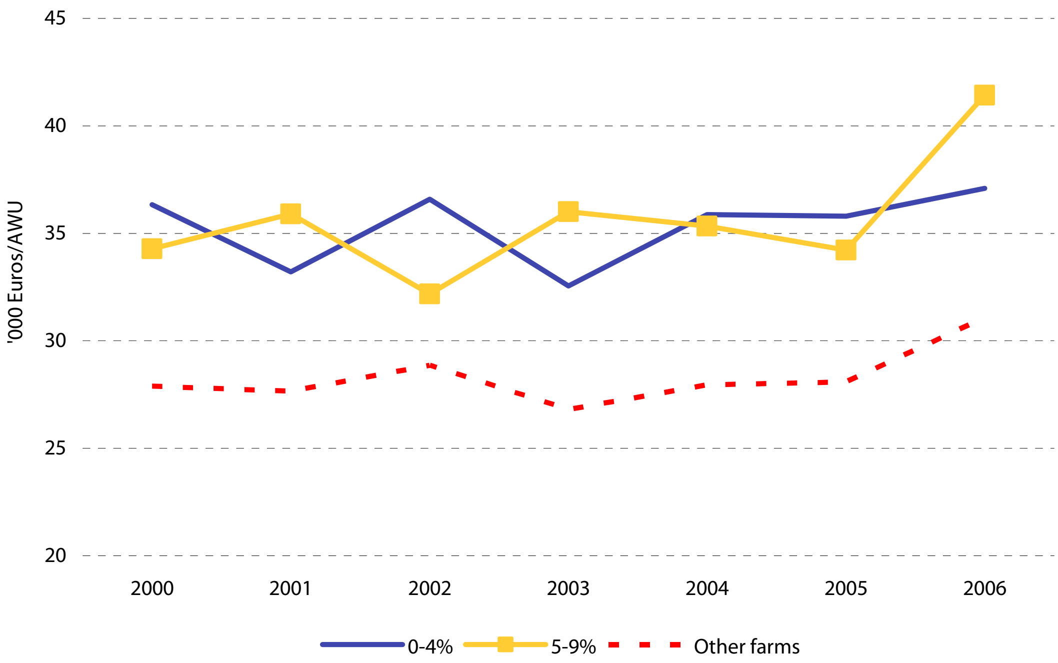
Diagram FR.31: Mean (plus and minus one standard deviation) of gross farm income per hectare, 2000-2006



Source: Analysis of FADN database

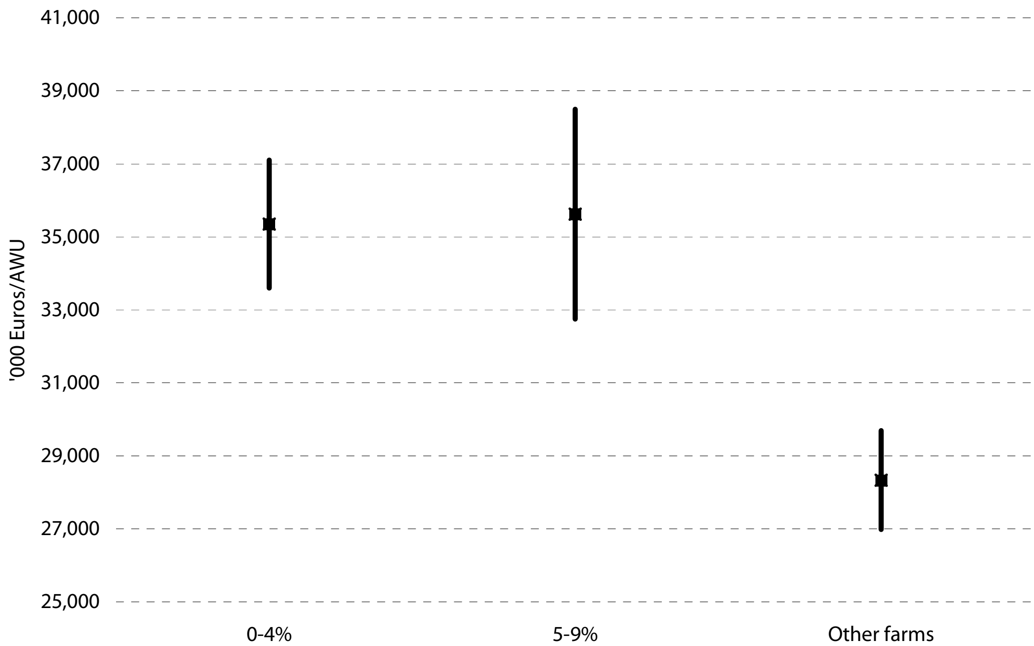
5.2.2 Farm net value added per annual work unit for mixed crops and livestock specialists

Diagram FR.32: Farm net value added per annual work unit, 2000-2006



Source: Analysis of FADN database

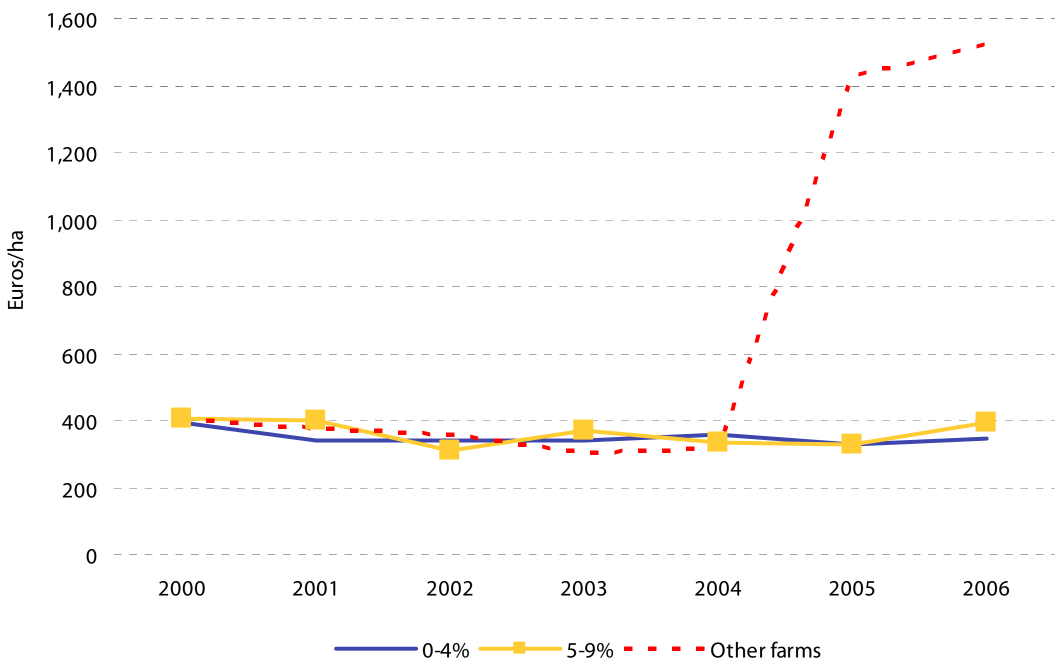
Diagram FR.33: Mean (plus and minus one standard deviation) of farm net value added per annual work unit, 2000-2006



Source: Analysis of FADN database

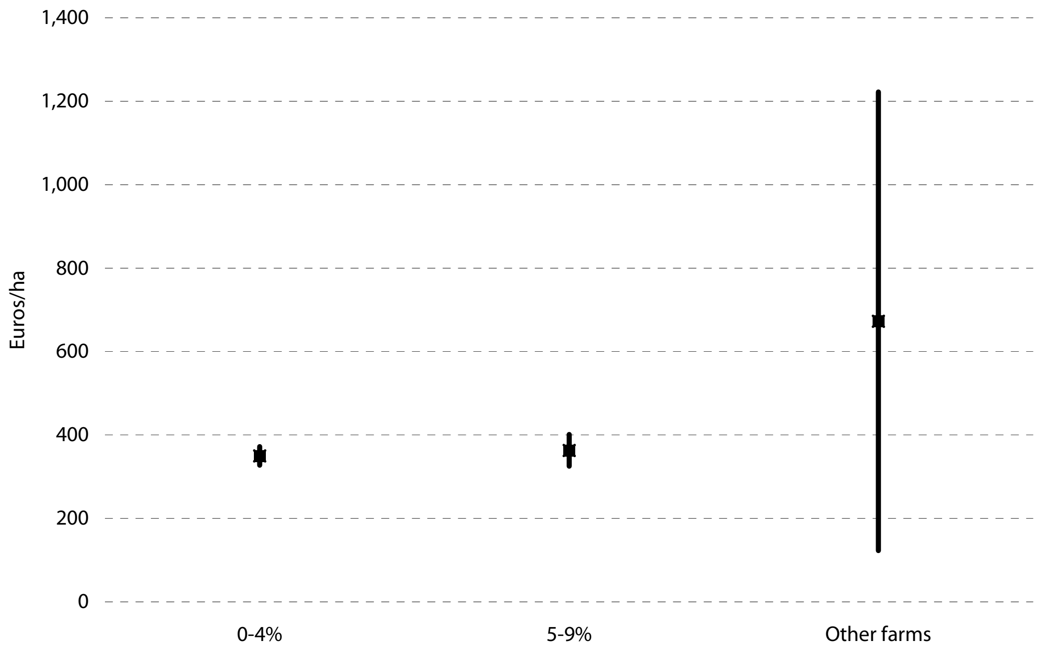
5.2.3 Family farm income per hectare for mixed crops and livestock specialists

Diagram FR.34: Farm family income per hectare, 2000-2006



Source: Analysis of FADN database

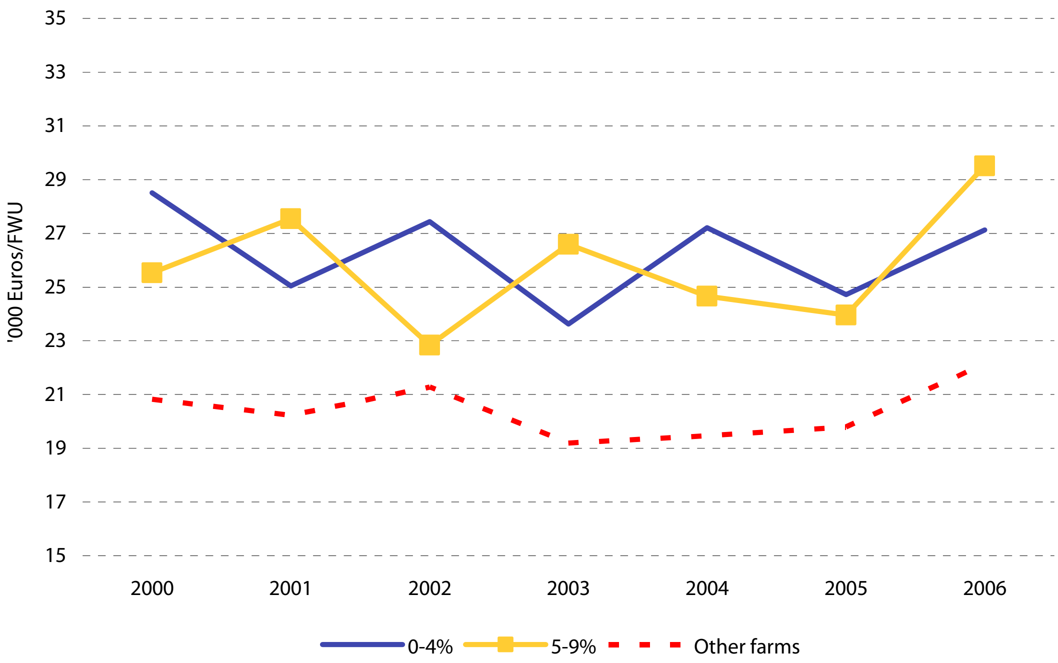
Diagram FR.35: Mean (plus and minus one standard deviation) of family farm income per hectare, 2000-2006



Source: Analysis of FADN database

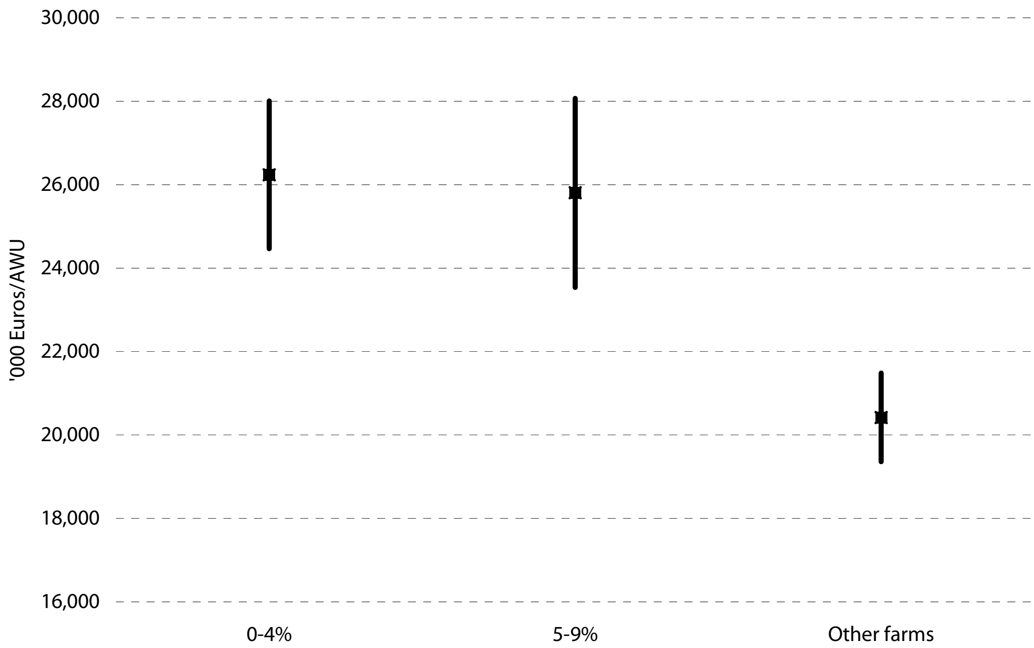
5.2.4 Family farm income per family work unit for mixed crops and livestock specialists

Diagram FR.36: Family farm income per family work unit, 2000-2006



Source: Analysis of FADN database

Diagram FR.37: Mean (plus and minus one standard deviation) of family farm income per family work unit, 2000-2006



Source: Analysis of FADN database

6. The development of the local feed compounding industry

Table FR.23 describes the steady progress towards greater concentration and larger scale within the French feed compounding sector since 1997.

The table includes separate data for the years immediately before and after the 2003 reform. We observe that:

- The number of compounders has fallen by almost 23% between 1997 and 2007, and the decline has continued since the reform.
- National compound feed production has fallen slowly, since 1997.
- The average output per plant rose by almost 25%, to over 70,000 tonnes per plant, from 1997 to 2007.

Table FR.23: The number and annual output of French feed compounders, 1997-2007 ('000 tonnes)

	Number of compounders	Compound feed output ('000 tonnes)	Annual output per plant ('000 tonnes)
1997	410	23,251	56.7
2003	338	22,609	66.9
2004	330	22,320	67.6
2007	316	22,362	70.8
% change 1997-2007	-22.9%	-3.8%	24.8%

Source: FEFAC Feed and Food Statistical Yearbook, 2007

In France, trading companies and farmers' cooperatives are licensed, which permits them to benefit from State credit guarantees through the *Office National Interprofessionnel des Grandes Cultures* (ONIGC). The main participants in the feed processing industry are licensed trading companies and cooperatives. As a result, they represent a direct link between agricultural producers and feed processors.

In 2007, the feed industry comprised 207 enterprises (cooperatives, large private groups and small independent feed processors). 316 feed mills (excluding pet food mills) produced 22.4 million tonnes of feed. Of these, 6.4 million tonnes were pig feed, 8.8 million tonnes poultry feed and 5.1 million tonnes of livestock feed. 65% of the total feed produced in France is consumed in just three administrative regions located, all in Western France, with good access to imported ingredients, notably of soybeans and soybean meal, and with strong local demand for compound feeds from pig and poultry producers: these regions are Bretagne, Pays de Loire and Poitou-Charente.

Currently, the feed sector includes a small number of large groups, which are the result of mergers and acquisitions of large private companies. Among these groups are Etablissements Glon (Sanders) and Guyomarch (recently renamed Evialis).

Some significant restructuring has also been observed at the regional level. About 10 to 12% of the total feed volume is processed by companies operating only one-site factory of less than 5,000 tonnes of annual compounding capacity.

Other key players are large cooperative groups such as Epis-centre[2] and Terrena[3].

Table FR.24 describes the evolution of raw material volumes processed by the feed industry from 2000 to 2006, while Table FR.25 summarises the incorporation rate of different raw materials into feed for the main end-uses in 2006.

- Overall, the three protein crops under review represent about 2.5% of the total tonnage of ingredients used by the feed industry.
- Field pea use in the compound feed sector fell by 60% between 2000 and 2003. It remained virtually unchanged between 2003 and 2006.
- Field peas are mostly incorporated into pig feed (42.1% of total field pea use in 2006), followed by poultry feed (22.3%) and ruminant feed (16.4%), while all other animals, including pets, consume the remaining 19.2%.

Evidence from interviews with processors highlighted the reality that, while the feed industry has a significant interest and willingness to process fields peas (in particular for pig feed), at a general level, there are major factors that, over time, have acted to limit their use of protein crops. These are:

- The small quantities of protein crops available in some regions, which discourages feed producers from having separate bins in their silos for storing these products over the marketing year
- The strong disincentive to publish feed formulations that include protein crops and are valid for several months, when the supply (at both local and national level) of these ingredients is difficult to ensure.

These factors mean that feed processors tend to prefer raw materials that are widely available, such as soybean meal and rapeseed meal, both of which also offer a higher protein content.

Table FR.24: Evolution of raw material use by the French feed industry, 2000-2006

	2000		2003		2006	
	'000 tonnes	*%*	*'000 tonnes*	*%*	*'000 tonnes*	*%*
A. Cereals	**10,180,5**	**45,0**	**11,174,8**	**50,0**	**10,623,8**	**49,9**
B. Roots and tubers	**72,6**	**0,3**	**1,0**	**-**	-	-
C. Co-products from processing	**2,581,3**	**11,4**	**2,354,5**	**10,5**	**2,355,7**	**11,1**
D. Oils and fats	**294,0**	**1,3**	**216,3**	**1,0**	**203,4**	**1,0**
E. Dehydrated products	**630,0**	**2,8**	**642,3**	**2,9**	**732,0**	**3,4**
F. Protein and oleoprotein crops	**1,840,2**	**8,1**	**891,2**	**4,0**	**805,7**	**3,8**
Of which field peas	*1,247,5*	*5,5*	*505,8*	*2,3*	*505,2*	*2,4*
Of which field beans	*1,4*	-	*45,7*	*0,2*	*28,2*	*0,1*
Of which sweet lupins	*3,2*	-	*5,4*	-	*1,1*	-
G. Meals	**5,563,6**	**24,6**	**5,911,1**	**26,5**	**5,477,3**	**25,7**
H. Animal products	**390,8**	**1,7**	**40,7**	**0,2**	**38,0**	**0,2**
J. Dairy products	**24,7**	**0,1**	**18,2**	**0,1**	**17,0**	**0,1**
K. Others	**1,121,5**	**5,0**	**1,093,4**	**4,9**	**1,042,6**	**4,9**
TOTAL	**22,626,7**	**100,0**	**22,342,5**	**100,0**	**21,295,6**	**100,0**

Source: Agreste

[2] Epis-centre has 8,020 members, total sales of €1.77 billion in 2007/08, collects 1.8 million tonnes of inputs and markets 4.6 million tonnes, of which 48% are exports. It processes 630,500 tonnes of feed products.

[3] Terrena has 25,000 members and is a multi-activity cooperative, including feed processing, meat and dairy processing, etc. Animal feed sales in 2007 exceeded €170 million, and total sales amounted to €3.311 billion.

Table FR.25: Incorporation rate of raw materials in selected feed products (2006)

	Total feed	Poultry feed		Pig feed	
	'000 tonnes	*'000 tonnes*	*%*	*'000 tonnes*	*%*
A. Cereals	**10,624**	4,301		3,166	
B. Roots and tubers	-	0		0	
C. Co-products from processing	**2,356**	308		620	
D. Oils and fats	**203**	95		47	
E. Dehydrated products	**732**	53		72	
F. Protein and oleoprotein crops	**806**	236	29.3%	291	36.1%
Of which field peas	*505*	113	22.3%	213	42.1%
Of which field beans	*28*	8	27.8%	11	39.7%
Of which sweet lupins	*1*				
G. Meals	**5,477**	1,524		1,273	
H. Animal products	**38**	0		0	
J. Dairy products	**17**	1		13	
K. Others	**1,043**	**319,1**		**266,4**	
TOTAL	**21,296**	**6,837**	32.1%	**5,748**	27.0,%

Source: Agreste

7. Evidence from interviews and questionnaires with stakeholders in the French protein crop sector

There are two main sources from which we drew evidence: one was through direct interviews with stakeholders and the other, analysis of individual questionnaires completed by 18 farmers. This is described in the following two sections. The questionnaires were lengthy and many respondents did not complete them in full. Given the relatively small sample of completed questionnaires, prudence should be exercised when interpreting the results.

Questionnaires for processors were fewer in number since many of them are transnational companies active in several Member States. The analysis for this is not presented in the individual case studies but can be found in the Main Report.

7.1 Interview evidence

The producer and processor questionnaires and the series of interviews with different segments of the sector provided the following conclusions regarding the impact of the CAP measures on the area planted to protein crops and decisions about crop rotations.

- Farmers are more interested in food end-uses and in export markets than they are in the feed market for protein crops. However, protein crop production for the premium-price food markets and export markets is considered to be very risky. This is because production volumes fluctuate significantly from year to year, and adverse climatic conditions during the growing season can result in lower crop prices if the quality criteria for food uses and for export sales (also for food) are not met.

- Producers do not believe that a larger coupled aid for protein crops would have resulted in a significantly larger area planted to these crops. Farmers are aware of the benefits (in particular the savings on fertiliser use and higher yields in following crops) in developing a rotation that includes protein crops. They would continue to apply this rotation, and even increase the area cultivated under field peas, if the *aphanomyces* fungal disease could be properly controlled.

- Large scale infestation of this disease would be a disaster for the development of the production of field peas. In terms of changes in the relative distribution of protein crops, the production of field beans has increased since the reform, but this has not made up for the sharp reduction in the area cultivated under field peas.

- Unfortunately, in terms of the availability of disease resistant field pea varieties, the outlook is not encouraging. This is because seed producers and researchers in the agri-chemical industry tend to consider the potential outlet for their findings/products in the field pea sector now too small to justify a large investment in more R&D, when the major arable crop areas are so much larger.

Regarding the changes in the gross margins of protein crops relative to alternative crops and its impact on production of protein crops

- Time series data on margins for protein crops are only available for field peas, the main protein crop. Analysis of these data reveals that their gross and net margins declined during the period under review (2000-2007). The only crop year when this pattern was broken was 2007/08, but that was a year during which all COP products benefited from high market prices. As a result of this change in profitability, field peas have been mostly directly replaced by rapeseed and, to a much lesser extent, by lentils, in rotations with cereals. Rapeseed and cereals are generally more profitable and less risky crops.

Evolution and size of the organic protein crop sector

- Organic crop production has not been viewed as a possible option for French farmers until the mid-2000s. Interviews with feed compounders and producers revealed that the organic sector is expanding, although slowly, in response to a growing demand by consumers. This applies also to protein crops, but the organic share of total output is estimated to be no more than 1%.

- Organic protein crop production is of some interest to mixed crop-livestock specialists, who want to be assured of the traceability of their organic protein feed ingredients.

Importance of the on-farm use of protein crops for feed?

- There is clear evidence that the share of protein crop output used on-farm has been growing. One piece of evidence is that certified seeds are being used for a smaller share of total areas, which indicates that farmers use the crops that are harvested as seeds for the following year.

- Several farmers indicated during interviews that they use field peas grown on the farm for their pig and for their dairy operations.

- Sweet lupins were said to be mainly used on-farm, which is why the marketed tonnages were so small.

Interest of feed compounders in the use of protein crops

- Feed compounders have observed the sharp reduction in protein crop supply and turned to other sources of proteins to replace the reduced availability of protein crops, with soybean meal being the raw material of choice. One (very minor) exception to this trend is the market for green peas for horse feed. This niche outlet is similar in structure to the pet food sector, in which compounders and their customers are willing to pay a premium for certain protein crops by virtue of their appearance in the feed product.

- The main alternatives to protein crops in compound feed are soybean meal and rapeseed meal, which offer significantly higher protein contents than field peas and field beans.

- The banning of the use of meat and bone meal in feed in 2001, following BSE, has removed an important element of support for protein crop feed demand (where these crops were mixed with high protein animal by-products). This explains the dramatic decline in protein crop use in feed between 2000 and 2003 in Table FR.17.

- The presence of GMOs is also a key factor in many purchases of protein ingredients, favouring rapeseed meal, sunflower meal and protein crops over soybean meal.

Evolution of food uses of field peas, field beans and sweet lupins

- Local food use of field peas, field beans and sweet lupins is very small. The main pulses consumed by French households are lentils. A new outlet for field beans has been developed in Picardie by Roquette, and this is in the manufacture of processed dairy products (it is believed that the protein crops act as a source of fibre and as a texturising agent in these products). One of the company's potato starch factories has been converted into a field bean processing plant to supply this new end-use.

7.2 Summary of analysis of farmers' questionnaires

The following section summarises the key points that emerged from the analysis of questionnaires administered to protein crop farmers during the fieldwork carried out for this evaluation. While this evidence provides a valuable cross-section of the different conditions in the protein crops sector, the high frequency of no responses to some questions undermines the applicability of the survey's findings to the wider population of French farmers growing protein crops. Looking ahead, simulations of full decoupling, based on the results of the farmers' survey, are indicative of a fall in protein crop area of around 15% from 2008 levels.

7.2.1 Protein crop areas

- Over the period 2003/04 – 2008/09, the majority of farmers reported a decline in area dedicated to protein crops. The modal class for this is a decline of 15-30%. In line with the decline in area, the majority of responses reported a decline in output of over 50% over the same period.
- The majority of farmers surveyed reported that plantings take place around November and over February/March. Almost 90% of farmers interviewed harvest their protein crops around July.

7.2.2 Crop rotations

- On average, 10% of arable land is planted to protein crops.
- Around 90% said they have a rotation cycle for protein crops.
- Almost 95% of respondents indicated that wheat and rye are the crops mostly used in rotation with protein crops.
- Almost two thirds of respondents cited protein crops as a good antecedent as the reason for using them in their rotation cycle. Nearly a third of respondents highlighted the fact that they are a free source of nitrogen.
- Sunflower was reported as the most popular crop famers would use in rotation cycles in place of protein crops.

7.2.3 Production of alternative (non-protein) crops

- Nearly half of participants reported no change since 2003 in total area dedicated to other crops (i.e. not protein crops).
- Three quarters of respondents said protein crop areas had been replaced by other crop, most notably rye.

7.2.4 Protein crop quality

- Almost three quarters of farmers changed the variety of protein crops they cultivated over the last five years. Of these, 90% said this was to improve yield.
- The majority of participants said they obtained their protein crops seeds from a cooperative.

7.2.5 Outlets for your protein crops

- Only 6% of farmers interviewed said they used their protein crop output directly on farm for feed. They also indicated that less than 20% of their production is used in this way.
- Cooperatives are the main buyer of their crop for around 60% of respondents. Traders are the main buyer for another 17%, while feed compounders are the main buyer for another 11%.
- Around 60% of farmers interviewed said that their protein crop was mainly used in feed outlets. Of this group, 64% said that their protein crop was destined for feed users nationally. The crop was mainly used for food for 11% of respondents.

7.2.6 Protein crop marketing

- 28% of respondents said they had a contract with a processor while 6% reported that they had contracts with traders. A third said they had contracts with other agents.
- 64% of those with contracts said they were with cooperatives, while 9% said the contracts were with private firms.
- Over 60% of farmers said that quality and price were the main elements included in the contract, while half said quantity was included in the contract.
- 55% of those interviewed with contracts said that they were not permitted to sell their protein crops to other processors outside the contract.
- Quality is measured as the percentage of germination of seeds for around 22% of farmers. Insect damage followed next.
- 28% of those interviewed said that they received a premium or incentive from the processor for improved quality of protein crops.
- The average priced received per tonne of field beans in 2003 was €140 (s.d.49.8). This rose to €202 in 2007 (s.d.52.5) and decreased to €185 (s.d.36.3) in 2008.

7.2.7 Use of inputs

- Generally speaking, responses regarding changes in the use of inputs have a normal distribution, with the majority indicating that there was little or no change in the use of seed, fertiliser, sprays and labour per hectare of protein crops. The exception is irrigation, with the majority of respondents indicating a decrease in its use.
- Only 17% of farmers grow protein crops on irrigated land. All of the protein crop area was irrigated for the majority of this group. Sprinkler is the only irrigation system used.

7.2.8 On-farm employment and labour used

- Less than 20% of household employment is derived from protein crops for all of the farmers who answered this question. For this group, less than 20% of employed (i.e. non-family) labour time is spent on protein crop production.
- Around two thirds of respondents do not contract out specific farm operations. Of those who did, harvesting was the main operation to be contracted out, the average cost of which was around €85 per hectare.

- Around 40% of those interviewed derive their income completely from farm activities. Of those who replied, 72% derived less than 20% of their farm revenue from protein crops (including the special area payment) in 2003. In 2007, 78% derived less than 20% of their farm revenue from protein crops (including the special area payment).

- The mode answer for how those interviewed calculated profit was gross revenue minus cash, labour, machinery (depreciation or hire) and land costs. Profitability is typically judged per hectare.

- Rapeseed, wheat and maize were commonly reported as being the most profitable crops in 2008.

- Just over a fifth felt that the ranking of crop profitability had changed over the last five years, with durum what commonly report as being the most profitable crop.

7.2.9 The impact of reforms in the Common Agricultural Policy

- More than half of farmers felt that the introduction of a decoupled payment had not affected the area they planted to protein crops. Nearly two fifths said it had a slight impact.

- 44% of respondents said that the change in payment system for protein crops since 2003 had an effect on the area planted to protein crops. Of these, a quarter said that it greatly affected their decision, while three quarters said it had a slight affect.

- The responses suggest that as the level of payment tied to protein crops decreases, area planted to protein crops decreases. If coupled payments were completely removed, area under protein crops would fall by 15%. If coupled payments rose to €100, are under protein crops would rise to by over 25%.

- A number of elements are taken into consideration in famer's decision to grow protein crops. The most important of these is the price paid by the trader/processor, followed by protein crops area payment and the price of other crops. The benefits of protein crops for the following crops emerged as an important factor.

- 28% of respondents said their reasons for growing protein crops had changed since 2003. The majority indicated that this was the opportunity cost of other crops, followed by agronomic problems of protein crops

8. Impact of the CAP measures upon the local protein crop sector

Protein crop area in France contracted significantly between 2000 and 2008, declining from around 461,000 hectares to around 165,000 hectares. The rate of decline accelerated in the last three years. Total protein crop area fell from around 420,000 hectares in 2005 to around 165,000 hectares in 2008.

In terms of individual protein crops, these have been following quite different patterns over the period 2000-2008. The share of field peas (the largest crop in terms of area and production) in protein crop production fell from 93.3% in 2000 to 59.6% in 2008, while the share of field beans rose from 5.4% to 39.3%. The share of sweet lupins remained fairly stable at around 1.5%.

The findings of this report provide no evidence to suggest that the fall in French protein crop area is the direct consequence of the changes introduced with the 2003 reform[4] .

There is weak evidence that the adoption of a uniform €55.57 special aid per hectare favoured production of protein crops in regions with lower reference yields under regionalisation plans compared to regions with higher reference yields, under the *ceteris paribus* assumption.

However, our assessment reveals that the main reasons for the decline of the sector can be found in agronomic factors and market developments which occurred outside the CAP policy framework.

- The fungal root disease, *aphanomyces,* has greatly affected area planted to field peas throughout the evaluation period. While a*phanomyces* has been a problem since the 1980s, its impact has increased in recent years, particularly in the northern regions, which are the main areas of production of field peas. So far, no effective ways of fighting this pest have been developed, with growers being increasingly reluctant to expand field pea cultivation in land free of the disease.

- Comparison of gross margins of protein crops and alternative COP crops for the regions of Eure-et-Loir and Seine Maritime does not provided a uniform picture on the ranking of gross margins following the 2003 changes to the CAP measures. In Eure-et-Loir, field peas often generated marginally higher gross margins than common wheat, barley and rapeseed for food uses over the period 2000-2004. In contrast, gross margins of field peas were always lower than gross margins of competing COP crops in Seine Maritime over the period 2003-2004 (the only years for which data are available).

- While farmers recognise the benefits offered by protein crops both in terms of rotational benefits and ability of these crops to fit into the structure of farming in general, these favourable aspects are not sufficient to encourage farmers to expand areas given over to these crops.

- The feed compounding sector has been undergoing a process of consolidation which started prior to 2003 reform. While the numbers of plants has declined, the average output per unit has increased. The net result is that total production has remained fairly unchanged over the period 1997-2007. At the same time, data show that demand for protein crops fell dramatically over the period 2000-2003. This was mainly due to the banning of the use of meat and bone meal in feed in 2001, following the BSE outbreak, which removed an important element of support for protein crop feed demand. Protein

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[4] These are the partial integration of the previous aid for protein crop production into the Single Payment Scheme and the special aid for protein crops set at €55.57 per hectare.

crops were replaced by alternative feed ingredients, such as cereals, rapeseed and soybeans, which were readily available in large supplies and reasonably priced.

- The continuing decline in production means that the sector is now lacking critical mass to justify research into improved varieties, development of crop protection products to fight *aphanomyces*, investment by feed compounders in storage capacities, etc. This will further endanger the future viability of the sector.

German Protein Crop Sector

This monograph has the following structure.

- We consider, first, the development of the protein crop sector within Germany.
- Then, we review the development of alternative cereals, oilseed and protein (COP) crop production within the country.
- We describe the main production systems applied to protein crops, notably as regards crop rotations.
- We then analyse the gross margins on protein crops vs. those on alternative COP crops.
- We present analysis from the FADN database of the significance of protein crops in German farm incomes.
- We review the development of the local feed compounding sector and its attitudes towards the use of protein crops in their feed mixtures.
- We summarise the evidence collected during the fieldwork. The main tools of investigation consisted of questionnaires administered to protein crop farmers and interviews with feed compounders.
- We conclude with a discussion of the impact of the CAP measures upon the local protein crop sector.

1. The development of the protein crop sector

In Germany, there is a long tradition of protein crop production, covering all three crops, field peas, field beans and sweet lupins. For details, see Table GE.1, which presents national data on output, areas and yields, from 1990 until 2006.

The two main reasons for this strong tradition in domestically grown protein crops are, first, the externalities provided by protein crops within the crop rotation (*Vorfruchtwert*), which are captured in the form of higher yields for the following crops and, second, the high protein content compared to the protein content of feed cereals for livestock farmers using protein crops for on-farm feed. The latter is particularly true of sweet lupins, which are a popular crop for mixing with feed cereals on-farm, particularly in poorer soils in Eastern Germany, where they are mixed with rye, a cereal well-suited to such soils.

Because of the importance of on-farm feed, the data on aspects such as yields and prices are less precise for sweet lupins than for the other protein crops. The areas from 1990 to 2002 for sweet lupins have been derived from the data on "other dry pulses", assuming that lupins represent a constant share (this is estimated at 88.8%). Disaggregated regional series on lupins are not available.

Tables GE.1 to GE.7 provide details of the areas, output and yields by region of the two most widely marketed protein crops (the distinction in this instance is made with sweet lupins, which are used more heavily on-farm, without entering the commercial marketing chain).

- For field peas, the main regions of production lie to the East and South of the country.
- For field beans, the most important production regions are in the West and South.

Table GE.8 describes the development of the country's export, import and net export flows in the three protein crops, combining intra-and extra-EU volumes.

It is evident that the trade balance fluctuates between net imports and net exports of the same product over time. In 2007, the latest year for which comprehensive data are available, the net balances were very modest. For field peas, there was a small net import flow. For field beans, there was a net export volume of a similar magnitude to the net imports of field peas. For sweet lupins, there was a very small trade deficit.

Table GE.1: Production, yields and prices of field beans, field peas and sweet lupins in Germany[1]

	Field Beans			Field Peas			Sweet Lupins	
	Area hectares	Yield tonnes/ha	Price €/tonne	Area hectares	Yield tonnes/ha	Price €/tonne	Area hectares	Yield tonnes/ha
1990	27,510	3.7	234	16,901	3.6	259	52,565	N/A
1992	17,991	3.1	269	28,652	2.6	292	8,702	N/A
1994	30,388	3.0	126	45,288	3.3	126	17,847	N/A
1995	25,498	3.4	126	64,195	3.4	126	29,657	N/A
1996	21,125	3.7	126	87,344	3.4	140	35,606	N/A
1997	25,816	3.6	126	119,299	3.4	134	34,807	N/A
1998	26,145	3.5	113	167,549	3.5	123	26,549	N/A
1999	23,222	4.1	108	164,483	3.7	115	21,754	N/A
2000	17,677	3.5	133	141,320	2.9	135	23,619	2.1
2001	20,624	3.9	134 [2)]	163,610	2.4	142 [2)]	30,545	3.4
2002	18,518	3.5	129	148,428	2.8	136	36,228	2.9
2003	19,300	3.0	109	139,400	2.8	115	45,627	2.2
2004	15,511	4.1	113	121,500	3.8	123	35,818	3.8
2005	15,700	3.8	118	110,300	3.1	119	38,600	3.3
2006	15,000	3.3	110	92,100	3.1	117	32,800	2.8

[1)]:1986-1990 Federal Republic of Germany, since 1991 Germany. Data on lupins since 2002 are derived from DESTATIS., in earlier years, it aggregated lupin areas with other dry pulses, and it has been assumed that lupins occupied a stable proportion of the overall dry pulse area prior to 2002 (this is estimated at 88.8%) . Yield data for lupins have been calculated from regional data for 2000-2006: from Gesellschaft zur Förderung der Lupine e. V.. For 2007, it has been derived from.Lupinen Verwertung und Anbau. Rastatt. No earlier official national data are published on lupin yields.

[2)]: 2001 price Richtwert-Deckungsbeiträge 2003 published by the Landwirtschaftskammer (Chamber of Agriculture) Hannover

Source: derived from FISCHER, 1999, p. 591; ZMP, 2002, p.143, 144 (sown areas since 1999), p.147, (yields since 1998), KTBL, StDB, various years (prices since 1998), Fachserie 3, R 3, 2.1, 2007. .

Table GE.2: Regional areas under field peas, 2000-2007 (hectares)

	2000	2001	2002	2003	2004	2005	2006	2007
Baden-Württemberg	5,515	7,203	5,621	5,371	4,779	4,500	3,700	2,904
Bavaria	10,749	13,355	14,592	14,733	14,454	13,700	13,900	11,886
Brandenburg	20,860	23,983	22,460	20,159	16,819	16,900	13,800	11,940
Hesse	6,010	8,264	8,317	6,627	6,083	4,400	3,600	2,441
Mecklenburg-Western Pomerania	15,027	13,657	11,436	9,174	7,186	5,400	4,000	2,822
Lower-Saxony	4,958	7,027	6,811	4,960	5,304	3,400	2,800	1,926
North Rhine-Westphalia	1,458	2,214	2,347	1,730	2,515	1,800	2,400	2,133
Rhineland-Palatinate	4,273	6,341	4,775	3,805	2,947	2,200	2,000	1,421
Saarland	380	452	283	300	236	200	200	209
Saxony	18,186	21,047	18,545	17,903	15,186	15,800	12,100	8,378
Saxony-Anhalt	35,450	39,597	34,520	33,533	27,162	24,700	18,500	9,833
Schleswig-Holstein	1,381	1,880	1,465	1,299	1,527	900	700	513
Thuringia	17,062	18,568	17,233	16,324	17,256	16,300	14,400	11,274
Germany, total	141,309	163,588	148,405	135,918	121,454	110,200	92,100	67,680

Source: ZMP Martkbericht: Getreide, Ölsaaten und Futterplanzen, various years. Bonn. Various years.

Table GE.3: Regional yields of field peas, 2000-2007 (tonnes/hectare)

	2000	2001	2002	2003	2004	2005	2006	2007
Baden-Württemberg	3.5	3.6	3.4	3.0	3.5	3.4	3.5	3.4
Bavaria	3.3	3.7	3.3	2.7	3.6	3.3	3.3	3.3
Brandenburg	1.8	2.6	2.1	1.7	3.3	2.2	2.1	1.7
Hesse	3.7	3.6	3.2	3.7	3.6	3.8	3.9	2.8
Mecklenburg-Western Pomerania	2.3	3.3	2.6	2.8	3.9	2.7	2.9	2.3
Lower-Saxony	3.9	4.2	3.3	3.7	3.9	3.8	3.5	3.2
North Rhine-Westphalia	4.3	4.5	3.8	4.2	4.3	3.6	4.0	3.5
Rhineland-Palatinate	3.6	3.6	3.4	3.3	3.3	3.3	3.4	3.3
Saarland	3.0	2.8	3.1	2.6	2.8	2.8	3.0	2.7
Saxony	2.8	3.1	2.7	2.6	3.9	3.3	3.0	2.7
Saxony-Anhalt	3.1	3.6	2.7	3.2	4.0	3.3	3.2	2.3
Schleswig-Holstein	3.8	4.2	3.9	4.2	4.5	4.4	4.0	3.7
Thuringia	3.1	3.8	2.7	3.2	4.2	3.4	3.4	2.6
Germany, total	2.9	3.4	2.8	2.9	3.8	3.1	3.1	2.6

Source: ZMP Martkbericht: Getreide, Ölsaaten und Futterplanzen, various years. Bonn. Various years.

Table GE.4: Regional production of field peas, 2000-2007 ('000 tonnes)

	2000	2001	2002	2003	2004	2005	2006	2007
Baden-Württemberg	19.41	25.86	18.89	16.33	16.82	15.26	12.91	9.87
Bavaria	35.90	48.75	48.01	39.48	51.89	44.66	45.45	39.58
Brandenburg	36.92	63.32	47.62	34.47	56.18	36.34	29.53	19.94
Hesse	22.12	30.08	26.53	24.45	22.08	16.63	13.97	6.71
Mecklenburg-Western Pomerania	34.11	44.39	29.28	25.50	28.24	14.80	11.72	6.55
Lower-Saxony	19.09	29.16	22.14	18.10	20.42	12.82	9.88	6.14
North Rhine-Westphalia	6.21	10.01	8.90	7.27	10.81	6.53	9.62	7.42
Rhineland-Palatinate	15.30	23.02	16.09	12.44	9.67	7.30	6.72	4.68
Saarland	1.16	1.28	0.88	0.77	0.67	0.57	0.61	0.55
Saxony	50.38	65.04	49.33	46.37	59.68	51.51	36.06	22.29
Saxony-Anhalt	109.90	140.97	92.86	108.31	108.92	81.02	59.57	22.81
Schleswig-Holstein	5.25	7.97	5.74	5.47	6.93	3.98	2.82	1.91
Thuringia	53.23	69.82	46.87	52.56	71.78	54.61	48.96	29.09
Germany, total	408.97	559.64	413.12	391.53	464.10	346.01	287.83	177.55

Source: ZMP Martkbericht: Getreide, Ölsaaten und Futterplanzen, various years. Bonn. Various years.

Table GE.5: Regional areas under field beans, 2000-2007 (hectares)

	2000	2001	2002	2003	2004	2005	2006	2007
Baden-Württemberg	1,551	1,862	1,661	1,601	1,088	900	800	738
Bavaria	2,356	3,861	3,103	3,484	2,199	2,300	1,900	1,983
Brandenburg	706	709	396	570	186	100	100	75
Hesse	838	1,077	918	1,012	925	1,300	1,100	1,014
Mecklenburg-Western Pomerania	489	688	748	815	604	300	400	308
Lower-Saxony	1,124	1,148	2,159	2,224	1,371	1,500	1,500	1,169
North Rhine-Westphalia	1,643	2,690	2,235	2,545	2,689	2,800	3,100	2,543
Rhineland-Palatinate	98	-	174	155	182	100	200	203
Saarland	31	-	61	53	44	34	33	22
Saxony	3,676	2,968	2,889	2,846	1,559	1,700	1,800	995
Saxony-Anhalt	670	702	762	1,012	1,180	900	1,000	904
Schleswig-Holstein	833	880	832	668	914	1,100	900	853
Thuringia	3,621	3,764	2,568	3,040	2,556	2,500	2,100	1,477
Germany, total	17,636	20,349	18,506	20,025	15,497	15,534	14,933	12,284

Source: ZMP Martkbericht: Getreide, Ölsaaten und Futterplanzen, various years. Bonn. Various years.

Table GE.6: Regional yields of field beans, 2000-2007 (tonnes/hectare)

	2000	2001	2002	2003	2004	2005	2006	2007
Baden-Württemberg	3.4	3.4	3.4	2.8	3.2	3.3	3.1	3.2
Bavaria	3.7	3.8	3.6	2.7	3.7	3.7	3.4	3.7
Brandenburg	2.0	2.7	2.9	0.9	2.3	2.1	1.1	0.9
Hesse	2.7	3.2	3.3	2.9	4.2	3.2	2.8	2.2
Mecklenburg-Western Pomerania	2.6	3.3	3.3	3.0	4.5	2.7	2.7	3.7
Lower-Saxony	4.4	4.5	4.0	4.2	4.4	4.3	4.0	4.0
North Rhine-Westphalia	4.1	4.6	4.0	4.4	4.6	4.3	4.0	4.0
Rhineland-Palatinate	3.5	0.0	3.2	2.9	3.0	3.0	2.9	2.8
Saarland	3.3	0.0	3.3	2.5	3.1	2.9	2.7	2.6
Saxony	3.2	4.0	3.2	2.3	4.4	4.3	3.0	3.6
Saxony-Anhalt	3.4	4.0	3.0	3.1	3.8	3.8	2.3	3.5
Schleswig-Holstein	5.6	5.2	3.9	5.2	4.8	5.1	3.7	3.7
Thuringia	3.3	3.9	3.2	2.3	4.1	3.0	2.6	3.3
Germany, total	3.5	3.9	3.5	3.0	4.1	3.8	3.3	3.5

Source: ZMP Martkbericht: Getreide, Ölsaaten und Futterplanzen, various years. Bonn. Various years.

Table GE.7: Regional production of field beans, 2000-2007 ('000 tonnes)

	2000	2001	2002	2003	2004	2005	2006	2007
Baden-Württemberg	5.24	6.24	5.66	4.47	3.49	2.95	2.50	2.33
Bavaria	8.74	14.48	11.14	9.41	8.18	8.46	6.42	7.42
Brandenburg	1.38	1.93	1.14	0.52	0.44	0.21	0.11	0.07
Hesse	2.26	3.40	2.98	2.89	3.88	4.13	3.11	2.21
Mecklenburg-Western Pomerania	1.29	2.29	2.50	2.40	2.74	0.82	1.06	1.15
Lower-Saxony	4.91	5.18	8.61	9.34	6.02	6.44	5.99	4.63
North Rhine-Westphalia	6.70	12.43	8.96	11.22	12.37	11.96	12.52	10.12
Rhineland-Palatinate	0.35	-	0.56	0.46	0.54	0.30	0.59	0.56
Saarland	0.10	-	0.20	0.13	0.14	0.10	0.09	0.06
Saxony	11.62	11.84	9.24	6.40	6.83	7.36	5.31	3.60
Saxony-Anhalt	2.26	2.77	2.31	3.16	4.48	3.38	2.28	3.16
Schleswig-Holstein	4.66	4.59	3.22	3.50	4.40	5.57	3.35	3.16
Thuringia	12.02	14.75	8.09	6.84	10.53	7.45	5.48	4.86
Germany, total	61.54	79.91	64.63	60.75	64.03	59.13	48.82	43.32

Source: ZMP Martkbericht: Getreide, Ölsaaten und Futterplanzen, various years. Bonn. Various years.

Table GE.8: German foreign trade, combining intra- and extra-EU trade, in protein crops, 2000-2007 (tonnes)

	Field peas			Field beans			Sweet lupins		
	Exports	Imports	Net Exports	Exports	Imports	Net Exports	Exports	Imports	Net Exports
2000	20,799	78,582	-57,783	7,274	4,488	2,786	373	62,154	-61,781
2001	41,468	57,406	-15,938	5,785	3,866	1,919	922	19,380	-18,459
2002	85,808	37,755	48,053	2,414	3,743	-1,329	1,435	9,567	-8,132
2003	49,779	37,194	12,585	1,308	3,874	-2,566	282	7,603	-7,321
2004	37,654	91,162	-53,508	7,903	2,350	5,553	463	14,754	-14,291
2005	76,716	26,316	50,400	9,259	511	8,748	841	458	383
2006	50,231	35,891	14,341	9,220	446	8,774	756	2,766	-2,010
2007	42,714	47,350	-4,635	4,439	387	4,051	449	1,046	-596

Sources: FAO, COMEXT

2. The development of alternative crop production

Table GE.9 reveals the trends in the areas under each of the major cereals, oilseed and protein (COP) crops since 2000-01, before the 2003 reform. The bottom rows of the table permit one to compare areas before and after the reform. The main points to note are:

- The protein crop sector as a whole has contracted significantly in scale since the reform. Between the period from 2000-01 to 2003-04 to the period from 2004-05 to 2008-09, the total protein crop area declined by 33%, and the decline accelerated towards the last year, 2008-09.
- Within the sector, field peas suffered the sharpest decline in area (of 40%) comparing pre-and post-reform periods, averaging 88,000 hectares in the post-reform era.
- Field beans also declined substantially, dropping 29% between the two periods, to cover only 14,000 hectares in 2008-09.
- Sweet lupin areas were the best maintained among the protein crops, with a fall of only 2% between the two periods, and covered 26,000 hectares in 2008-09.
- The other sector that lost a great deal of ground after the reform was other cereals, among which rye is the most important. The average area under these crops fell 17% after the reform.
- Among the more significant COP crops, the main gainers from producers' decisions to respond to the reform by adapting their choice of crops, were rapeseed (with an area increase of 16% after the reform), maize (with growth of 8%) and common wheat (with an advance of 5%).

The combined area under the major COP crops was barely altered after the reform. However, in 2008-09, when the compulsory set-aside was set at 0%, the combined area was at its highest level since the turn of the century.

Table GE.9: Areas of the major cereals, oilseeds and protein crops in Germany, 2000-2008 ('000 hectares)

	Protein crop	*Field pea*	*Field bean*	*Sweet lupin*	Rapeseed	Sunflower	Common wheat	Barley	Maize	Durum wheat	Other cereals	Total Area
2000-01	183	*141*	*18*	*24*	1,078	26	2,960	2,068	*363*	*9*	*1,637*	8,324
2001-02	215	*164*	*21*	*31*	1,138	25	2,893	2,112	*397*	*5*	*1,638*	8,423
2002-03	204	*149*	*19*	*36*	1,297	26	3,010	1,970	*399*	*5*	*1,557*	8,468
2003-04	202	*136*	*20*	*46*	1,271	38	2,960	2,087	*473*	*8*	*1,334*	8,372
2004-05	173	*122*	*16*	*36*	1,279	32	3,093	1,973	*454*	*8*	*1,363*	8,374
2005-06	165	*110*	*16*	*39*	1,301	27	3,163	1,947	*443*	*10*	*1,266*	8,322
2006-07	140	*92*	*15*	*33*	1,429	32	3,103	2,025	*401*	*12*	*1,161*	8,303
2007-08	113	*68*	*12*	*33*	1,546	19	2,998	1,934	*383*	*8*	*1,261*	8,261
2008-09	85	*48*	*11*	*26*	1,373	26	3,218	1,969	*520*	*6*	*1,318*	8,515
Average pre-reform	201	*147*	*19*	*34*	1,196	29	2,956	2,059	408	6	1,542	8,397
Average post-reform	135	*88*	*14*	*33*	1,386	27	3,115	1,970	440	9	1,274	8,355
Percentage change	-33%	*-40%*	*-29%*	*-2%*	16%	-5%	5%	-4%	8%	35%	-17%	0%

Source: FAO, Eurostat. For 2008-09, the data have been derived from estimates prepared by COPA-COGECA. It should be noted that the total protein crop areas listed here are consistently higher (by 2% to 15%) than the area on which special aids were paid from 2004/05 to 2008/09. It is believed that the difference represents areas that were planted, but which were not harvested as dried products.

Note: Pre-reform is the period from 2000-01 to 2003-04; post-reform is the period from 2004-05 to 2008-09

3. The production systems applied to protein crops

Due to their amino-acid composition, the protein in field peas and field beans is viewed with less favour in non-ruminant livestock production than other major sources of protein, e.g. soybean meal and rapeseed meal. In pork production, in particular, the protein from field beans does not provide the total amount of all required amino acids.

Declining prices for mineral fertiliser since the mid-1990s until the mid-2000s (which reduced the monetary benefit from the nitrogen-fixing properties of protein crops) and the increasing availability of domestic and imported protein ingredients (led by substantial increases in the production of rapeseed meal as a by-product from increased biodiesel production, and offering livestock producers a more favourable amino-acid composition) have meant that the demand for protein crops declined. This was reflected in a reduction reported during interviews in investments to boost the productivity of the protein crop sector.

Consequently, protein crop production has increasingly become a niche activity, with production volumes stated to be falling below the critical mass considered to be necessary for financial viability on the part of seed companies, traders and feed compounders.

While protein crops, in terms of gross margins, have been at a disadvantage to alternative COP crops throughout the entire evaluation period (2000-2008), their position has deteriorated further since 2005 (as is explained in the discussion of gross margins in the next section). This has led to a reduction in protein crop plantings, most notably of field peas. Without placing a high valuation of the crop rotation value (*Vorfruchtwert*) of protein crops, they were seen as increasingly uncompetitive in relation to winter-planted cereals or oilseeds, and also as uncompetitive when contrasted with spring-planted crops, such as spring barley or many of the feed crops.

At a farm level, therefore, the decision to produce protein crops strongly depends on the valuation of their rotational benefits. Due to differences in soil qualities, water availabilities, etc., the final level of the crop rotational value varies amongst different farms and is reflected in different assessment of the opportunity costs by different farmers.

The following table (Table GE.10) provides an indication of the difference in common wheat yields on land grown immediately after different crops in the previous year as perceived by members of the Landwirtschaftskammer Niedersachsen (Chamber of Agriculture in Lower Saxony) in Hannover. In this example, a common wheat price of €100 per tonne is applied.

Table GE.10: Yield of wheat after previous crops

Previous crop	Wheat yield tonnes/ha	Differences in yields tonnes/ha	Monetary value €/ha
Sugar beets	5.7		
Rapeseed	7.0	1.2	124
Field peas	8.2	2.4	241
Additional wheat yield after peas relative to rapeseed		1.2	117
Additional wheat yield after peas relative to average of sugar beet and rapeseed		1.8	179

Source: Information from interviews with members of the Landwirtschaftskammer Niedersachsen (Chamber of Agriculture in Lower Saxony), Hannover.

Table GE.10 indicates that, based on the information provided by this group of respondents, wheat yields immediately after field peas are significantly higher than under any other rotation. Compared with sugar beet or rapeseed as the previous crops, wheat yields are around 40% or 16% higher, respectively. Applying a wheat price of €100 per tonne, the rotational value of protein crops can be seen to vary from €117/hectare, when compared directly with rapeseed, to €179/hectare, where an average for sugar beet and rapeseed is used as the basis for comparison.

4. The gross margins on protein crops vs. alternative crops

In this section, we consider the behaviour of revenues, production costs and gross margins for field peas, field beans, common wheat, barley, maize and rapeseed in the region selected for the detailed German case study research, the Land of Niedersachsen (Lower Saxony). For all crops, the data on yields, prices and the components of costs are from ZMP. The coupled payment data (for protein crops throughout the entire period under review and for all other COP crops until 2004) are derived from analysis of the FADN data for the Land.

The data for field beans and all the cereals and rapeseed cover all the years from 2000 to 2007. Detailed field pea data were available only for 2000. For the subsequent years it is assumed that each of the components of costs, namely seeds, fertilisers, crop protection and other input costs, move each year by the same percentage as the same category of costs in the production of field beans.

4.1 Field pea revenue and production costs

Table GE.11 presents estimates of revenue and costs of field peas for this region. The table reveals that:

- Following the application of the SPS in 2005, the total coupled payments for protein crops fell by over €340 per hectare.
- As a result, total revenues fell from over €800 to an average of close to €500 per hectare
- Production costs prior to 2007 were close to €300 per hectare, but rose by almost €50 in 2007.

Table GE.11: Lower Saxony, field pea revenue and variable costs (€/hectare)

	2000	2001	2002	2003	2004	2005	2006	2007
Yield (t/ha)	3.9	4.2	3.3	3.7	3.9	3.8	3.5	3.2
Field Pea Price per tonne	135	142	136	115	123	119	117	135
Protein Crop Arable Aid (€/ha)	415	390	385	397	343			
Protein Crop Special Aid (€/ha)					56	56	56	56
Return per ha								
Field Pea Price	519	590	441	421	474	449	414	429
Coupled Payment	415	390	385	397	399	56	56	56
Total Revenue	**934**	**980**	**826**	**818**	**872**	**505**	**469**	**485**
Variable costs								
Seed	101	106	102	86	92	89	88	101
Fertiliser	65	79	63	80	82	72	75	96
Crop Protection	53	68	60	64	57	59	69	68
Other (e.g. irrigation, drying)	78	86	61	82	93	75	67	85
Total variable costs	**297**	**339**	**286**	**313**	**324**	**295**	**300**	**349**
Gross margins	**637**	**641**	**540**	**505**	**548**	**210**	**170**	**135**

Source: ZMP, FADN for estimates of CAP support.

4.2 Field pea gross margins

Table GE.12 and Diagrams GE.1-GE.5 depict describe the evolution of the gross margins for field peas and field beans in relation to the main alternative cereal crops and rapeseed from 2000 to 2007. The derivation of gross margins for alternative crops is shown in Table GE.13.

The main conclusions to be drawn from these comparisons are:

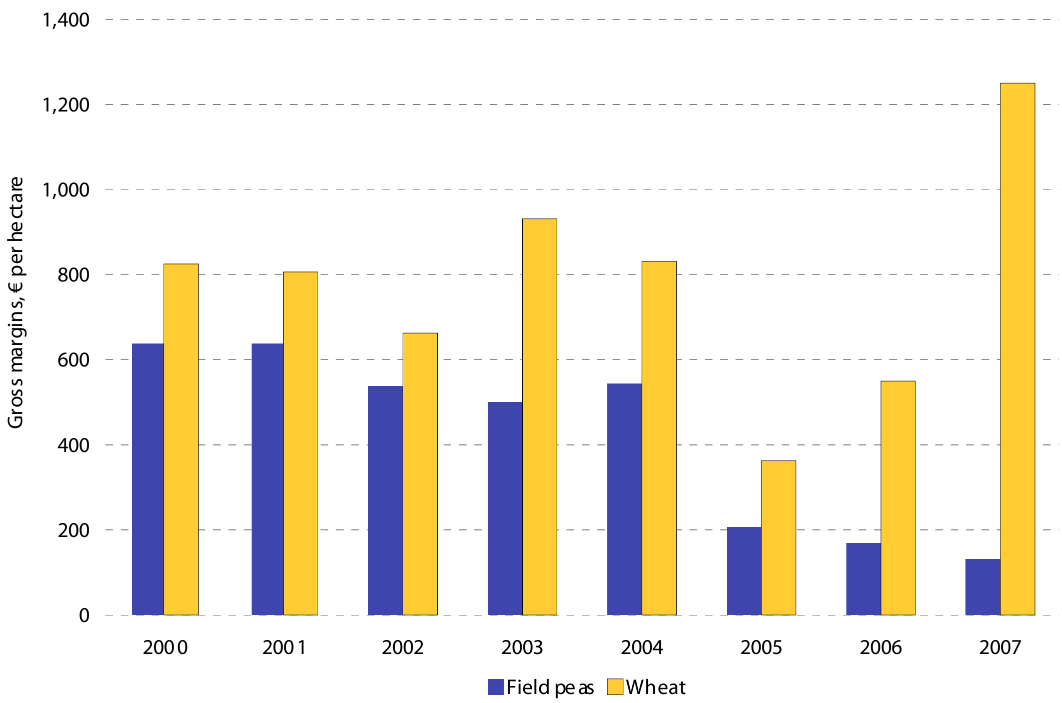
- Following the implementation of the SPS, the gross margins per hectare declined for all crops in 2005, but then the margins for common wheat, barley and rapeseed increased sharply in the next two years mainly due to the exceptionally high prices for these crops prevailing in this period.
- For both field peas and field beans, gross margins per hectare remained comparatively low from 2005 to 2007.
- Field peas consistently returned the lowest gross margins of any of the crops.

Table GE.12: Lower Saxony, gross margins for main COP crops, 2000-2007 (€ per hectare)

	2000	2001	2002	2003	2004	2005	2006	2007
Field peas	637	641	540	505	548	210	170	135
Field beans	680	696	647	564	569	261	188	213
Wheat	829	811	666	933	835	363	554	1,250
Barley	790	689	760	758	660	415	849	546
Maize	847	1,136	1,065	763	575	365	368	386
Rapeseed	744	888	744	787	813	401	464	1,289

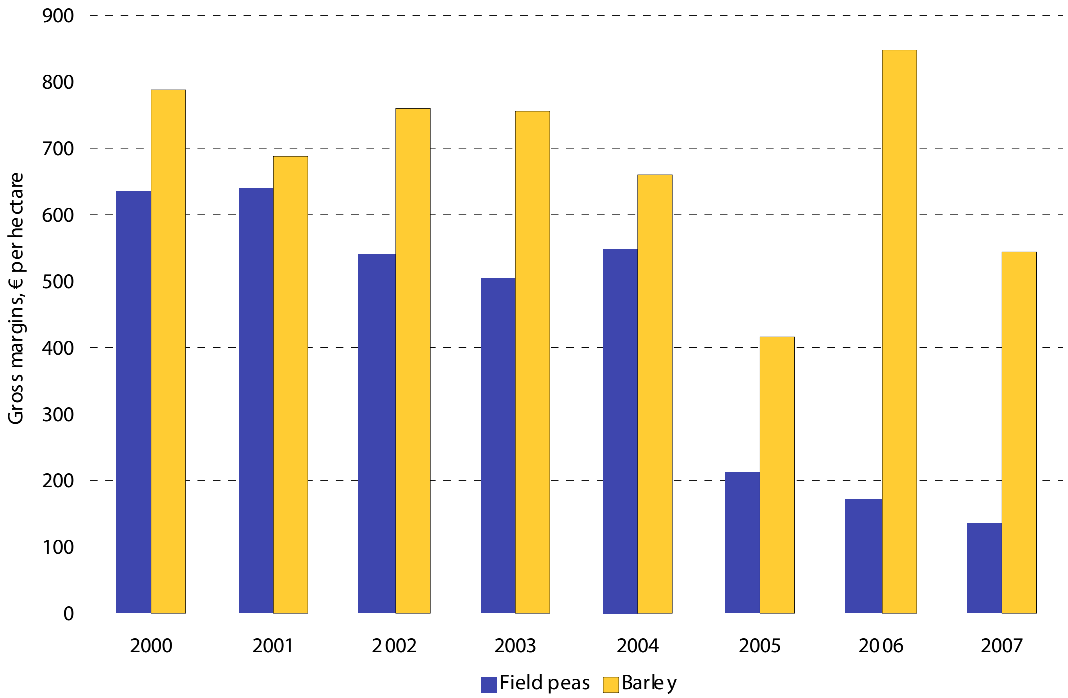
Source: ZMP. Estimates of CAP support derived from the FADN database for protein crop producers in the Land. From 2005 onwards, gross margins for protein crops only include the protein crop special aid. For all other COP crops, coupled support was eliminated under the 2003 reform. No coupled support is included in the gross margins for these crops from 2005 onwards.

Diagram GE.1: Lower Saxony, field pea gross margins vs. common wheat, 2000-2007



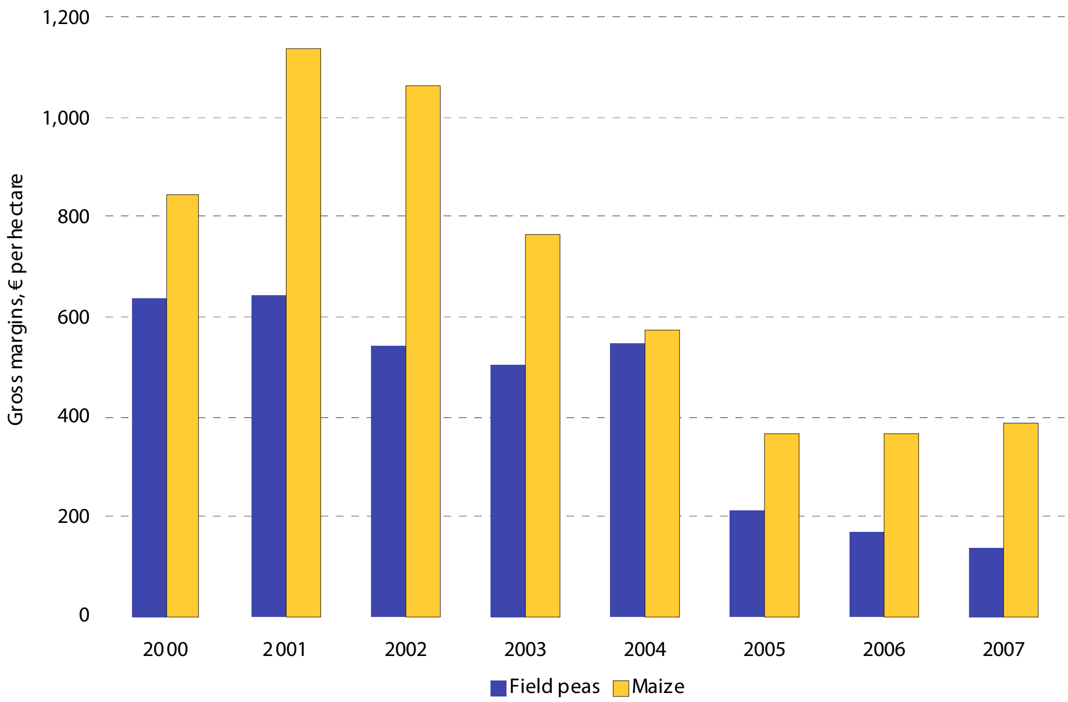
Source: ZMP, FADN

Diagram GE.2: Lower Saxony, field pea gross margins vs. barley, 2000-2007



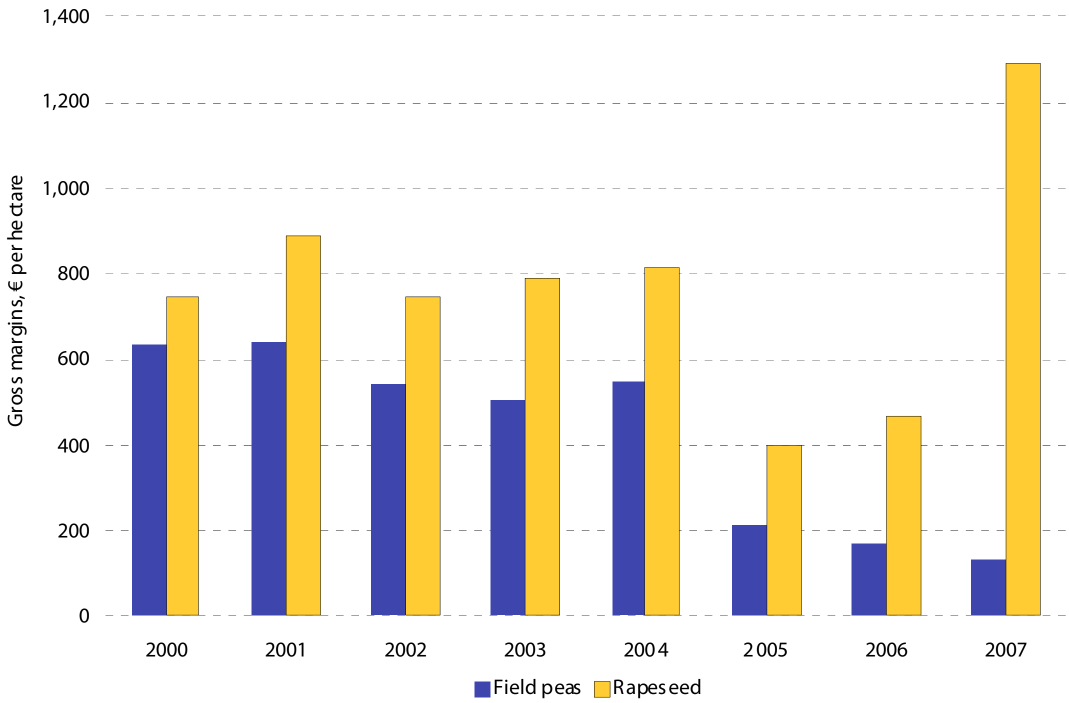
Source: ZMP, FADN

Diagram GE.3: Lower Saxony, field pea gross margins vs. maize, 2000-2007



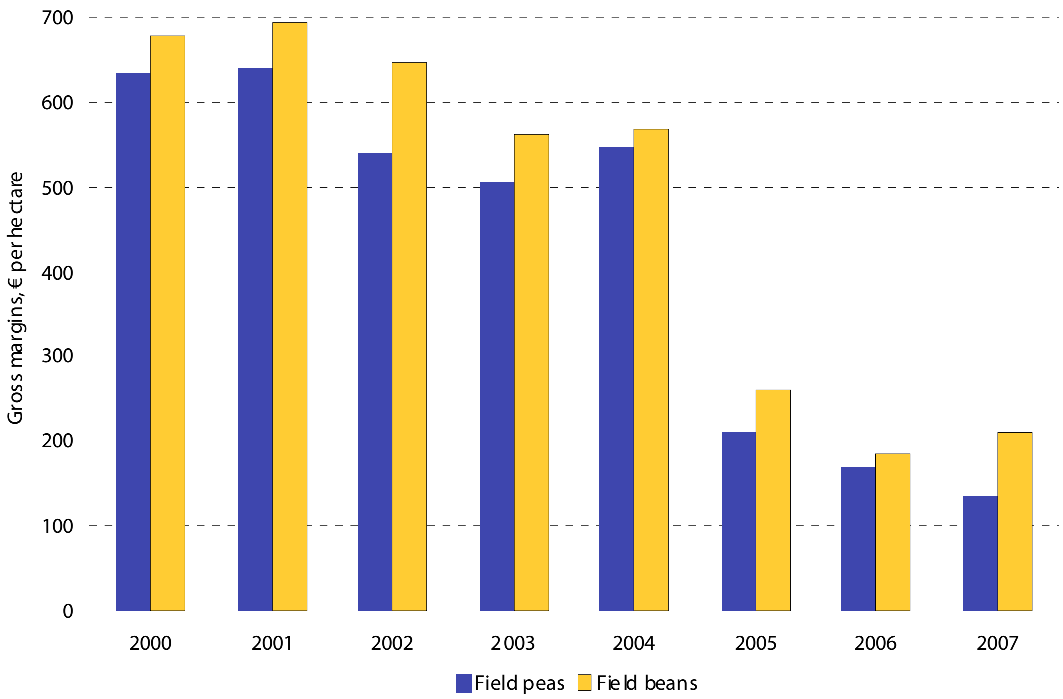
Source: ZMP, FADN

Diagram GE.4: Lower Saxony, field pea gross margins vs. rapeseed, 2000-2007



Source: ZMP, FADN

Diagram GE.5: Lower Saxony, field pea gross margins vs. field beans, 2000-2007



Source: ZMP, FADN

Table GE.13: Lower Saxony, revenue and variable costs of alternative crops (€/hectare)

		2000	2001	2002	2003	2004	2005	2006	2007
Wheat	Price	816	809	639	901	822	694	900	1,636
	CAP support	333	338	339	358	347	0	0	0
	Total Revenue	1,150	1,147	977	1,259	1,170	694	900	1,636
	Variable costs	321	336	311	326	335	331	346	386
	Gross margins	829	811	666	933	835	363	554	1,250
Barley	Price	733	613	681	683	586	728	1,172	829
	CAP support	333	338	339	358	347	0	0	0
	Total Revenue	1,066	951	1,020	1,040	934	728	1,172	829
	Variable costs	276	262	260	282	274	313	323	283
	Gross margins	790	689	760	758	660	415	849	546
Maize	Price	1,064	1,025	969	871	776	931	918	935
	CAP support	333	330	322	358	347	0	0	0
	Total Revenue	1,397	1,355	1,291	1,228	1,124	931	918	935
	Variable costs	550	557	565	465	549	566	550	549
	Gross margins	847	798	726	763	575	365	368	386
Rapeseed	Price	617	766	694	748	813	756	814	1,616
	CAP support	431	432	343	356	347	0	0	0
	Total Revenue	1,048	1,198	1,037	1,104	1,160	756	814	1,616
	Variable costs	304	310	293	317	347	355	350	327
	Gross margins	744	888	744	787	813	401	464	1,289

Source: Price and cost data provided by ZMP. Estimates of coupled CAP support derived from the FADN database for the Land.

4.3 Alternative crops

The main alternative crops to field peas that are considered in the following analysis are those included previous five diagrams, the three main cereals, rapeseed and field beans. The costs and revenues of these crops have been estimated from detailed data for Lower Saxony. For all these crops, changes in the levels of coupled support from the FADN data for COP specialists in the Land are incorporated into the analysis.

Table GE.14 and Diagram GE.6 contrast the gross margins on field peas with the weighted average gross margins on the other five crops from 2001 to 2007. In line with the approach applied to the other MS, values have been estimated for three periods: prior to the 2003 reform (2001-2003); immediately after the reform (2004-2005); and finally, after the reform was complete (2006-2007).

The table and diagram compare the differences in average gross margins between field peas and the major COP crops as a group[5] with the annual change in the proportion of field peas in total COP crop areas one year later. The lag reflects the adaptive expectations of farmers responding to the outcome of the previous harvest.

Table GE.14: Difference between gross margins on field peas and weighted average gross margins on other COP crops vs. annual changes in the following crop year in the field pea share of the combined area of major COP crops, Lower Saxony, 2001-2007

	2001-2003	2004-2005	2006-2007
GM difference, field peas vs. other COP crops, € per hectare	-236	-189	-638
GM difference without extra coupled aids for protein crops	-280	-243	-693
Annual % change in field pea area as share of COP crop area	-0.1%	-0.1%	-0.1%

Sources: ZMP; Eurostat; FADN database

[5] The crops included are wheat, maize, barley and rapeseed.

- The average disadvantage of field peas vs. the weighted average of the main alternative crops, in terms of gross margins, went from an average of €236 per hectare in 2001-2003 to one of €189 in 2004-2005, but then worsened very substantially to a disadvantage of €638 per hectare in 2006-2007.

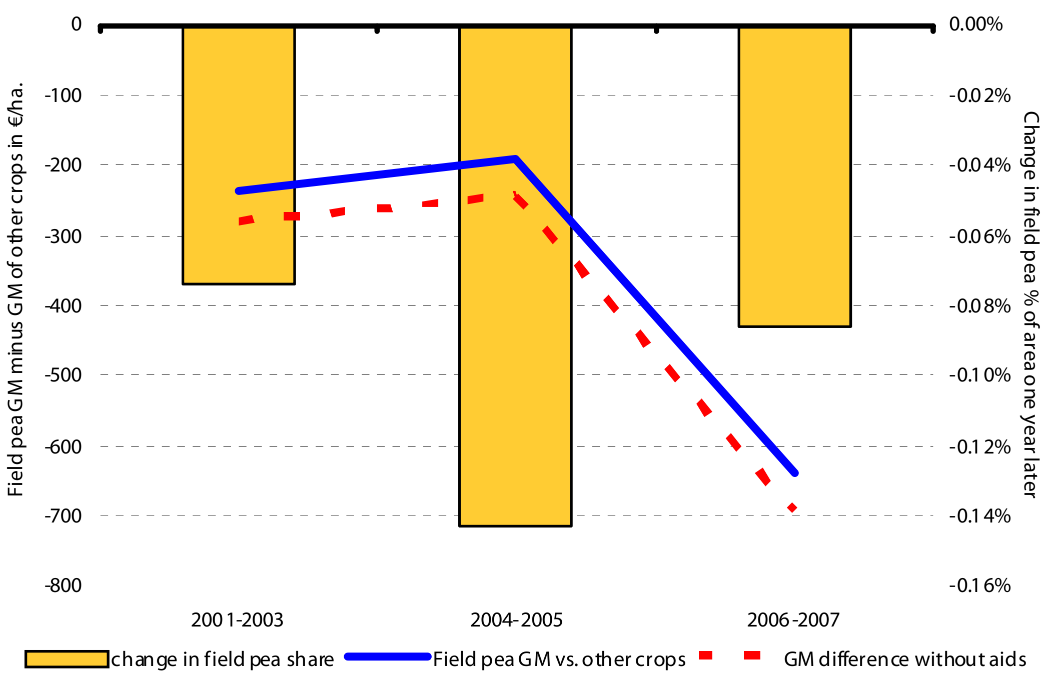
- The absence of coupled payments for protein crops would inevitably have made even less competitive the economic attractions of field pea cultivation. Its competitive disadvantage would have been €280 per hectare in 2001-2003 and €243 in 2004-2005. Its disadvantage would have almost trebled in 2006-2007, at €693 per hectare.

- Table GE.14 includes details of the average annual changes that occurred in the field pea share of the COP crop area over the same periods. These changes are described in Table GE.9.

- The field pea share fell be an annual 0.1% in the first period (because the analysis applies a one year lag between the signal that producers receive from their gross margins to their planting decisions, the first period covered by the table and diagram refer to the years from 2002 to 2004).

- The share then fell by an annual 0.1% in response to the gross margins experienced in 2004-2005 and by a further 0.1% per annum in response to the outcomes of the 2006-2007 crops.

Diagram GE.6: Annual changes in the field pea share of the area under major COP crops, 2001-07 vs. field pea gross margin competitiveness in relation to the weighted average for other major COP crops, with and without protein crop aids, Lower Saxony



Source ZMP, FADN
Note: The "with aids" calculations include the special aid of €55.57/ha. The "without aids" case excludes this aid.
"Field pea GM vs. other crops" measures the difference between the gross margin on field peas and the weighted average gross margin on the other major COP crops, where the weights are the areas under the different crops.
The average percentage area changes relate to the period one year after the gross margin calculations.

4.4 Field bean revenues and costs

Table GE.15 lists the revenues and variable costs of field bean producers in Lower Saxony.

Table GE.15: Lower Saxony, field bean revenue and variable costs (€/hectare)

	2000	2001	2002	2003	2004	2005	2006	2007
Yield (t/ha)	4.4	4.5	4.0	4.2	4.4	4.3	4.0	4.0
Field Bean Price per tonne	133	134	129	109	113	118	110	126
Protein Crop Arable Aid (€/ha)	415	390	385	397	343			
Protein Crop Special Aid (€/ha)					56	56	56	56
Return per ha								
Field Bean Price	581	603	514	456	494	505	440	497
Coupled Payment	415	390	385	397	399	56	56	56
Total Revenue	**996**	**993**	**899**	**853**	**893**	**560**	**496**	**553**
Variable costs								
Seed	146	95	91	94	126	122	124	129
Fertiliser	38	46	37	47	48	42	44	56
Crop Protection	60	77	68	72	64	66	78	77
Other (e.g. irrigation, drying)	72	79	56	76	86	69	62	78
Total variable costs	**316**	**297**	**252**	**289**	**324**	**299**	**308**	**340**
Gross margins	**680**	**696**	**647**	**564**	**569**	**261**	**188**	**213**

Source:ZMP, FADN

- We observe that variable costs of production of field beans were in the region of €300 per hectare from 2003-2006, but then rose to €340 in 2007.

- Total revenues per hectare were comparatively stable, averaging close to €900 per hectare until 2004. Following the introduction of the SPS, however, gross revenues per hectare, excluding decoupled payments, settled in the €490-€560 range in 2005-2007.

Since Diagram GE.7 revealed that the differential between field pea and field bean gross margins per hectare is quite stable from year to year, we have not prepared a separate series of diagrams to contrast annual field bean gross margins with the gross margins on other crops, since the diagrams would appear similar to those prepared for field peas, but with the difference that field beans have typically generated a slightly higher gross margin each year than field peas.

Table GE.16 and Diagram GE.7 contrast gross margins on field beans with the weighted average gross margins on common wheat, barley, rapeseed, maize and field peas from 2001 to 2007. These values are estimated for the same three periods as the corresponding table and diagram for field peas, namely 2001-2003, 2004-2005 and 2006-2007.

The table and diagram compare the differences in average gross margins between field beans and the major COP crops as a group with the annual change in the proportion of field beans in total COP crop areas one year later. This assumption is applied to reflect the adaptive expectations of farmers who are assumed to react to the outcome of the previous harvest.

- The average disadvantage of field beans vs. the weighted average of the main alternative crops, in terms of gross margins, was stable in the first two periods but then surged.

- The disadvantage was €162 per hectare in 2001-2003 and €153 in 2004-2005, but it then deteriorated to €589 per hectare in 2006-2007.

- The absence of coupled payments for protein crops would have worsened the relative competitiveness of field beans. The crop's competitive disadvantage would have been €206 per hectare in 2001-2003, €207 in 2004-2005 and €645 per hectare in 2006-2007.

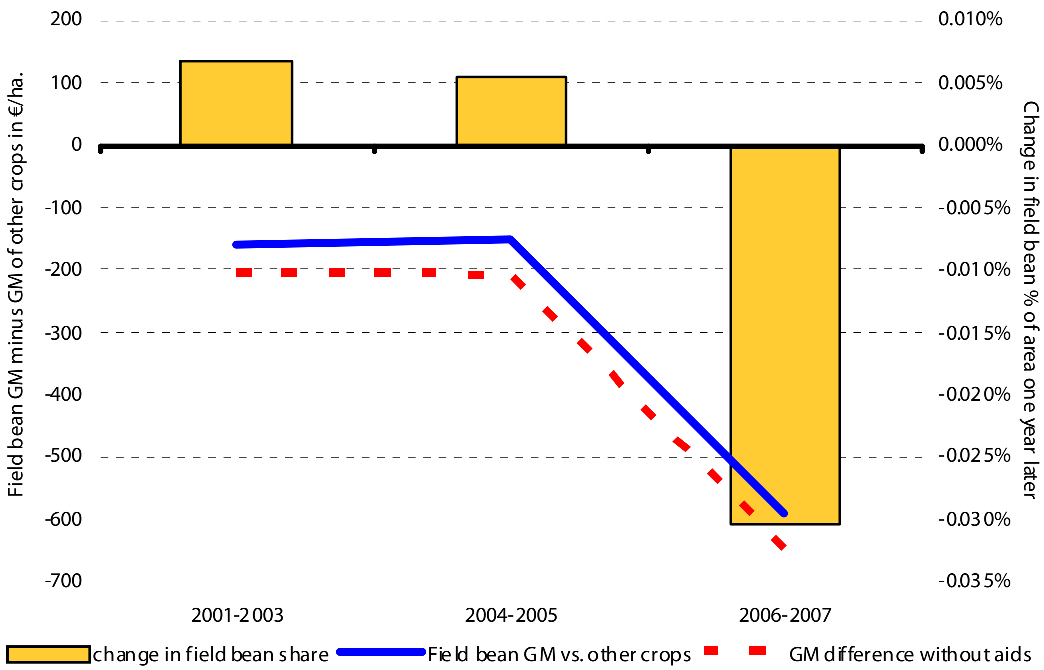
- The field bean share of the COP crop area fluctuated over the same period, as was described in Table GE.9. The field bean share of the COP crop area grew very slightly indeed from 2002 to 2004 and again from 2005 to 2006, but then declined slowly in 2007-2008 as farmers reacted to the gross margins observed in 2006-2007.

Table GE.16: Difference between gross margins on field beans and weighted average gross margins on other COP crops vs. annual changes in the following crop year in the field pea share of the combined area of major COP crops, Lower Saxony, 2001-2007

	2001-2003	2004-2005	2006-2007
GM difference, field beans vs. other COP crops, € per hectare	-162	-153	-589
GM difference without extra coupled aids for protein crops	-206	-207	-645
Annual % change in field bean area as share of COP crop area	0.0%	0.0%	0.0%

Sources: ZMP; Eurostat; FADN database

Diagram GE.7: Annual changes in the field bean share of the area under major COP crops, 2001-07 vs. field bean gross margin competitiveness in relation to the weighted average for other major COP crops, with and without protein crop aids, Lower Saxony



Source: ZMP, FADN

Note: The "with aids" calculations include the special aid of €55.57/ha. The "without aids" case excludes this aid. "Field bean GM vs. other crops" measures the difference between the gross margin on field beans and the weighted average gross margin on the other major COP crops, where the weights are the areas under the different crops. The average percentage area changes relate to the period one year after the gross margin calculations.

5. The significance of protein crop production in farm incomes

In this section, we present four measures of profitability for protein crop farms and compare their values with the values of the same indicators for "other farms". These measures of profitability have been extracted from the FADN database; they are: gross farm income per hectare, farm net value added per annual working unit, farm family income per hectare and farm family income per farm working unit. We have classified protein crop farms on the basis of the share of farm UAA that is devoted to protein crops.

The aim of this analysis is to ascertain whether there are any structural differences in the profitability of farms that choose to grow protein farms relative to farms that do not grow these types of crops, *ceteris paribus,* i.e. when both sets of farms belong to the same type of farming.

When presenting data from the FADN database, a minimum number of 15 observations (farms) per year is required to ensure that the results presented meet a satisfactory degree of statistical precision. Within the FADN database of protein crop farms, the only UAA size category for which data for 15 or more farms are available is the category "Greater than 50 hectares". In this section, we show the results for this UAA size class only, distinguishing between the two types of farming most protein crops farm belong to: "COP specialists" and "Mixed crops and livestock".

The results of this analysis are shown in diagrams GE.8 to GE.23. They reveal that

- No clear pattern emerges with respect to the profitability of farms growing protein crops relative to "other" holdings for the different measures of income covered in our assessment.
- There are no clear indications that the size of the share of area devoted to protein crops is linked to increasing (decreasing) returns in any consistent fashion.
- For mixed crops and livestock specialists, for three out of four measures of income, the income of farms devoting between 20% and 100% of area to protein crops appear to be more volatile than the income of farms with little or no area planted to protein crops.

COP Specialists

Diagram GE.8: Gross farm income per hectare

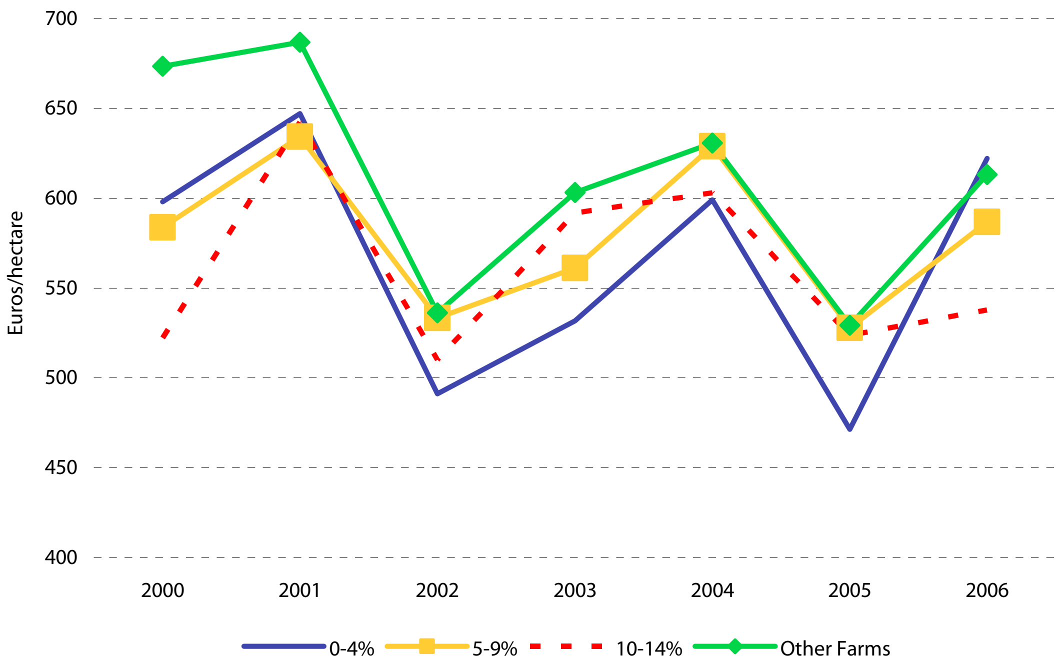


Diagram GE.9: Mean (plus and minus one standard deviation) of gross farm income per hectare, 2000-2006

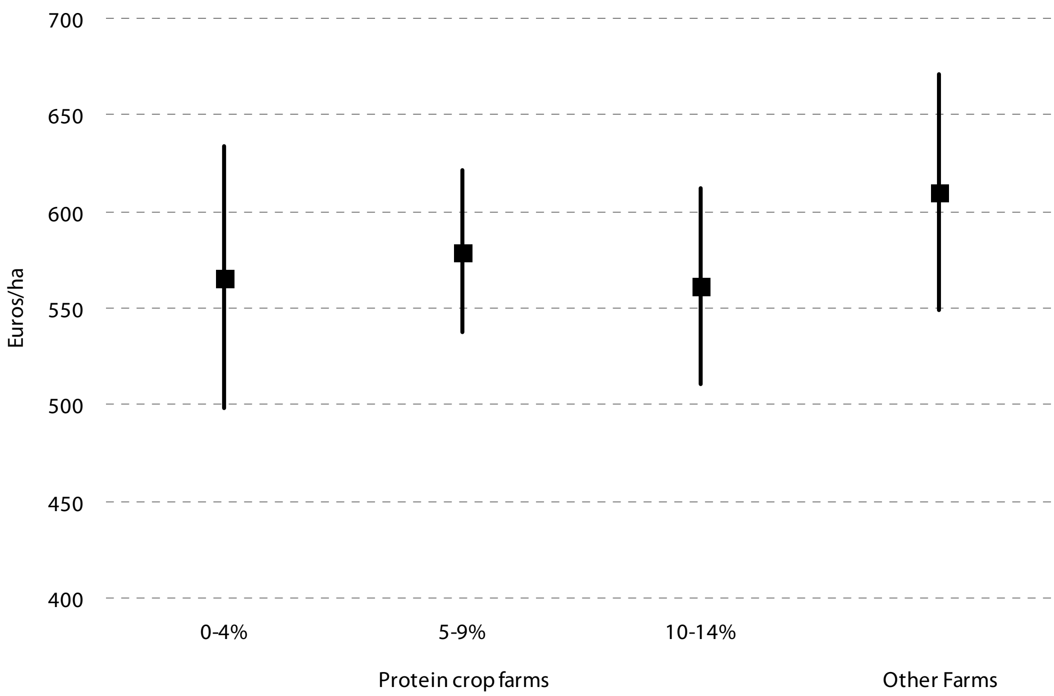


Diagram GE.10: Farm net value added per annual work unit

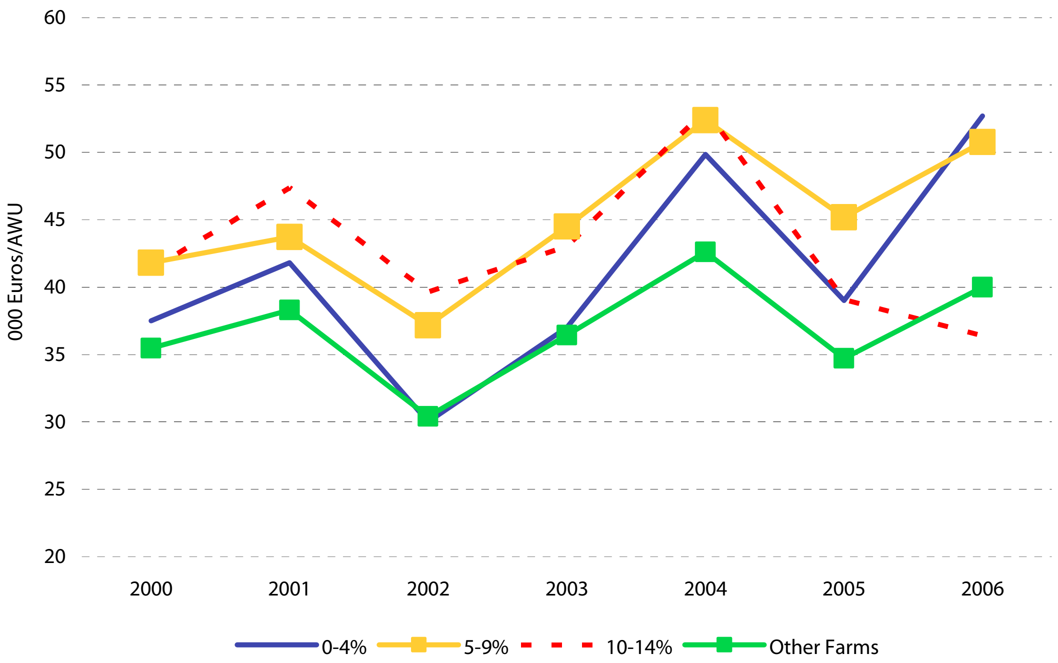


Diagram GE.11: Mean (plus and minus one standard deviation) of farm net value added per annual work unit, 2000-2006

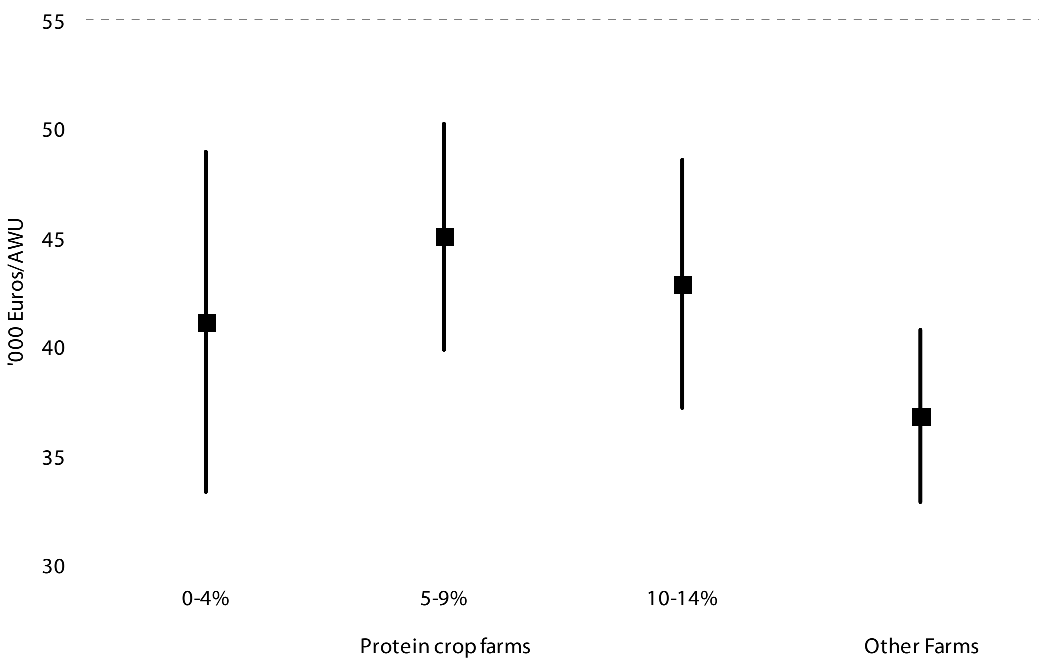


Diagram GE.12: Family farm income per hectare

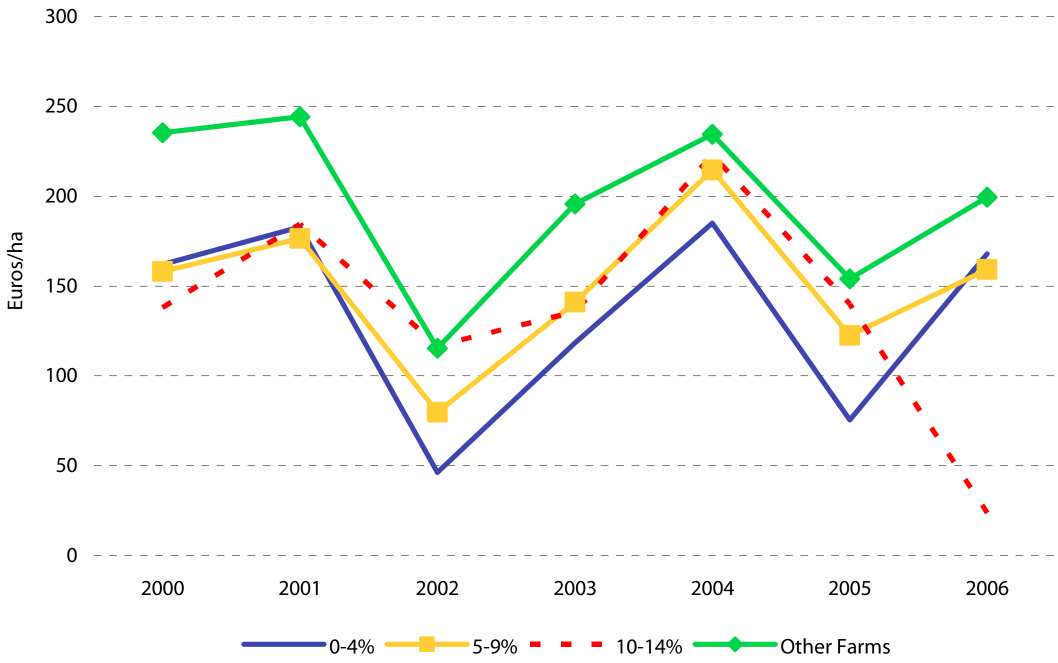


Diagram GE.13: Mean (plus and minus one standard deviation) of family farm income per hectare, 2000-2006

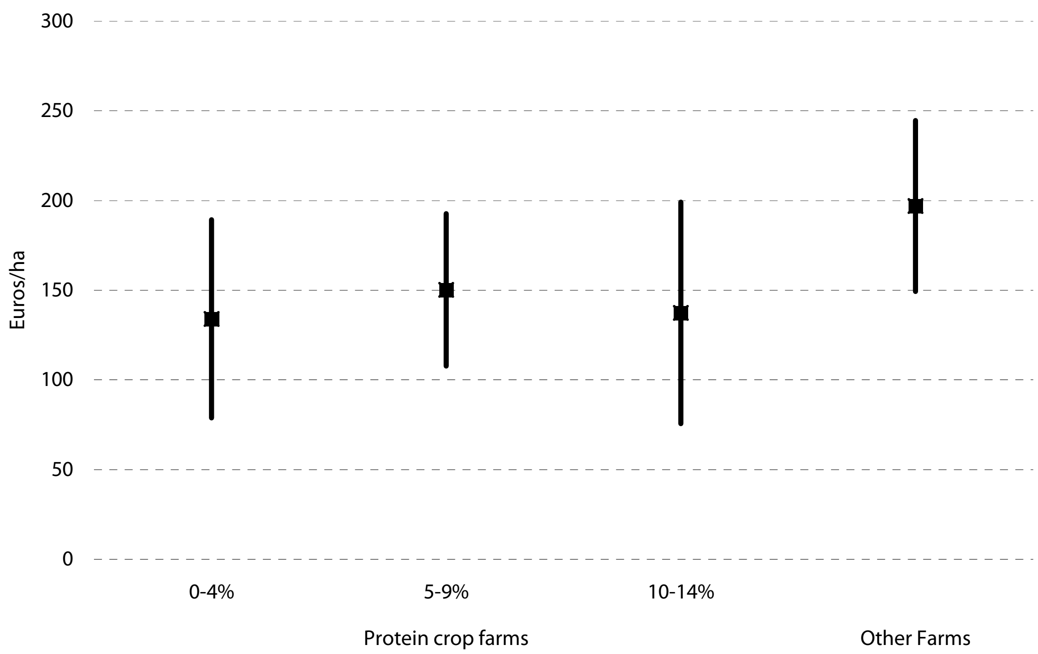


Diagram GE.14: Family farm income per family work unit

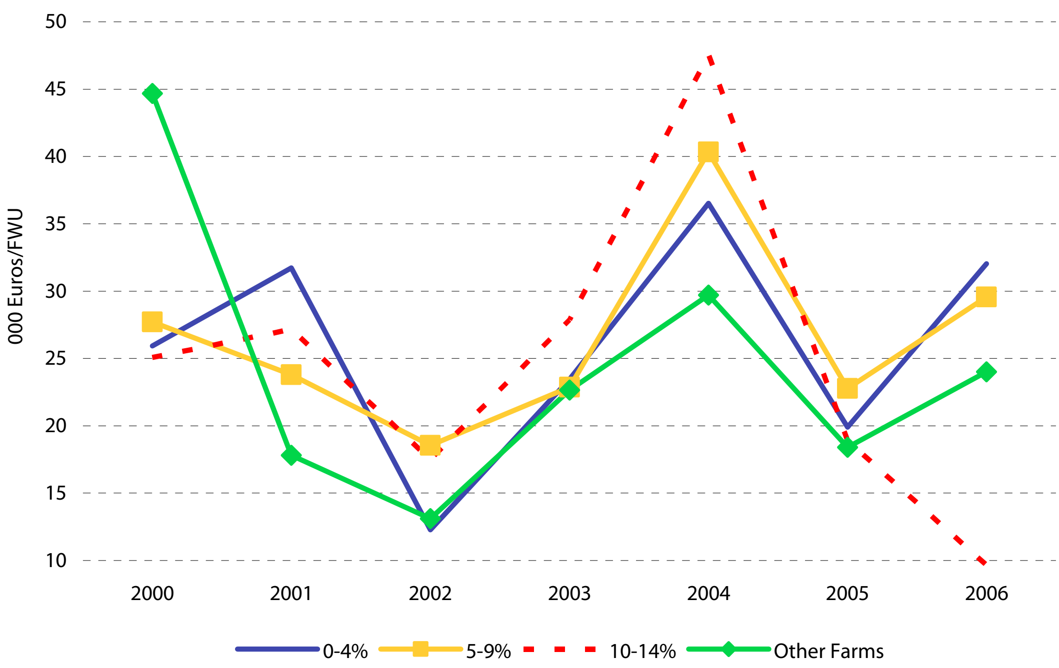
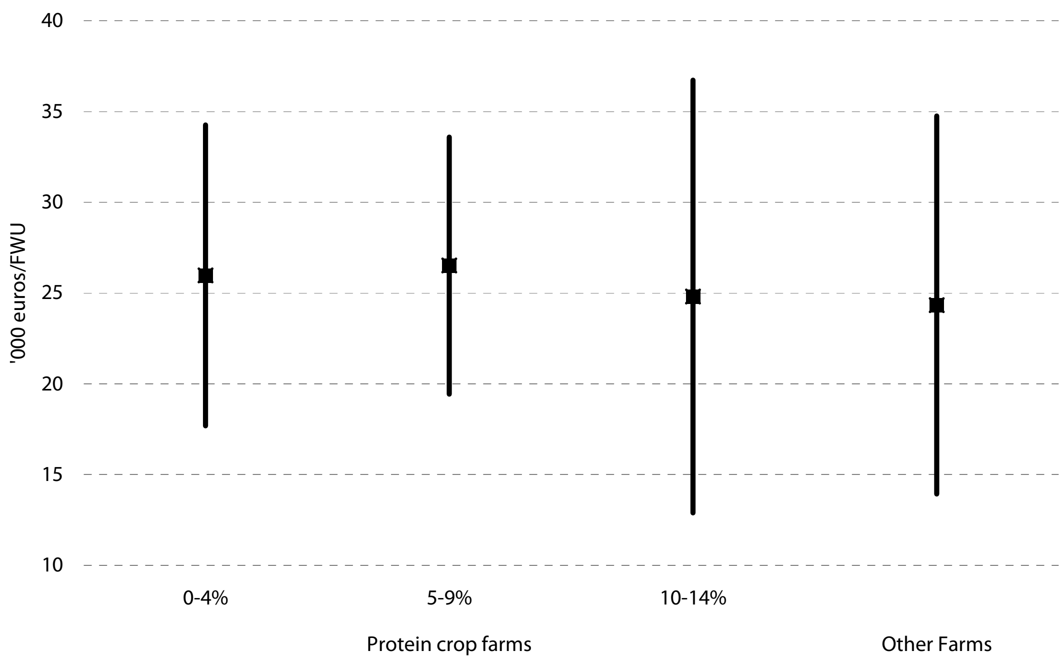


Diagram GE.15: Mean (plus and minus one standard deviation) of family farm income per family work unit, 2000-2006



Mixed crops and livestock specialists

Diagram GE.16: Gross farm income per hectare

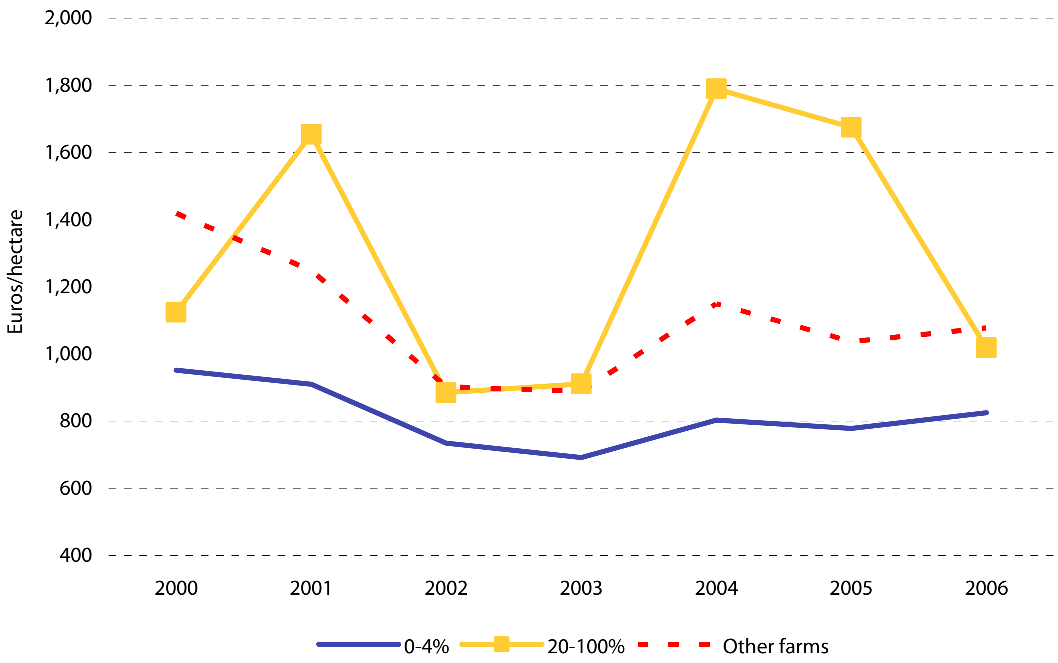


Diagram GE.17: Mean (plus and minus one standard deviation) of gross farm income per hectare, 2000-2006

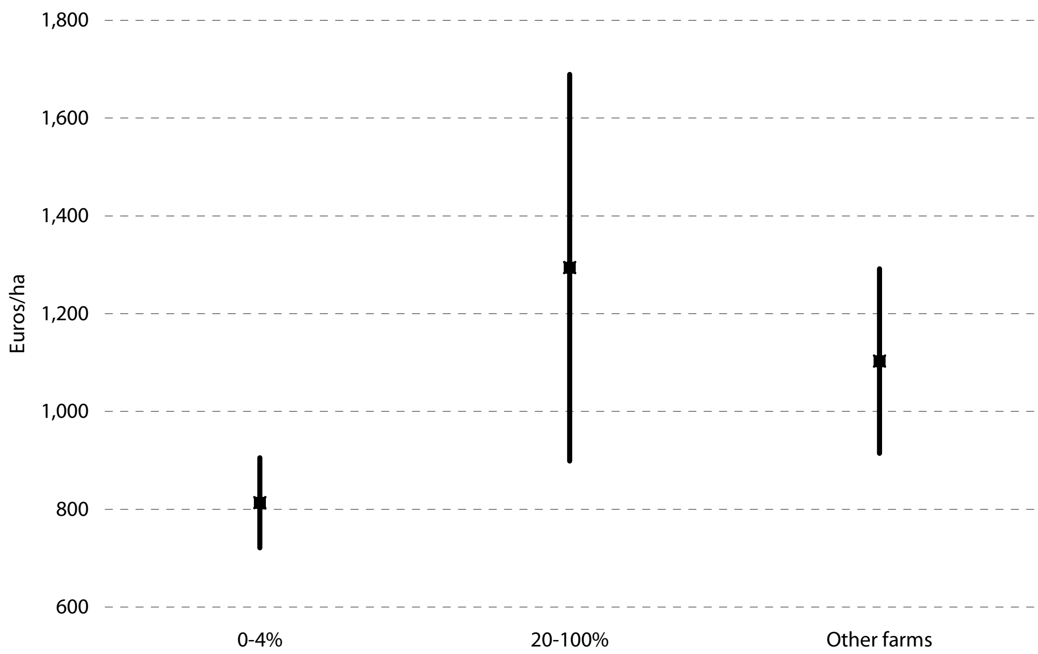


Diagram GE.18: Farm net value added per annual work unit

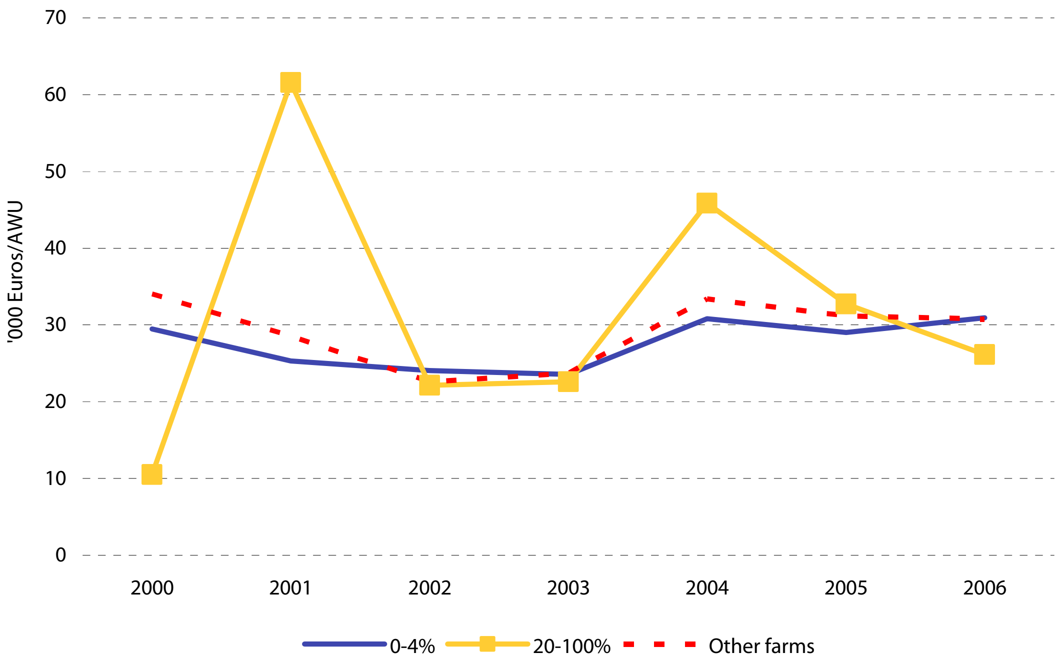


Diagram GE.19: Mean (plus and minus one standard deviation) of farm net value added per annual work unit, 2000-2006

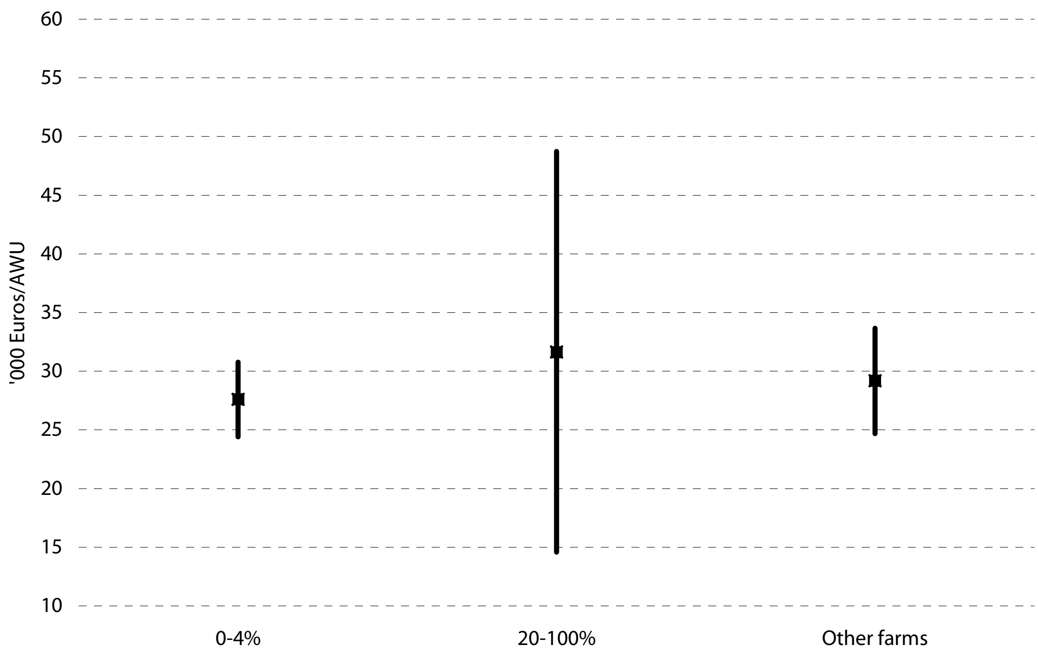


Diagram GE.20: Family farm income per hectare

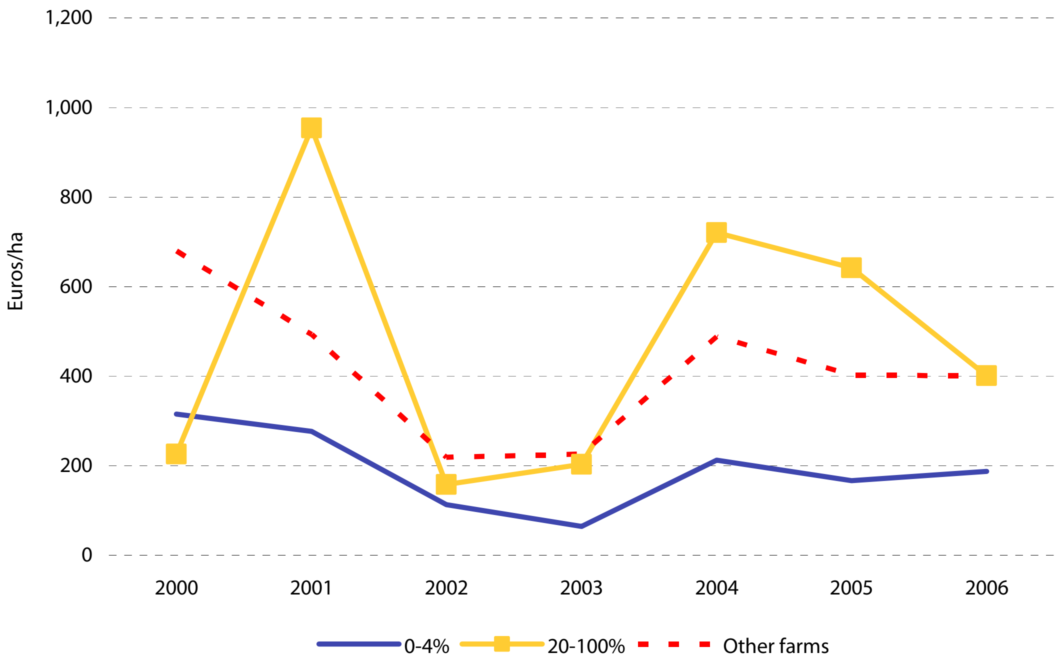


Diagram GE.21: Mean (plus and minus one standard deviation) of family farm income per hectare, 2000-2006

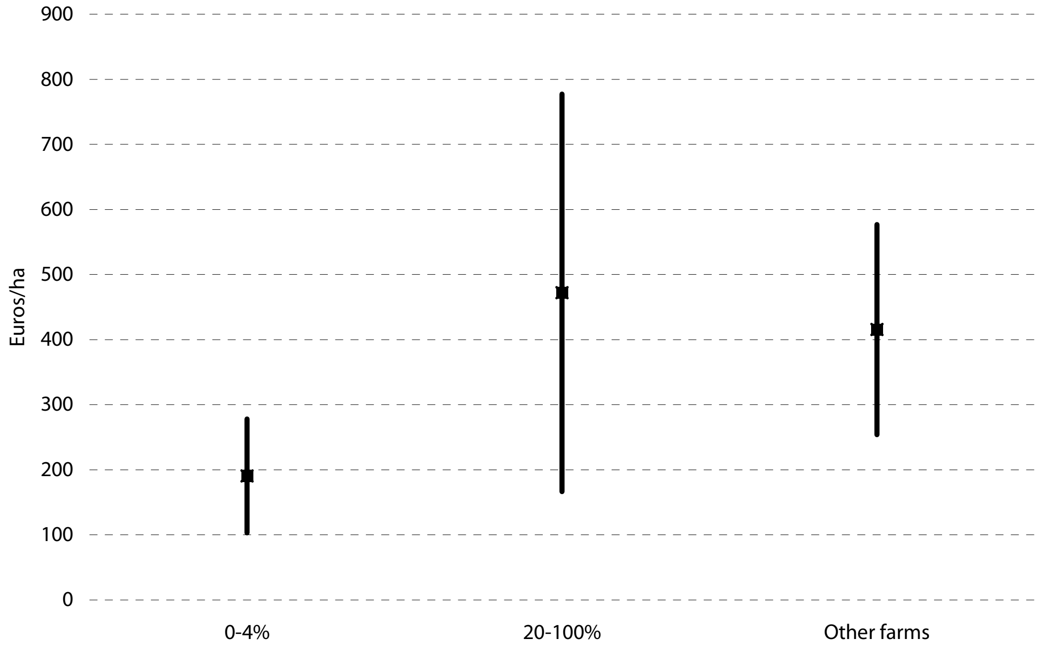


Diagram GE.22: Family farm income per family work unit

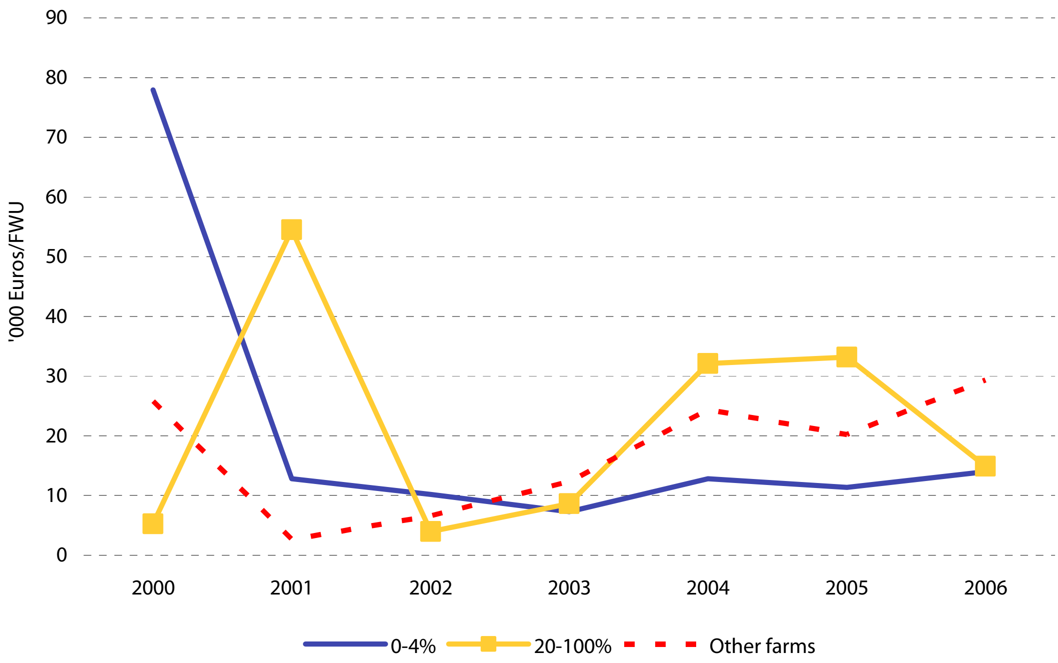
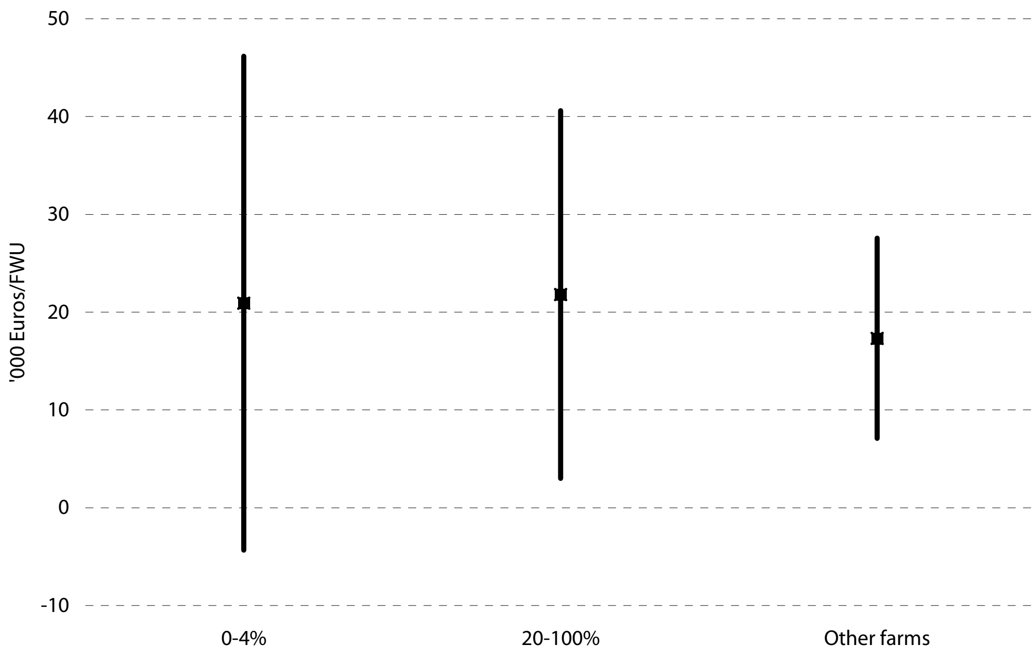


Diagram GE.23: Mean (plus and minus one standard deviation) of family farm income per family work unit, 2000-2006



6. The development of the local feed compounding industry

Table GE.17 describes the steady progress towards greater concentration and larger scale within the German feed compounding sector since 1997.

The table includes separate data for the years immediately before and after the 2003 reform. We observe that:

- The number of compounders has fallen by almost exactly 35% between 1997 and 2007, and the decline has continued since the reform.
- A point remarked upon in interviews, but now revealed by the table, is that the location of feed compounding plants has been increasingly determined by access to major protein feed ingredients, and most notably soybean meal. This has led to a concentration of feed compounding plants in regions on the sea coast or readily supplied along a major river to a river port.
- National compound feed production has increased fairly steadily, if slowly, since 1997.
- The average output per plant rose by almost three quarters, to over 60,000 tonnes per plant, from 1997 to 2007.

Table GE.17: The number and annual output of German feed compounders, 1997-2007 ('000 tonnes)

	Number of compounders	Compound feed output ('000 tonnes)	Annual output per plant ('000 tonnes)
1997	541	18,798	34.7
2003	408	20,009	49.0
2004	396	20,139	50.9
2007	352	21,310	60.5
% change 1997-2007	-34.9%	13.4%	74.2%

Source: FEFAC Feed and Food Statistical Yearbook, 2007

7. Evidence from interviews and questionnaires with stakeholders in the German protein crop sector

7.1 Interview evidence

For this country case study, key actors and stakeholders in the protein crop sector in Germany have been interviewed. This includes interviews with farmers, processors, seed producers, trading companies, farm advisors and representatives of farmers' associations, as well as representatives of the public administration and academics.

There are two main sources from which we drew evidence: one was through direct interviews with stakeholders and the other, analysis of individual questionnaires completed by 26 farmers. This is described in the following two sections. The questionnaires were lengthy and many respondents did not complete them in full. Given the relatively small sample of completed questionnaires, prudence should be exercised when interpreting the results.

Questionnaires for processors were fewer in number since many of them are transnational companies active in several Member States. The analysis for this is not presented in the individual case studies but can be found in the Main Report.

7.1.1 Interviews with farmers:

We begin with a description of the selection of farmers for the interviews and questionnaires.

Finding the addresses of farmers who are actively involved in protein crops production was quite difficult. In the end, the selection of farmers was based upon information compiled by the Landwirtschaftskammer Niedersachsen (Chamber of Agriculture in Lower Saxony). From this, we approached 26 farms in Lower Saxony who are, or have been, protein crop producers.

This list of producers was prepared in winter 2008 and included 9 (of the total of 26 farms) holdings that are organic farms, which is a relative high proportion of organic farms in the total sample. In 2007, 2.5% of all agricultural holdings in Lower Saxony were organic farms. There are no official data for the national organic share of output, but an informed source estimated that organic output may account for as much as 40% of the national total today.

Evidence from interviews with farmers:

- All interviewed farmers made clear that both political and market developments contributed to the decline in protein crop production in Germany. The decline in the protein crop areas was partially caused by the partial decoupling of direct payments on these crops. The protein crops have been substituted mainly by cereals and oilseeds.
- The expansion in the oilseed area in Germany has been substantial significant due to the increase in biodiesel production in Germany (see Table GE.9 for details of the growth in the rapeseed area). Relative price movements in favour of cereals also contributed to the decline in protein crop production.
- The group of farmers who state that they intend to continue growing protein crops were in most cases organic producers. These producers indicated that they will continue or even increase their current level of protein crop area, due to the high rotational value associated with protein crop production. In view of the high level of cereal crop prices in 2008, they often attributed higher values to rotational benefits than those indicated in Table GE.10, above. Protein crops' contribution to soil quality and nitrogen fixing is included in such producers' calculation of the opportunity costs of protein crop production.

- A further factor favouring the production of protein crops on organic farms vis-à-vis conventional farms has been the way in which they simplify the traceability of protein feeds. For the main protein ingredients, such as soybean and rapeseed meals, it is costly to create a separate identity-preserved supply chain for organic products, via crushing plants. With protein crops, then supply chain is much simpler and shorter, especially if the organic farmer is using the crop in its own on-farm feed mixing.
- In Table GE.18, below, the number of applicants and the total area covered by applications for the protein premium in Lower Saxony are listed for organic and non-organic farms between 2005 and 2008.
- We observe that within this period of time the total number of farms applying for the protein crop special aids declined by 60%, while the area the was included in applications for the protein special aids declined by 62%.
- While this was happening, the number of conventional farms and their areas covered by applications for protein crop special aids declined by more than 70%.
- In the meantime, the number of organic farms and their associated organic protein crop areas declined only by 34% and 38%, respectively, as measured by their applications for special aids.

Table GE.18: Applications for protein crop special aids in Lower Saxony, by number and area, 2005-2008

	all applicants		organic farming		conventional farming	
	number	ha	number	ha	number	ha
2005						
Field peas	646	3,686.74	103	693.38	543	2,993.36
Field beans	238	1,648.85	119	1,025.45	119	623.40
Sweet lupins	228	1,258.21	104	712.89	124	545.32
other protein crops	44	188.89	18	128.39	26	60.50
total*	**1,156**	**6,782.69**	**344**	**2,560.11**	**812**	**4,222.58**
2006					0	0.00
Field peas	588	3,122.68	96	633.72	492	2,488.96
Field beans	216	1,604.38	112	970.55	104	633.83
Sweet lupins	190	1,004.39	78	581.79	112	422.60
other protein crops	48	174.39	17	64.45	31	109.94
total*	**1,042**	**5,905.84**	**303**	**2,250.51**	**739**	**3,655.33**
2007					0	0.00
Field peas	303	1,810.85	80	713.84	223	1,097.01
Field beans	163	1,030.99	111	859.86	52	171.13
Sweet lupins	113	726.89	59	448.04	54	278.85
other protein crops	31	116.56	10	35.50	21	81.06
total*	**610**	**3,685.29**	**260**	**2,057.24**	**350**	**1,628.05**
2008					0	0.00
Field peas	203	958.86	56	422.73	147	536.13
Field beans	136	965.73	101	768.33	35	197.40
Sweet lupins	88	511.02	55	353.49	33	157.53
other protein crops	38	132.92	14	54.88	24	78.04
total*	**465**	**2,568.53**	**226**	**1,599.43**	**239**	**969.10**

Source: The Landwirtschaftskammer (Chamber of Agriculture) Hannover
Note: * The total number of applicants might include double counting across different protein crops.

- Out of the 17 interviewed farmers who are running conventional farms (i.e., non-organic farms), 7 have already stopped growing protein crops this season. Another 4 stated that they are thinking of giving up protein crop production if the protein crop special aid of 55.57 €/hectare is fully incorporated into the Single Farm payment.
- Only 6 farmers of conventional (i.e., non-organic) protein crops said that they would continue growing protein crops even without the protein crop premium.
- Reasons for the decline in protein crop production include:
    - ♦ The reduction in protein coupled payments after the reform (this was mentioned as a reason by most farmers interviewed). The 2003 CAP reform with the introduction of a single farm payment scheme caused a strong deterioration of protein crop profitability relative to other crops.
    - ♦ A poor performance of protein crops in terms of their relative profitability against alternative COP crops was another major reason why producers decided to reduce protein crop production.
    - ♦ The rotational benefits of protein crops seem to have become less and less important. Some farmers mentioned that, if fertiliser and pesticide prices rose significantly, the rotational benefits might become important again.
    - ♦ The significant increase in the field pea area after the 1993 MacSharry reform coincided with technical progress in improved varieties of field peas. These new varieties were better suited for the relative dry continental climate and the lower soil qualities in eastern Germany. They were also less prone to lodging before harvest, being more erect, with stronger stalks, and hence were better suited to normal harvesting techniques.
    - ♦ Since then, however, there has been limited technological progress in protein crops relative to other arable crops
    - ♦ One barrier to the greater cultivation of field peas is the need for good soils.
    - ♦ A further, often mentioned, issue was problems during with the harvest, especially with field peas, which are vulnerable to splitting.
    - ♦ A major concern was the highly volatile yields and – an even stronger argument for giving up protein crop production – highly volatile qualities – of protein crop output.
    - ♦ Producers are concerned by the declining interest they discern among compound feed producers in protein crops. Farmers realise that the market for protein crops is getting smaller and smaller. In some cases, farmers mentioned that the current market size is below a critical mass. Some farmers even used the word ‘niche product’ for the sector.
    - ♦ As users of feed in some instances, producers commented upon the availability of cheaper protein ingredients in their feed rations. The growing production of oilseeds for biodiesel, and the increased supply of rapeseed meal, was mentioned in this context.
    - ♦ In almost all cases, those interviewed produced protein crops as feed crops and not as food crops. Only two organic farmers had some experience of selling their protein crops also as food crops.

- ♦ Organic farmers appreciate the value of protein crops in the crop rotation, emphasising that they are more confident about the traceability of their home-produced protein than they are about protein ingredients in purchased compound feed.
- ♦ In terms of administrative burden for farmers, the additional work involved in filling in forms to apply for the (coupled) protein crop special aids does not seem to create additional costs. (Farmers said that they are now very used to filling in such forms!).

7.1.2 Interviews with feed processors:

- The president of the Deutscher Verband Tiernahrung e.V. (German Association of Animal Feed Producers) said that the use of protein crops for compound feed has declined strongly within the last few years and expected this trend to continue.
- He also anticipates that on-farm use for feed will be more resilient, especially on organic farms.
- The increasing transaction costs for compound feed producers (collection, quality control and continuity in supply) are the main factor behind the declining attractiveness of protein crop use. The main alternatives are feed cereals and oilseed meal, which has become more plentiful since the biofuel boom.
- Due to their amino-acid composition, the protein in field peas and field beans is viewed with less favour in non-ruminant livestock production than other major sources of protein, e.g. soybean meal and rapeseed meal. In pork production, in particular, the protein from field beans does not provide the total amount of all required amino acids. This is discussed in detail in EQ2.

7.1.3 Interviews with traders:

- In three interviews with trading companies, the past and expected future development in the area of protein crops was discussed intensively. One of these companies is international; the other two are primarily local.
    - ♦ All three traders have been active in the protein crop trade in the past. However, due to a combination of low quantities, low qualities, high transaction costs (because the market became too segmented) and profitable alternatives (mainly protein based on meal from oilseed processing), all three trading companies are not longer involved in the trade in protein crops
    - ♦ The largest company clearly indicated that in Germany the marketed share in protein crops in far below a sustainable threshold for a profitable involvement by large scale traders.
    - ♦ They view protein crop markets increasingly as niche markets for organic farms, which prefer to use domestically grown protein instead of imported sources.

7.1.4 Interviews with seed producers:

- There are three companies (still) involved in seed and breeding activities in the area of protein crops: Steiner Saatzucht for sweet lupins, Norddeutsche Pflanzenzucht (member of Saatenunion) for broad beans and KWS Lochow for field peas.

- At this moment, less than 50,000 hectares use certified protein crop seeds. During the interviews it became clear this market size might be appropriate for a single company. Yet, today, three companies are involved in the seed market for protein crops. This is seen as an indication of the need for further structural change (giving up the supply of protein crop seeds) or cooperation/mergers among the trio.

7.1.5 Interviews with people working in the public sector administration

Interviews with civil servants active in the protein crop sector revealed that the declining relative profitability and the problems in cultivating protein crops (notably the high volatility in yields and qualities) were widely mentioned as a major factor behind the declining importance of protein crop production.

The administrative burden of a coupled protein premium for the public administration is relatively low. All areas are digitally registered and the coding system covers four types of protein crops: field peas, field beans, lupins and other protein crops (mainly grain legumes).

7.1.6 Interviews with members of farmers' associations

One interview with a leading representative of the national farmers' association in the sector UFOP (Union zur Förderung des Ölpflanzenanbaus) yielded the statement that, for the past three years, German protein crop production has fallen below the critical mass needed for a sustainable development of the protein crop sector. This is especially true in terms of further technological developments (improved machineries, pesticides, fertilisers and the breeding of protein crops) and for advisory services for farmers growing protein crops.

180,000–200,000 hectares of protein crop were said to be the threshold needed for a sustainable market development in Germany. The current (2007) area of protein crop production is barely two thirds of this level.

There are two long and medium term trends that were described as potentially contributing to an increase in the area cultivated with protein crops. One such trend is the growth in labour costs. Increasing labour costs might contribute to a declining degree of specialisation, i.e., an extreme concentration on just two or three crops (wheat, rapeseed and sugar beets), which would cause extreme peaks in the distribution of labour requirements within a growing season. If labour costs increase much further, a wider crop rotation with protein crops might contribute to more even distribution of labour within the growing season.

Another aspect is how farmer value the contribution of protein crops within the crop rotation (Vorfruchtwert). When energy and fertiliser prices are low, the crop rotation value of protein crops is seen as rather limited, but under high energy prices and high fertiliser prices, the externalities offered by protein crops within a farming system which might also contribute to higher protein crop production.

7.2 Summary of analysis of farmers' questionnaires

The following section summarises the key points that emerged from the analysis of questionnaires administered to protein crop farmers during the fieldwork carried out for this evaluation. While this evidence provides a valuable cross-section of the different conditions in the protein crops sector, the high frequency of no responses to some questions undermines the applicability of the survey's findings to the wider population of German farmers growing protein crops. Looking ahead, simulations of full decoupling, based on the results of the farmers' survey, are indicative of a fall in protein crop area of around 15% from 2008 levels.

7.2.1 Protein crop areas

- Around 50% of respondents reported a decline of over 50% in the area planted to protein crops between 2003/04 and 2008/09. In line with the decline in area, a similar proportion of respondent reported a fall in output over the same period.
- On average, 13% of arable land is planted to protein crops.
- Plantings take place in March/April, while harvesting is carried out in July/August in the majority of cases.

7.2.2. Crop rotations

- Protein crops are grown in rotation for the majority of farmers. Virtually all respondents indicated that this is for the improvement in the quality of soil.
- Cereals, in particular barley, are the crops most used in rotation with protein crops. Other crops are oilseeds, sugar beet and fodder crops (grass, clover).
- Wheat and oilseed were the crops most commonly mentioned as alternative to protein crops in rotation cycles.

7.2.3. Production of alternative (non-protein) crops

- Just below 60% of respondents reported no change in total area dedicated to other crops (i.e. not protein crops) between 2003/04 and 2008/09, while around 30% reported an of between 1 and 30%.
- 54% of total sample said that protein crop area has been replaced by other crops (the rest did not reply). The most common crops that replaced protein crops were cereals (64%) and oilseeds (50%).

7.2.4. Protein crop quality

- Over two thirds of respondents have not changed protein crop variety between 2003/04 and 2008/09. For the farmers who changed variety, the main reasons were improved yield and quality.
- Around 35% of those interviewed obtain protein crop seeds from cooperatives. Other sources account for the rest of respondents.

7.2.5. Outlets for your protein crops

- More than 90% of farmers surveyed use their protein crop output directly on the farm for feed. On farm use tends to account for more than 50% of total farm output.
- The main buyers of protein crops tend to be other agents, followed by traders and cooperatives.
- Feed outlets are the main destination of protein crop output, around two thirds of this is sold locally.

7.2.6. Protein crop marketing

- All of those who responded stated that they did not have a contract with a trader and/or processor.

7.2.7. Use of inputs.

- Most farmers have not changed their seed use. However, all are adopting new crop protection products.
- Around 25% of respondents have made investments linked to protein crop farming in the last five years. Of these 67% said that they had used rural development funds for these investments.

7.2.8. On-farm employment and labour used

- Less than 20% of household employment is derived from protein crop production; this proportion has not changed between 2003/04 and 2008/09.
- Protein crop production also accounts for less than 20% of employed labour time. No change has been recorded between 2003/04 and 2008/09.
- Around half of the sample contracted out some farm services. The most common service contracted out is harvesting. The average cost of which was €125 per hectare in 2008.
- The share of farm revenue not affected by the choice of crop increased between 2003/04 and 2008/09 from less than 20% to less than 40% for the vast majority of farmers.
- For all respondents, less than 20% of farm revenue is derived from protein crop production, including special area payment.
- All farmers calculate farm profits as gross revenue minus cash costs. All said that profitability was judged per hectare.
- Nearly half of the sample indicated that sugar beet was the profitable crop in 2008; it was followed by wheat and potatoes. For the majority of farmers, the ranking of crop profitability has not changed over the last five years.

7.2.9. The impact of reforms in the Common Agricultural Policy

- Around two thirds of farmers felt that the introduction of a payment which is not tied to their choice of crop had affected the area they planted to protein crops, with more than half sample indicating a great impact.
- Around 65% of framers stated that the change in payment systems for protein crops since 2003 had affected the area planted to protein crop. More than 50% said it had greatly affected their decision.
- Our responses indicate that as the level of payment tied to protein crops decreases, area planted to protein crop decreases. If coupled payments were completely removed, area under protein crops would fall by 8%. If coupled payments rose to €100, area under protein crops would increase by up to 36%.
- The price of other crops is the main factor affecting farmers' decision of planting protein crops. Just over two thirds stated that protein crop area payment was important as is the price paid by the trader/cooperative.
- 65% of farmers that their reasons for growing protein crops had changed since 2003. The main reason was the low price and low profitability of these crops.

8. Impact of the CAP measures upon the local protein crop sector

The protein crop sector contracted significantly in the years following the implementation of the 2003 reform. Total protein crop area fell 33% between the period from 2000-01 to 2003-04 to the period from 2004-05 to 2008-09. Field pea area was the worst hit, declining by 40% comparing the two periods. It was followed by field bean area, which fell 29% between the two periods. In contrast, area under sweet lupins remained virtually unchanged.

Based on the findings of this report, there is no clear indication that this decline is a direct result of the changes introduced with the 2003 reform[6] . Rather, there is strong evidence that a number of exogenous market factors, some of which pre-dated the 2003 reform, have acted to harm demand for protein crops.

- In terms of gross margins, our analysis reveals that protein crops have been at a disadvantage to competing COP crops throughout the entire evaluation period (2000-2008). While this disadvantage has worsened since 2005 (following changes in the coupled payments), the gross margin ranking has always been unfavourable to protein crop production, *ceteris paribus*.

- While farmers recognise the rotational benefits associated with protein crop production, this factor has become less important over time due to relatively low fertiliser and energy prices.

- In terms of demand of protein crops from the feed compounding industry, this has been declining over time. The greater availability of alternative feed ingredients produced domestically, such as cereals and rapeseed, together with easy access to imported supply of soybeans, has meant that use of protein crops in compound feed has been falling since prior to the 2003 reform.

- The decline suffered by the sector means that area under these crops is now below the threshold needed for a sustainable market development. The effects of this are cutbacks in research and higher transaction costs for traders and feed compounders, reducing the attractiveness of protein crop production even further.

However, there is one factor favouring production of protein crops in the future. This is the development of organic farming. Within this sector, protein crops are greatly appreciated for their rotational benefits. In addition, they simplify the traceability of protein feeds compared to other protein feed ingredients, such as soybean and rapeseed. During the fieldwork, organic producers stated their intentions to continue or even increase their production of protein crops.

This monograph has the following structure.

- We consider, first, the development of the protein crop sector within Hungary.

- Then, we review the development of alternative cereals, oilseed and protein (COP) crop production within the country.

- We describe the main production systems applied to protein crops, notably as regards crop rotations.

[6] These are the partial integration of the previous aid for protein crop production into the Single Payment Scheme and the special aid for protein crops set at €55.57 per hectare.

Hungarian Protein Crop Sector

- For Hungary, there are no data regarding the gross margins on protein crops, because they represent such a small percentage of the overall area that separate cost estimates have not been prepared by official agencies.
- We present analysis from the FADN database of the significance of protein crops in Hungarian farm incomes.
- We review the development of the local feed compounding sector and its attitudes towards the use of protein crops in their feed mixtures.
- We summarise the evidence collected during the fieldwork. The main tools of investigation consisted of questionnaires administered to protein crop farmers and interviews with feed compounders.
- We conclude with a discussion of the impact of the CAP measures upon the local protein crop sector.

1. Description of the development of the protein crop sector

The production of protein crops is not significant in Hungary. Even the largest protein crop, field peas, was planted on only 20-22,000 hectares in recent years, which represented just 0.5% of the total arable area. The areas under field beans and sweet lupins are negligible, covering only 1,000 hectares together in 2007. Protein crop production peaked in Hungary in the pre-transition years when it was supported by generous subsidies. Table HU.1 reveals that between 1986 and 1990, the average protein crop area was 132,700 hectares (3% of the total arable area), of which 114,000 hectares (86%) were field peas. Protein crop area fell dramatically to 22,300 hectares by 2006-2007, accounting for around 0.5% of total arable area.

Table HU.1: Areas, production and yields of protein crops in Hungary 1981-2007

area ('000 hectares)	***1981-1985 average***	***1986-1990 average***	***1991-1995 average***	***1996-2000 average***	***2001-2005 average***	***2006-2007 average***
field peas	49.8	114.0	85.0	50.5	22.6	21.2
field beans	11.5	13.2	1.2	0.4	2.1	0.7
sweet lupins	8.9	5.5	3.8	1.5	0.4	0.4
total	*70.2*	*132.7*	*90.0*	*52.4*	*25.1*	*22.3*
production ('000 tonnes)						
field peas	119	294	186	103	51	50
field beans	21	18	1.5	0.3	2.7	1.5
sweet lupins	8	5	2.5	1.4	0.4	0.5
total	*148*	*317*	*190*	*105*	*54*	*52*
yields (tonnes/hectare)						
field peas	2.4	2.6	2.2	2.0	2.3	2.4
field beans	1.8	1.2	1.2	0.7	1.2	1.8
sweet lupins	0.9	0.8	0.7	0.9	1.1	1.5

Source: CSO

Table HU.2 summarises the changes in the areas used for protein crops since 2000. They declined from 30,800 hectares in 2000 to 23,400 hectares in 2007. Field pea areas fell after 2000, but have recently stabilised around 22,000 hectares. Field bean areas have shrunk dramatically since 2000, dropping from 3,900 hectares in that year to a mere 600 hectares in 2007. Sweet lupin areas fell to a few hundred hectares by 2002 and, since then, they have ranged between 200 and 400 hectares.

Table HU.2: Areas of protein crops in Hungary 2000-2007 ('000 hectares)

	Field peas	*Field beans*	*Sweet lupins*	*Protein crops*
2000	25.5	3.9	1.4	30.8
2001	26.4	2.9	0.7	30.0
2002	22.5	2.9	0.3	25.7
2003	22.4	2.3	0.4	25.1
2004	21.7	1.2	0.2	23.1
2005	19.9	1.2	0.2	21.3
2006	20.1	0.8	0.3	21.2
2007	22.3	0.6	0.4	23.4

Source: CSO

The production of protein crops is regionally scattered in Hungary: half of the 19 counties can be considered to be relatively important production areas, with a significant proportion of total national production of one of the protein crops (see Table HU.3).

Table HU.3: Shares of the main production areas (counties) within the total protein crop production 2007

Counties	*Field peas*	*Field beans*	*Sweet lupins*
Baranya (South)		12	
Békés (South-East)	24	24	
Borsod-Abaúj-Zemplén (North-East)	8		
Csongrád (South)	12		
Fejér (Central)	13		
Hajdú-Bihar (East)	7	14	
Jász-Nagykun-Szolnok (East)		13	
Somogy (South-West)	7		22
Szabolcs-Szatmár-Bereg (North-East)			56
Other counties	29	37	22
Total	***100***	***100***	***100***

Source: CSO

Stakeholders in the protein crop sector interviewed during the fieldwork pointed out that

- In Hungary, there has been a long tradition of protein crop farming. These crops used to be an important component of human nutrition and livestock feeding. National production was never large enough to cover the protein requirements of the livestock sector. The deficit is so big that it can only be met by continuously increasing protein ingredient imports.

- In the past, Hungary introduced a number of initiatives to increase protein crop production, none of which was successful. One of the main reasons that they failed was that the subsidies on which output growth was based were removed.

- The areas under these crops in 1996 were about 60% less than they were in 1986-1990. This partly mirrored the 50% slump in meat and bone meal output in the same period, and meat and bone meal, as high protein sources of feed, is mixed with field peas, whose protein content is low, to enable protein crops to be used in non-ruminant feeds. However, despite substantially reduced livestock numbers, "we are still unable to cover the protein requirements of our livestock sector".

The yields of protein crops are highly dependent on climate, especially rainfall, during the growing period. This explains the fluctuating yields described in Table HU.4. These were an important factor behind the decrease in field beans and sweet lupin plantings.

In practice, protein crop farming is mainly an activity of small farmers. Many of whom grow the crops for their on-farm feed use to feed their own livestock with their cereal and protein crop output mixed on their farms. As we shall see in the discussion of foreign trade, below, much of the field pea sold through formal markets is exported.

Factors behind the low share of protein crops in arable areas in Hungary include the following:

- The relatively high prices of protein crops compared to imported soybean meal, which limits demand for the limited production that occurs;
- Low protein crop yields per hectare when compared to soybeans (one of the reasons is the lack of irrigation);
- After EU accession, cereal and oilseed farming provided a secure and more profitable alternative to protein crop farming;
- Protein crop farming requires more special expertise and care from growers than other major COP crops;
- The anti-nutritional characteristics of many traditional varieties of protein crops;
- Larger compound feed companies are not interested in purchasing home-grown protein crops because of the small and fluctuating quantities in which they are available;
- These companies consider, not protein crops, but soybean meal to be the ideal constituent in feed mixtures due to its high protein content and favourable amino acid composition;
- A vicious circle associated with a lack of critical mass: due to dwindling protein crop areas, no efficient, up-to-date herbicides have been developed and registered; thus the competitive position of protein crops vis-à-vis other COP crops (in terms of yields and profitability) deteriorated, resulting in further shrinkage in areas.
- Some sweet lupin growers gave up production because of plant diseases, which they could not cope with.
- Although sweet lupins are an option that attracts support within agro-environmental programmes, it is not popular because there is no integrated plant protection system in place.

Table HU.4: Areas, production and yields of protein crops, 2003-2007

Year	Field peas hectares	Field peas tonnes	Field peas t/ha	Field beans hectares	Field beans tonnes	Field beans t/ha	Lupins hectares	Lupins tonnes	Lupins t/ha
2003	22,435	30,188	1.33	2,303	2,206	0.92	395	272	0.69
2004	21,735	64,409	2.96	1,156	1,867	1.31	204	216	1.06
2005	19,940	50,214	2.52	1,248	2,398	1.56	208	391	1.88
2006	20,148	49,342	2.45	783	2,026	2.22	306	569	1.86
2007	22,286	50,990	2.29	593	858	1.31	376	430	1.14

Source: CSO.

Table HU.5 describes the development of the country's export, import and net export flows in the three protein crops, combining intra-and extra-EU volumes, over the period 2000-2007.

It is evident that there has been no trade of any note in either field beans or sweet lupins over time. In 2007, the most recent year for which comprehensive data are available, both exports and imports of both crops were zero.

For field peas, there was a consistent net export flow. The net export volume peaked at over 10,000 tonnes in 2004, the year of peak output since 2000, but had shrunk to well below 1,000 tonners in both 2006 and 2007. Analysis of the destinations for the exports reveals that, on average over the latest five years (2003-2007) for which trade data were available, a majority of gross exports (57% on average) were outside the EU.

Calculations of the average unit values from 2003 to 2007 of field pea exports to non-EU and EU destinations reveal a marked difference between the prices paid in these markets. For sales to EU MS, the average reported unit value over these five years was €264.5 per tonne. For sales to non-EU destinations, the unit value was €431.4 per tonne.

This differential is not out of line with the premium paid for peas for human or pet food uses in third country export markets over the prices paid for peas in feed applications in important field pea exporting MS, such as Germany and the UK.

Table HU.5: Hungary foreign trade, combining intra- and extra-EU trade, in protein crops, 2000-2007 (tonnes)

	Field peas			Field beans			Sweet lupins		
	Exports	Imports	Net Exports	Exports	Imports	Net Exports	Exports	Imports	Net Exports
2000	10,393	3,459	6,934	0	0	0	163	0	163
2001	8,217	5,950	2,267	0	0	0	0	0	0
2002	11,159	4,949	6,210	0	0	0	0	0	0
2003	10,523	3,295	7,228	0	0	0	0	0	0
2004	12,084	1,821	10,263	0	0	0	0	0	0
2005	10,876	3,268	7,608	0	0	0	0	0	0
2006	2,054	1,239	816	0	0	0	0	0	0
2007	2,514	1,980	535	0	0	0	0	0	0

Sources: FAO, COMEXT

2. The development of alternative crop production

Table HU.6 summarises the development of the areas under each of the major cereals, oilseed and protein (COP) crops since 2000-01, i.e., several years before the implementation of the 2003 reform, and before Hungarian accession.

The bottom rows of the table permit one to compare areas before and after the 2003 reform, which coincided with the period of Hungarian membership of the EU.

The main points to note from analysis of this table are:

- Area under protein crops has remained fairly stable over the period 2004-05/2007-08, averaging around 21,000 hectares. Estimates for 2008-09 suggest that area declined to around 18,000 hectares.
- Comparison of the average area pre-reform with the average area post reform indicates that combined protein crop area fell by around 23% in the years post-accession.
- The declines were relatively greatest for sweet lupins (an area decline of 70%) and field beans (a decline of 69%). For the major protein crop, field peas, the decline was one of 16%.
- Among the major COP crops, the other crops that lost ground in their areas after the reform were barley (whose area was down 9%) and maize (a reduction of 3%, comparing the post-reform period with the period up until 2003-4).
- The major beneficiaries from the period of accession were the two oilseeds crops, w2ith a 59% increase in the rapeseed area and a 34% increase in the area planted to sunflower.
- Common wheat managed a 1% increase in its area after the reform, but this represented a decline in its overall share of the COP area, since the final column of the table indicates that the total area under the main COP crops rose 4% in the post-reform period.

Table HU.6: Areas of the major cereals, oilseeds and protein crops in Hungary, 2000-2008 ('000 hectares)

	Protein crop	*Field pea*	*Field bean*	*Sweet lupin*	Rapeseed	Sunflower	Common wheat	Barley	Maize	Durum wheat	Other cereals	Total Area
2000-01	31	25	4	1	116	299	1,010	325	*1,193*	*15*	*222*	3,209
2001-02	30	26	3	1	110	320	1,192	368	*1,258*	*14*	*250*	3,541
2002-03	26	23	3	0	129	418	1,100	371	*1,206*	*11*	*268*	3,527
2003-04	25	22	2	0	69	511	1,103	341	*1,145*	*11*	*287*	3,491
2004-05	23	22	1	0	103	480	1,162	331	*1,190*	*12*	*307*	3,608
2005-06	21	20	1	0	122	511	1,121	316	*1,196*	*9*	*276*	3,572
2006-07	21	20	1	0	143	535	1,069	294	*1,229*	*9*	*265*	3,565
2007-08	23	22	1	0	225	505	1,102	324	*1,055*	*8*	*256*	3,498
2008-09	18	17	1	0	250	560	1,126	332	*1,180*	*8*	*241*	3,715
Average pre-reform	28	24	3	1	106	387	1,101	351	1,200	13	257	3,442
Average post-reform	21	20	1	0	169	518	1,116	319	1,170	9	269	3,592
Percentage change	-23%	-16%	-69%	-70%	59%	34%	1%	-9%	-3%	-28%	5%	4%

Source: FAO, Eurostat. For 2008-09, the data have been derived from estimates prepared by COPA-COGECA.

Note: Pre-reform is the period from 2000-01 to 2003-04; post-reform is the period from 2004-05 to 2008-09

3. The production systems applied to protein crops

Protein crops, primarily field peas, are usually grown preceding and following wheat, to make the maximum use of their nitrogen-fixing and yield-enhancing impacts. Interviews with farmers revealed the following key points.

3.1 Field peas

- Its protein content is around 22-28%, and is attractive to farmers by virtue of its short growing period. It is considered an exceptional preceding crop, which increases the usable nitrogen stock of the soil (by 30-50 kg of N/year) through the rhizobia living on its roots. It also increases the humus content of the soil and improves its biological activity.
- Field peas are also characterised by a tolerance of different farm conditions, being able to be grown on a very wide variety of soils.
- Summarising the opinions of a number of local experts in the crop, the main climatic factors that support the production of field peas are: temperature during the germination period, rainfall during the growing period; and the average temperatures during the same periods. The distribution of rainfall is very important for yield. The ideals are March-35-38 mm, April 40-46 mm, May 50-55 mm and June 60-65mm.
- The sowing period is mostly in the middle of March, and the harvesting time is the end of June and beginning of July. It has to be sown in the rotation between two cereals and it can be sown again on the same plot or after other legumes after 4-5 years, but the government is trying to enforce a seven year minimum rotation, to avoid a build-up of disease.
- During harvesting ,some adaptation is needed to cereal combine harvester, with the use of rubber fingers for the harvester .The crop must be treated with gas against weevils, right after pre-cleaning and has to be stored at a humidity level of below 14%.

3.2 Field beans

- The protein content of field beans is 27-30%, and five varieties are cultivated in Hungary.
- Its optimal sowing date is between the 10th of March and the 10th of April, when it has to be sown at a depth of 8-10 cm. The crop also needs increased protection while it is vulnerable to attack by pests and fungi. It is quite demanding of water, needing 300 mm of rainfall during its vegetative period. Yields can be increased considerably with irrigation. Harvesting occurs mainly in August.
- Its ability to fix nitrogen is estimated to be 70-80 kg per hectare. When planted ahead of wheat, it can increase yields by 0.6-1.0 tonnes per hectare.
- In common with field peas, it has to be harvested with harvesters equipped with rubber fingers. After harvesting it has to be screened and the weevils must be removed.

3.3 Sweet lupins

- This crop is produced partly as a green form of fodder and as a green source of manure too. It is a favourable feature of the cracked lupin grains that they do not need any treatments before being fed to animals. At present, there are five varieties in production.
- The sweet lupin is not demanding about soil types. It can be grown on a full range of soils, including those that are sandy. In cultivation, the most conducive conditions for

sweet lupins are the temperature during germination, a uniform distribution of rainfall, and the temperature while growing. From planting to harvesting takes 140-150 days and requires on average 250 mm of rain and 2500-2800 Celsius heat units for the best results.

- Sowing, using 120-140 kg of seed per hectare, takes place from mid-March to early April, where the crucial determinant is not the date, but the pace of soil heating.
- It follows cereals in rotations, and is a good prior crop for winter cereals and potatoes. Its other characteristic is that it raises the soil nitrogen content by 120-180 kg, which has the disadvantage of encouraging the quick emergence of weeds. It can generate a 15-20% increase in the yield of the succeeding plants in the rotation.
- Its production is made difficult because this plant is very sensitive to most major herbicides, and there are only a few products that can be used in lupin production. As chemical weed control is needed in Hungary, this sensitivity is, therefore, very important.
- Harvesting occurs between the end of July and early September. The harvester must advance more slowly than it does when harvesting cereals. Setting the harvester's drum needs special care and attention. The crop can be stored safely below 12% of humidity.
- The typical input use has not changed in recent years. The need for nitrogen is much less than for cereals, but the harvest requires more attention and care.

3.4 Comments applicable to all protein crops

- These crops are rarely used as part of an organic production system, though field beans are used as a green manure crop, sometimes in a double-cropping system. There are no separate statistics available regarding the organic production of protein crops.
- Irrigation is not commonly used for either field beans or sweet lupins, but it is sometimes used for field peas for food use. In Hungary, the total irrigable area was 205,728 hectares in 2004, 195,455 in 2005, and 199,373 in 2006. However, in practice, in 2006 only 62,123 hectares were irrigated, including 50,540 hectares of arable land and 3,800 of orchards.
- The preferred rotation employed on Hungarian farms has changed in recent years, with the most two favoured crops being maize and oilseeds and oil crops, with the two oilseed crops (sunflower and rapeseed) gaining in popularity thanks to biofuel demand and the energy crop premium.
- Hungary, as a new MS, does not apply compulsory set-aside, which encouraged the farming of rapeseed for biofuels in EU-15 MS. In some regions of Hungary, energy crop output grew when market opportunities existed to take advantage of the energy crop premium.
- The peak demands for labour occur at the same time for protein crops as for cereals.
- Research institutes working on protein crop breeding are limited by the low level of domestic demand for seeds. The contrast with cereals or sunflowerseed, in particular, in the range of new varieties available is substantial.
- The vulnerability of protein crops to pests and diseases is high in relation to other arable crop. Producers often try to save money by limiting their use of agri-chemicals. The sole exception is when producers are growing field peas under contract for the food market. In such cases, the trader or final user often stipulates the plant protection chemicals to be used.

4. The gross margins on protein crops vs. alternative crops

Hungary is the only one of the six MS selected for special case studies for which data do not exist on the gross margins earned on the cultivation of protein crops.

The areas under these crops are too small to attract the attention of agricultural economics research institutes that undertake regular analyses of the production costs and gross margins of other COP crops.

The FADN database also provides no assistance in this respect, again because the crops occupy too small a share of the UAA on individual holdings to form the basis for any cost and margin analysis.

The main findings of producer questionnaires, presented later in this monograph, constitute the best source of information about producers' perceptions about the economics of their protein crop production.

5. The significance of protein crop production in farm incomes

For four of the six selected member states studied in the case study monographs[7], it is possible to use the FADN database to compare the profitability of protein crop farms with the values of the same indicators for "other farms", i.e., farms that do not cultivate these crops. In these analyses, protein crop farms are classified on the basis of the share of farm UAA that is devoted to protein crops. The data used for this analysis have been extracted from the FADN database.

This analysis was to ascertain whether there are any structural differences in the profitability of farms that choose to grow protein farms relative to farms that do not grow these types of crops, *ceteris paribus,* i.e. when both sets of farms belong to the same type of farming.

The preferred approach was to conduct the analysis separately for the two main types of farms producing protein crops, namely "COP specialists" and "Mixed crops and livestock".

A constraint on the use of the FADN database is strict confidentiality about individual respondents. Analysis is only permitted when a minimum threshold of 15 producers in the relevant combination of size of holding and specialisation is exceeded each year. This threshold is also required to ensure that the results presented meet a satisfactory degree of statistical precision.

- Unfortunately, for Hungary, there is no single size class and no single specialisation that exceeds this minimum threshold of 15 respondents.
- Accordingly, it is regretted that it is not possible to prepare an analysis of the significance of protein crops in farm incomes in Hungary using FADN data.

In view of the impossibility of using data collected by FADN, we merely note, instead, the trends in the share of protein crops in overall farm incomes in Hungary.

Table HU.7 describes the development of the protein crop share of the overall value of Hungarian farm production from 2000 to 2007. From 2005 to 2007, this share was a very modest 0.09%, which helps to explain the limited interest in collecting more data about the sector.

Table HU.7: The share of the value of protein crop output within the total value of farm output in Hungary 2000-2007 (million Forints)

	2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*
Protein crop output (million HUF)	1,930	1,540	1,420	1,060	2,460	1,420	1,450	1,500
- of which field peas (million HUF)	1,900	1,500	1,400	1,050	2,441	1,382	1,369	1,416
Total farm output (billion HUF)	1,284	1,484	1,482	1,417	1,646	1,517	1,586	1,678
Share of protein crops within total farm output (%)	0.15%	0.10%	0.10%	0.07%	0.15%	0.09%	0.09%	0.09%

Source: CSO

[7] These four are France, Germany, Poland and the United Kingdom, although, even for these MS, the analysis can only be undertaken for a small number of size classes of holdings and a limited number of farm specialisations.

6. The development of the local feed compounding industry

Table HU.8 describes the decline in the number of Hungarian feed compounders since 2004, using data published by FEFAC, which does not include Hungary in its coverage prior to its accession. We observe that:

- The number of compounders has fallen by over 10% between 2004 and 2007.
- However, the production of compound feed fell at an even faster rate, declining by over 12% during the same three years, and livestock farming (especially of pigs) fell in Hungary n response to higher local feed cereal prices following accession and the application of the system of intervention buying to support cereal prices throughout the Community.
- The faster reduction in compound feed output than in the number of feed compounding plants meant that the average production per plant fell slightly (by 2%) from 2004 to 2007.

Table HU.8: The number and annual output of Hungarian feed compounders, 2004-2007 ('000 tonnes)

	Number of compounders	Compound feed output ('000 tonnes)	Annual output per plant ('000 tonnes)
2004	290	4,759	16.4
2007	260	4,180	16.1
% change 2004-2007	-10.3%	-12.2%	-2.0%

Source: FEFAC Feed and Food Statistical Yearbook, 2007

Only a few of the large feed processors use protein crops in their compound feeds. This is blamed mainly on the small and fluctuating quantities available on the local market, where prices are relatively high prices in comparison with soybean meal, which is considered the ideal constituent, in comparison to protein crops, in feed mixes due to its protein content and amino acid composition.

Even if they use protein crops, which in practice are almost exclusively field peas, these are often imported from Slovakia or the Czech Republic.

Typically, field peas are put by smaller, more flexible, processors into less valuable feed mixes which are used by small scale farmers fattening pigs and poultry or owning egg-laying hens.

The earlier discussion of foreign trade in protein crops noted that the export price of field peas on sales outside the EU has been well above the price of the field peas sold within the Community. This is interpreted as evidence that the third country exports are primarily destined for food use or premium pet food uses.

In Hungary, most field peas are sown primarily for food uses, but the output may later be sold for feed if it cannot be used for food (e.g., due to quality problems or a lack of food demand).

6.1 Marketing systems

The traders who purchase and sell protein crops are usually cereal traders for whom protein crops are of secondary importance.

Protein crop producers are regionally scattered in Hungary and they do not have their own sector-specific organisation. In terms of the supply chain, therefore, they are often organised around bigger farms, in most cases growing protein crops themselves as well.

These bigger farms, called “integrators”, provide farmers who contract with them with seed and other inputs, extension, and they also sell the produce if required by the contracted farmer.

- Integrators and processing companies play an important and useful role in the transfer of modern technology to agriculture.
- A few large integrators play an important role in collecting the products before their actual sale to traders, processors or exporters.
- For instance, in the supply of seeds to the oilseeds crushing industry, integrators supply an estimated 90 percent of the products to the factories.
- The package of services delivered by integrators differs one from another, but they usually include a package of inputs and credit which is advanced against the delivery of products after harvest.
- They often also provide a useful service as contractors for particular mechanical operations for small land owners, undertaking the cultivation of their fields and the harvesting of their crops.
- Finally, as noted above, the integrators offer support to small farmers in the marketing of agricultural products, including protein crops.
- One example visited during the study integrated 40 small farmers, with an average of 4 to 5 hectares of field peas each, and the integrator provided both extension and marketing services to the producers.

The traders interviewed during the fieldwork highlighted the following points:

- In feed, it was stated that field peas can replace soybean protein up to 50%. Their main constrain is that their lysine, cystine and methionine contents are less than desired.
- The protein content of field beans is 27-30%. They are used both for human and animal feed purposes. It can replace soybean meal in feed mixes up to 30%, mostly in pig and poultry feed. The crop is also a valuable green feed, silage crop and green manure.
- Hungary is broadly self-sufficient in most of the feed components. However, in 2008, mixed feed from Slovakia and Austria was imported for organic chicken and rabbit production.
- The main (user) sectors of protein are pork and poultry production. For the piglets, the main needs are more protein content and easy digestibility, and during the fattening period the need digestible protein gets lower.
- Peas are more suitable for older pigs and dairy cattle, but are not very well suited to young pigs or poultry, which need higher protein feeds, such as soybean meal, to fatten them more quickly. Even so, field peas are rarely used at levels above 6-8% in pig feed.

- One potential advantage for protein crops is that, for example, broiler chickens cannot easily digest sunflower meal if pieces of hull remain. Likewise, rapeseed meal with a high glucosinolate content cannot be fed to most animals.
- Falling local supplies of field peas, beans and sweet lupins were easily replaced with locally produced protein sources, such as rapeseed and sunflower meal, corn gluten feed and DDGS.
- However, there are instances when feed processors use soybeans as their main source of protein. Although there is some soybean production in Hungary (the area planted is around 20,000 hectares), the bulk of soybean requirements is imported.
- The largest Hungarian feed producers stated that they have easily switched from local protein crops because the soybean meal supply chain is well organised and it is a more cost-competitive protein source.
- In addition, these larger feed compounders anticipate expanding their use of rapeseed and sunflower meals, both of which are available locally or from neighbouring EU MS, such as Austria.
- If the EU applies further restrictions on GMO products, protein crops can play major role as a non-GM protein source.
- The best substitutes for soybean are sunflower and rape seed meal.
- Small farmers sometimes grow their own protein crops for on-farm use as pig feed.
- They sell small amounts on an ad hoc basis in village markets or directly to pigeon fanciers, who occasionally seek to buy larger quantities at premium prices.

7. Evidence from interviews and questionnaires with stakeholders in the Hungarian protein crop sector

There are two main sources from which we drew evidence: one was through direct interviews with stakeholders and the other, analysis of individual questionnaires completed by 27 farmers. This is described in the following two sections. The questionnaires were lengthy and many respondents did not complete them in full. Given the relatively small sample of completed questionnaires, prudence should be exercised when interpreting the results.

Questionnaires for processors were fewer in number since many of them are transnational companies active in several Member States. The analysis for this is not presented in the individual case studies but can be found in the Main Report.

Since Hungary only joined the EU in 2004, its producers had no real basis on which to assess the impact of the 2003 reform. Therefore any comparison tends to be mainly one of "with CAP", as opposed to the previous situation of "without CAP".

The major change after accession was the introduction of intervention support for cereals, which boosted the attraction of cereals for producers, but the promotion of biofuel demand for oilseeds and the application of the energy crop premium increased the attractions of oilseeds as well, and oilseed areas grew much more rapidly than cereal areas after accession. Protein crop areas were among the losers from this change in the preferred choice of crop.

7.1 Summary of interview evidence

- The Single Area Payment Scheme and CNDP applied to Hungary affect producers' crop choice in several respects. One respect was by focusing more attention on rotation rules and practices within the agri-environmental conditions that had to be met.
- Hungarian regulations regarding payments of income supports require that field peas be grown on the same plot of land no more than one year in seven, whereas the preferred practice is one year in four or five.
- Protein crops are widely acknowledged to offer nitrogen-fixing benefits to the succeeding crop, together with a yield boost. However, several producers mentioned the environmental disadvantages associated with the need for frequent pesticide and herbicide sprays on protein crops.
- The small scale of local output makes the development of support services difficult to sustain financially. For example, there are 47 varieties of field pea seeds available for planting, which complicates the management of the harvesting and marketing chain.
- The production of field beans for seed to be grown to supply the food export market is characterised by multi-year contracts by seed companies such as Monsanto and Syngenta. In these special cases, the crop is planted every three years in a rotation.
- Field peas for seed contracts are also reported to be attractive to producers, thanks to guaranteed prices. Surplus production is sold to the feed compounders.
- Producers mention the scope for planting lupins every four years as green manure, mostly in acid soils. However, good herbicides are not available for this crop.

7.2 Summary of analysis of farmers' questionnaires

7.2.1 Protein crop areas

- There is some evidence of an increase in protein crop area over the period 2003/04 – 2008/09. Like area, production has also increased over the period surveyed.

- On average, 13% of arable land is planted to protein crops.
- Plantings take place in March. Harvesting is undertaken mainly in June and July.

7.2.2 Crop rotations

- Around one third of farmers use protein crop as part of the rotation, while the rest tends to have a more opportunistic behaviour with regard to their use in rotation.
- The main reason for growing protein crops in rotation is the improved yield of the following crop, the nitrogen fixing characteristics of the crops are also an important element.
- Alfalfa is the most common crop farmers would use in a rotation cycle instead of protein crops. It is followed by cereals and sunflower.

7.2.3 Production of alternative (non-protein) crops

- There is no clear trend to be drawn for the response received changed in area of other crops (i.e. not protein crops).
- Most farmers did not report any significant change in the area planted to protein crops.

7.2.4 Protein crop quality

- Just over half respondents had changed their protein crop variety over the last five years. The main reasons for the change included export market and processor requirements. Another reason was improved yield.

7.2.5 Outlets for your protein crops

- 50% of farmers surveyed use their own protein crop output directly for on-farm feed. Less than 20% of total output is used in this way.
- Sales of protein crops tend to be equally distributed among traders, feed compounders and other agents.
- Around two thirds of respondents said their protein crop was used mainly in feed outlets. Of this, the majority is consumed nationally.
- A third of respondents said that protein crop output was mainly used in food outlets. Of these, a third was destined for EU markets, 22% was destined nationally, while a similar proportion is exported to non-EU markets.

7.2.6 Protein crop marketing

- Around one third of farmers have contracts with processors. Around 60% of contracts are with private entities, while the balance is with cooperatives.
- Quantity and quality are generally agreed in the contract. The main indicators of quality are water content, purity and germination. Only 43% of farmers reported that price is included in the contract.
- Just below 60% of farmers had a contract which permitted them to sell their protein crops to other processors outside the contract.
- The average price received per tonne of field peas, rose from €229 (s.d. 78.2) in 2003 to €277 (s.d. 86.4) in 2007 and again in 2008 to €302 (s.d. 164.4).
- The average price received per tonne of field beans, rose from €190 (s.d. 124) in 2003 to €248 (s.d. 155.3) in 2007 and again in 2008 to €294 (s.d. 129.3)
- In 2008 the average price received per tonne sweet lupins was €298 (s.d. 31.8)

7.2.7 Use of inputs

- Input use has not changed significantly over the last five years. Around 50% of farmers indicated they are now using new phyto-sanitary products.
- Organic farming accounts for less than 20% of the sample. The majority of respondents do not grow protein crops on irrigated land.
- Two thirds of those interviewed said that they had made investments linked to protein crop farming in the last five years, mainly in tractors and planting machinery. All of these responses said they had used rural development funds way towards these investments.

7.2.8 On-farm employment and labour used

- The majority of responses said that less than 20% of household employment is derived from protein crop production. A small number of cases reported that this was between 20-40%.
- The majority of responses said that less than 20% of farm revenue is derived from protein crops (including special area payment).
- Two thirds said they contracted out specific farm operations. Of those who did, harvesting was the most popular operation with an average cost of €63 per hectare
- Profitability is commonly judged per hectare or in some case per tonne of production.
- Wheat, followed by rapeseed was the most profitable crops in 2008.
- Nearly 80% of respondents felt that the ranking of crop profitability has changed over the last five years. Sunflower was regarded as the most profitable crop in 2003/04.

7.2.9 The impact of reforms in the Common Agricultural Policy

- Around 60% of those interviews felt that the introduction of a decoupled payment had not affected the area they planted to protein crops. 40% said it had some affect.
- Around one third of farmers have been affected by the change in payment system for protein crops since. Of these, 15% said it had a great affect while 19% said it a slight affect.
- Our responses indicate that as the level of payment tied to protein crop decreases, area planted to protein crop decreases. If coupled payments were completely removed, area under protein crop would fall by around 3%. If coupled payments rose to €100, area under protein crops would rise by around 25%.
- All those who responded said that they benefited from the coupled payments from national government on protein crop output. Over 80% of respondents highlighted agri-environmental programmes as other payments available to them. All of those who answered said that these payments were important for their decision to grow protein crops.
- The main influences on farmers' decisions to grow protein crops are the benefits for the following crop. Other elements include agri-environmental payments, prices paid by the trader/processor and protein crop area payments.
- Nearly half of those interviewed said that their reasons for growing protein crops had changed since 2003. The majority indicated the introduction of agri-environmental programmes as a major factor.

8. Impact of the CAP measures upon the local protein crop sector

Aggregate protein crop area stood at around 28,000 hectares in the years 2000-01 to 2003-04, compared with around 21,000 hectares in the years 2004-05 to 2008-09. This equates to a 23% fall. In terms of individual crops, sweet lupins and field beans suffered the largest decline (at around 70 %), albeit from a very small starting point. Field pea area, which accounted for almost the totality of protein crop area post the accession, fell by 16%.

Based on our assessment, there is no clear indication that this decline is a direct result of the changes introduced with the 2003 reform[8] .

Our analysis points to a number of exogenous factors (some of which pre-date the Hungarian accession) which, over time, have acted to harm demand for protein crops.

- Protein crop area has been on a downward trend since the early 1990s, falling from around 133,000 hectares per year in the period 1986-1990 to around 28,000 hectares in the years pre-accession.
- Interview evidence indicates that this decline was due to two main reasons. First, production subsidies, which were granted by the Hungarian government in order to encourage protein crop production, were removed. Second, the fall in meat and bone meal output in the early 1990s (following the BSE outbreak) meant that demand for protein crops, which were traditionally mixed with meat and bone meal in feed rations, fell as a result.
- Protein crops in feed rations were easily replaced by alternative feed ingredients: rapeseed and sunflower meal, corn gluten feed and DDGS. The increase in the use of these feed ingredients was partly compounded by the fact that, after the accession, cereal and oilseed farming were considered to provide a secure and more profitable alternative to protein crop production. Over the period 2004-05/2008-09, rapeseed area rose by 59%, while sunflower area rose by 34%. Imported soybean meal is also a popular feed ingredient among the largest feed compounders thanks to a well organised supply chain and competitive prices.
- While farmers recognise the rotational benefits associated with protein crop production, in terms of nitrogen-fixing properties and yield boost for the following crops, the vulnerability of these crops to pest and diseases is high in relation to other arable crops and is a major issue for farmers.
- The small size of the market for these crop means that the investment in research and development is limited. This has created a vicious cycle which affects negatively the competitiveness of these crops vis-à-vis other COP crops, which is likely to result in further area shrinkages.

At the same time, there is evidence of a relative increase (relative to the rest of the sector) in the economic competitiveness of field pea production in premium markets. Over the period 2003-2007, the majority of gross exports were to destinations outside the EU. Analysis of export unit values for intra and extra EU exports provides evidence that the third country exports are primarily destined to premium markets such as food use or premium pet food uses.

[8] These are the changes introduced by the Single Area Payment Scheme in new MS.

Polish Protein Crop Sector

This monograph has the following structure.

- We consider, first, the development of the protein crop sector within Poland.
- Then, we review the development of alternative cereals, oilseed and protein (COP) crop production within the country.
- We describe the main production systems applied to protein crops, notably as regards crop rotations.
- We then analysis gross margins on protein crops vs. those on alternative COP crops.
- We present analysis from the FADN database of the significance of protein crops in Polish farm incomes.
- We review the development of the local feed compounding sector and its attitudes towards the use of protein crops in their feed mixtures.
- We summarise the evidence collected during the fieldwork. The main tools of investigation consisted of questionnaires administered to protein crop farmers and interviews with feed compounders.
- We conclude with a discussion of the impact of the CAP measures upon the local protein crop sector.

1. Description of the development of the protein crop sector

In Poland, protein crops account for only a small fraction of the total arable area. Between 1995 and 2007, their share in the arable area lay between 1.0 and 2.0% (except in 2002, when it fell to 0.9%).

In Poland, protein crops are also grown in mixtures with cereals, on a scale that is significant in relation to the overall protein area (around 40,000 hectares of such mixtures in all). However, the mixtures typically contain only 20-30% of the protein crop. Thus under EU classifications, which require protein crops grown in mixtures to be "predominantly" composed of protein crops in order to be classified as protein crops, this would not be classified as a protein crop.

Considering only the three protein crops covered by the CAP measures (field beans, field peas and lupins), Table PO.1 and Diagram PO.1 reveal that national production over the period from 1995 to 2007 varied from 27,100 to 84,100 tonnes, with the peak in 2007. The output of field beans and field peas was fairly stable, but in the case of lupin a clear upward trend can be observed.

At the end of the 1980s, two protein crops (lupin and field beans) accounted for almost 70% of the total protein crop area. However in recent years, field beans have contributed only 10% of the total (6-10,000 hectares), with field peas accounting for a similar percentage. Sweet lupins contribute up to 35% of the protein crop total area, and the area devoted to the farming of mixtures of cereals and protein crops is of a comparable size.

Following a sharp drop at the start of the current decade, the protein crop area has increased gradually (see Table PO.1).

- The expansion in field beans (a demanding crop, with soil and other agronomic requirements similar to those for common wheat) has been small, from 6,100 hectares in 2002 to 9-10,000 hectares in 2005-2006, before falling back by roughly one third to 6,700 hectares in 2007.
- COPA-COGECA estimates for 2008 imply that the field bean area did not change significantly in the latest year. The decline reflected mainly economic factors. The strong rise in cereal prices reduced the relative profitability (already low) of field beans vs. common wheat.

- Field peas occupy a similar area (4-7,000 hectares) but no significant trend can be discerned, and the COPA-COGECA estimates for 2008 suggest that this did not change in the latest year.
- By contrast, the area under sweet lupins expanded almost tenfold, from 4,500 to 42,000 hectares, but the COPA-COGECA figures imply that the area was unchanged in 2008.

Although there are no coupled payments on protein crops in Poland, protein crop areas are included in SAPS payments. They are also covered by the CNDP national top-up scheme, where these payments are the same per hectare as for cereals or rapeseed.

Due to their low input requirements and favourable position in crop rotations (reducing fertiliser requirements and the use of chemicals for the following crop), interest in lupin cultivation is still high.

Under Polish conditions, yields of the main cereals grown after lupins are reported by agronomists in interviews to be, on average, 0.8 tonnes/hectare higher than the yields of cereals grown in rotation after other crops.

Despite some improvement over the time, when compared with the 1990s, protein crop yields in Poland are still relatively low. The improvement results from a growing use of inputs (fertilisers and sprays) and quite favourable weather conditions during the current decade.

A considerable increase in the area of high-yielding mixtures with cereals has also contributed to the growth in average reported yields, depicted in Diagram PO.2. The reduction in the area planted to mixtures over the last three years caused the recent decline in average yields of the total areas under protein crops (see Table PO.1 and, for detail on the individual protein crops, Table PO.1).

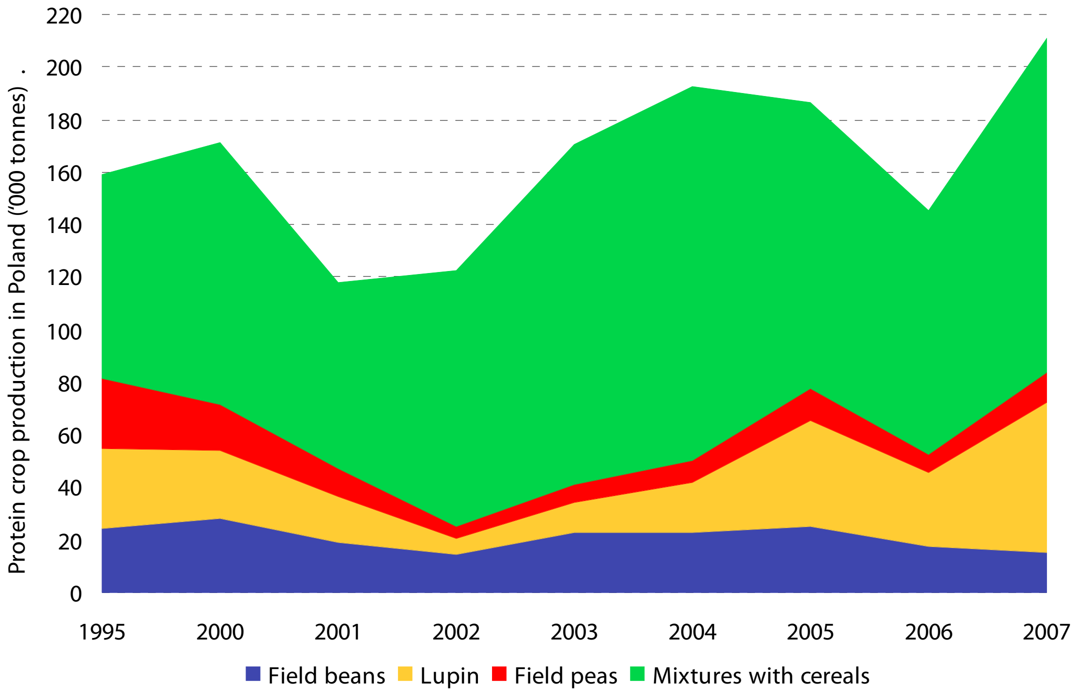
- Sweet lupin is the lowest yielding protein crop; over the last six years, its yields ranged from 1.1 to 1.6 tonnes/hectare
- The yields of field peas are a bit higher, but rarely exceed 2.0 tonnes/hectare, with the peak of 2.2 tonnes/hectare.
- Average yields of field beans ranged from 2.0 to 2.8 tonnes/hectare.

Table PO.1: Areas, yields and output of the three protein crops in Poland, 2000-2007

	2000	2001	2002	2003	2004	2005	2006	2007
Area ('000 ha)								
Field beans			6.1	9.4	8.2	10.5	8.9	6.7
Lupins			4.5	8.9	11.6	28.9	25.4	41.9
Field peas			4.0	4.5	3.7	7.2	4.4	7.1
Total of the above			14.6	22.8	23.5	46.6	38.7	55.7
Mixes with cereals			38.9	51.6	47.4	38.7	41.7	41.9
Total			53.5	74.4	70.9	85.3	80.4	97.6
Yield (tonnes/ha)								
Field beans			2.2	2.4	2.8	2.4	2.0	2.3
Lupins			1.4	1.3	1.6	1.4	1.1	1.3
Field peas			1.9	1.6	2.2	1.6	1.5	1.7
Total of the above			1.9	1.8	2.1	1.7	1.3	1.5
Mixes with cereals			2.7	2.5	3.0	2.8	2.2	3.0
Total			2.5	2.3	2.7	2.2	1.8	2.2
Production ('000 tonnes)								
Field beans	28.1	19.3	13.2	22.7	23.1	24.8	17.6	15.6
Lupins	26	17	6.5	11.2	19	40.9	28	56.5
Field peas	17.6	10.8	7.5	7.1	8.1	11.7	6.6	12
Total of the above	71.7	47.1	27.2	41.0	50.2	77.4	52.2	84.1
Mixes with cereals	99.2	70.8	105.3	129.4	142.4	108.8	93.5	126.4
Total	170.9	117.9	132.5	170.4	192.6	186.2	145.7	210.5

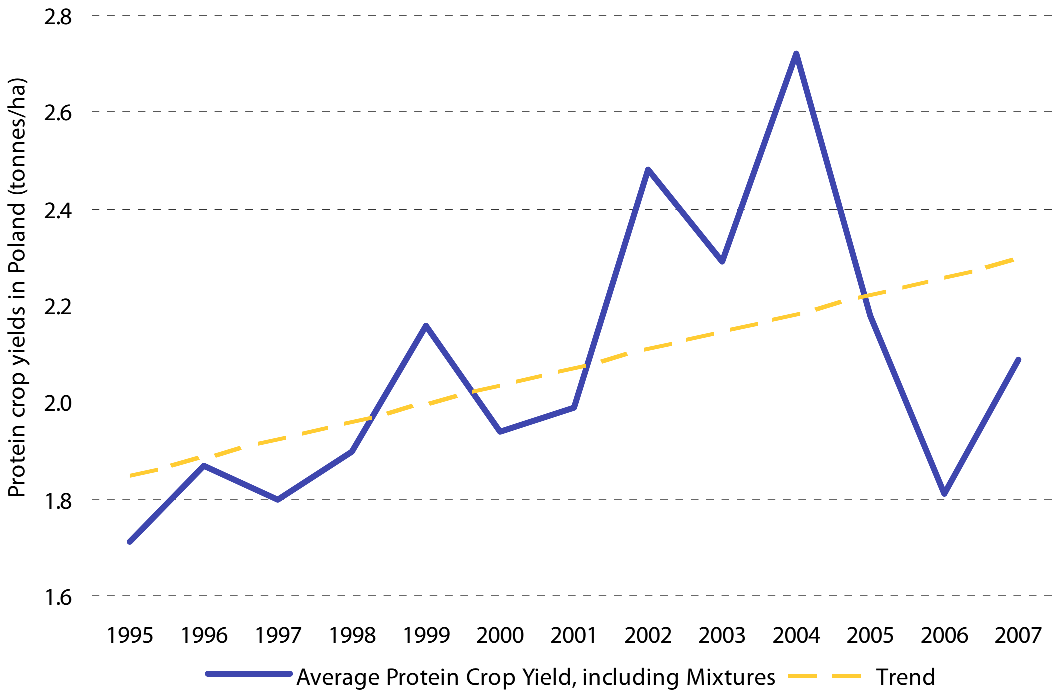
Note: a This includes mixtures with *Vicia sativa* (some 2-3,000 hectares)
Source: CSO. The CSO does not publish separate area data for individual crops for 2000 and 2001.

Diagram PO.1: Protein crop production in Poland ('000 tonnes)



Source: Central Statistical Office (CSO)

Diagram PO.2: Protein crop yields in Poland (tonnes/hectare)



Source: Central Statistical Office (CSO)

Table PO.2 describes the development of the country's export, import and net export flows in the three protein crops, combining intra-and extra-EU volumes, over the period from 2000 to 2007.

It is evident that the very small trade balances in field beans and sweet lupins have fluctuated between net imports and net exports over time. In 2007, the most recent year for which comprehensive data are available, net exports of both crops were very modest: 155 and 98 tonnes, respectively.

For field peas, there was a consistent net import flow. It peaked at a net import volume of 16,560 tonnes in 2003, and had shrunk to one of 9.560 tonnes in 2007.

Table PO.2: Polish foreign trade, combining intra- and extra-EU trade, in protein crops, 2000-2007 (tonnes)

	Field peas			Field beans			Sweet lupins		
	Exports	Imports	Net Exports	Exports	Imports	Net Exports	Exports	Imports	Net Exports
2000	2,752	11,124	-8,372	0	0	0	0	0	0
2001	2,190	18,439	-16,249	0	14	-14	0	0	0
2002	188	15,916	-15,728	0	0	0	0	0	0
2003	86	16,646	-16,560	0	0	0	0	0	0
2004	338	16,395	-16,057	118	16	102	351	0	351
2005	197	12,047	-11,850	434	148	286	0	0	0
2006	77	10,883	-10,806	36	16	20	0	33	-33
2007	326	9,886	-9,560	162	7	155	98	0	98

Sources: FAO, COMEXT

2. The development of alternative crop production

Table PO.3 reveals the development of the areas under each of the major cereals, oilseed and protein (COP) crops since 2000-01, i.e., several years before the implementation of the 2003 reform. In the table, the important category of mixtures of protein crops with cereals (mainly rye and triticale, which are grouped with minor cereals, such as oats, under "other cereals") is included within the cereals totals, since the main crop in such mixtures is the cereal crop.

The bottom rows of the table permit one to compare areas before and after the reform. It is evident from a comparison of this table with the area data in Table PO.1 that the FAO and Eurostat data in Table PO.3 are often very different from the data provided by the Polish Central Statistical Office. However, the FAO/Eurostat data allow one to make a direct comparison of individual protein crop area trends with the trends in the areas planted to other crops. Also, while the levels of the protein crop areas from the different sources do not agree, there is general agreement about the broad trends in areas, with sweet lupins the only protein crop to have made major gains.

The main points to note from analysis of Table PO.3 are:

- Both field peas and field beans experience a significant drop in planted areas in the period after the reform, although their areas have been comparatively stable since 2002-2003 and 2003-2004.
- Sweet lupin areas have bounded ahead, with the average post-reform areas more than double the pre-reform average.
- Among the other main COP crops, the main loser has been common wheat, whose post-reform area was 11% below its pre-reform total.
- The two major beneficiaries from the decline in common wheat plantings were rapeseed and maize.
- Polish rapeseed areas after the reform averaged 50% above their pre-reform average, boosted by the development of biodiesel demand.
- The maize area grew by 25% between the pre- and post-reform eras.

Table PO.3: Areas of the major cereals, oilseeds and protein crops in Poland, 2000-2008 ('000 hectares)

	Protein crop	*Field pea*	*Field bean*	*Sweet lupin*	Rapeseed	Sunflower	Common wheat	Barley	Maize	Durum wheat	Other cereals	Total Area
2000-01	45	11	14	19	437	1	2,635	1,138	*152*	*0*	*4,889*	9,296
2001-02	29	7	10	12	443	1	2,627	1,108	*224*	*0*	*4,861*	9,293
2002-03	15	4	6	4	439	1	2,414	1,096	*319*	*0*	*4,465*	8,748
2003-04	23	5	9	9	426	1	2,308	1,071	*356*	*0*	*4,428*	8,613
2004-05	23	4	8	12	538	3	2,311	1,051	*412*	*0*	*4,604*	8,942
2005-06	47	7	10	29	550	4	2,218	1,113	*339*	*0*	*4,593*	8,864
2006-07	39	4	9	25	624	5	2,176	1,221	*303*	*0*	*4,526*	8,893
2007-08	56	7	7	42	795	3	2,126	1,234	*262*	*0*	*4,768*	9,243
2008-09	56	7	7	42	755	3	2,275	1,206	*323*	*0*	*4,785*	9,403
Average pre-reform	28	7	10	11	436	1	2,496	1,103	263	0	4,661	8,987
Average post-reform	44	6	8	30	652	3	2,221	1,165	328	0	4,655	9,069
Percentage change	59%	-12%	-17%	169%	50%	372%	-11%	6%	25%		0%	1%

Source: FAO, Eurostat. For 2008-09, the data have been derived from estimates prepared by COPA-COGECA. Data may differ slightly from the estimates presented in Table PO.1 due to rounding errors.

Note: Pre-reform is the period from 2000-01 to 2003-04; post-reform is the period from 2004-05 to 2008-09

3. The production systems applied to protein crops

In this section, we examine the role played by protein crops within crop rotations in Poland, and analyse the importance of protein crops in holdings of different sizes.

- Among the three protein crops, field beans is the most demanding in respect of soil quality and tends to be grown on land that is also well suited to the production of common wheat, rapeseed and sugar beet, and hence competes for land with these crops.
- Field pea cultivation in Poland is characterised by having less onerous soil requirements than field beans. They are mainly grown on medium quality land, which is suitable for the production of less demanding crops, such as barley and oats or rye.
- The soil requirements for lupins are the least demanding among the three protein crops. They can successfully be grown on poor land, where the major traditional competitor is rye or oats.

The value of protein crops is most appreciated within the context of an arable crop rotation, where protein crops offer both nitrogen fixation and higher yields for the following crop.

Interviews with producers and agronomists yielded the general view that the best model for planting protein crops in a rotation was after cereals, in the third or fourth year after manure had been spread. Table PO.4 describes typical rotations for producers who plant protein crops as an integral element of their farming systems.

Due to the persistence of various pests and diseases among the protein crops in Polish conditions, it is considered an agronomic "must" to have a break of four to five years between protein crops grown in the same field.

Table PO.4: Typical crop rotations with the use of protein crops as a major crop

Years	Good land	Medium to poor land
1	Sugar beet	Potatoes
2-3 or 2-4	Winter barley or wheat	Oats or rye
4 or 5	Field beans	Field peas or sweet lupins

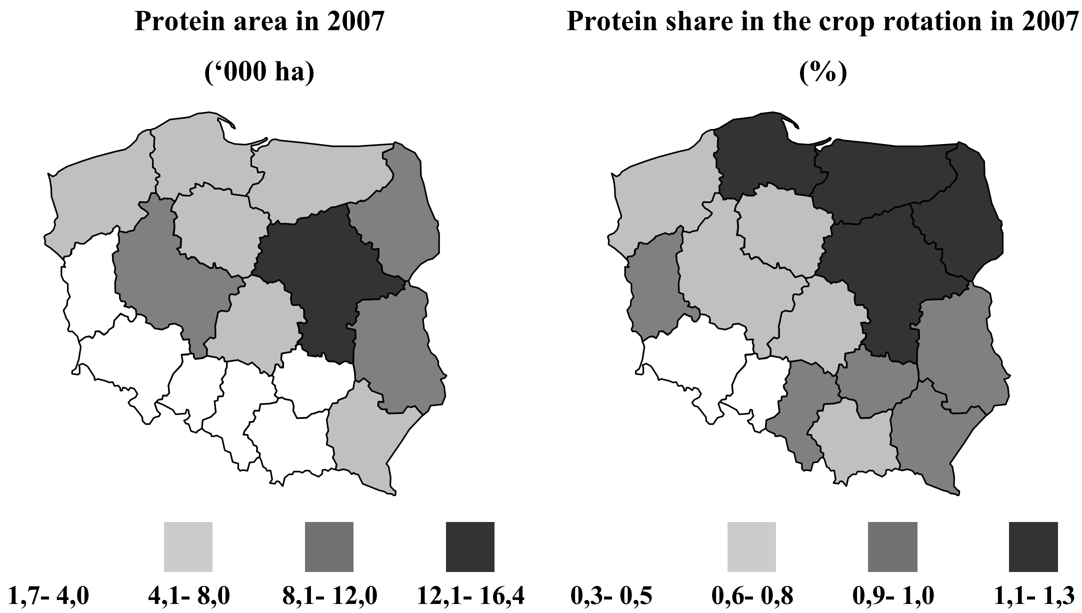
The scope of protein crop production in Poland shows a certain degree of variance across the country. In comparison to other crops (e.g., cereals or rapeseed) their importance is insignificant. Protein crops are most popular in the North Eastern part of the country, where they account, on average, for over 1% of the arable land in the crop rotation. This is illustrated in Map PO.1.

The largest protein areas are reported in the provinces of Mazowieckie and Lubelskie (where protein crops cover more than 10,000 hectares). Slightly smaller protein crop areas are to be found in Podlaskie and Wielkopolskie.

In terms of production volumes, the largest protein crop output was reported in Mazowieckie (which produced over 30,000 tonnes of production in 2007), followed by Wielkoposlkie, Lubelskie, Kujawsko-pomorskie and Podlaskie provinces, all of which harvested between 17 000 and 20 000 tonnes)

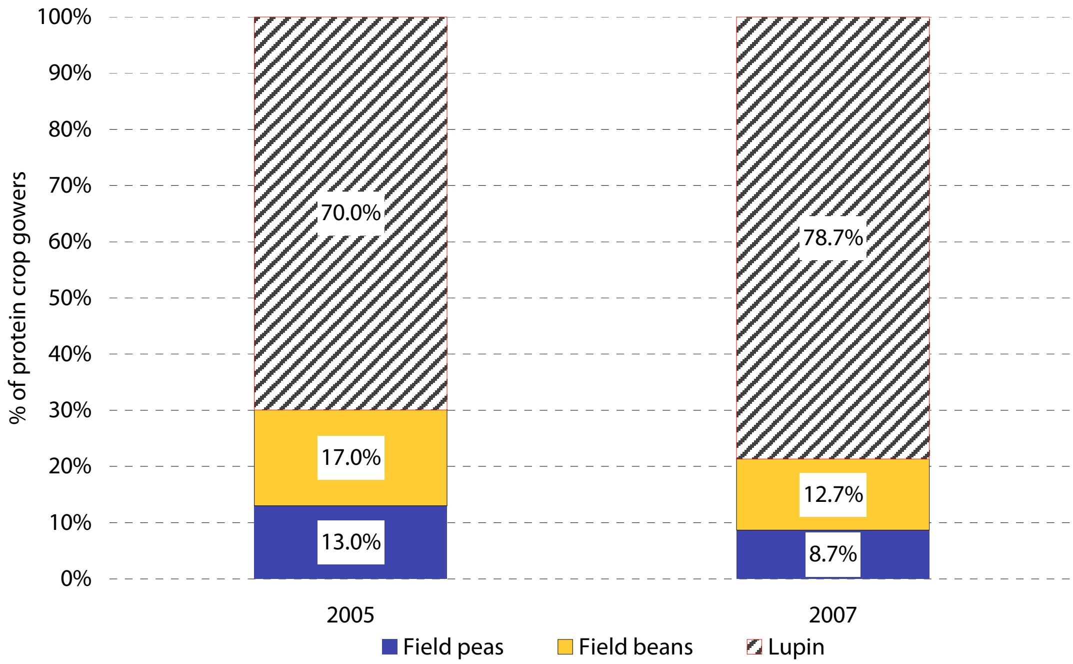
In contrast, the South Western region has the lowest interest in protein crops. They occupy less than 0.5% of the arable area and annual protein crop output varies between 4,000 and 8,000 tonnes.

Map PO.1: Protein area and protein share in the crop rotation (2007)



Source: CSO

Diagram PO.3: Distribution of the cultivation of the three protein crops among Polish growers, 2005 and 2007 (%)



Source: Central Statistical Office (CSO)

The Central Statistical Office data, plotted in Diagram PO.3, reveal that in 2007, protein crops were grown on 31,300 farms. The most popular of these crops was lupins, which was farmed by 78.9% of the total number of farms cultivating protein crops.

- We observe that, compared with 2005, the share of lupins in 2007 had increased by almost 9%[9].

Table PO.5 describes the distribution of protein crop areas by size of holding and by protein crop in 2007 (not including mixtures with cereals). Among the main points to note are that:

- Lupins were most popular among farms with 5-20 hectares of utilised agricultural area (UAA). Over 80% of that size of farms, which were reported to be cultivating protein crops, were said to grow it.
- The smallest farms (of 0-5 hectares) were least interested, in relative terms, in the cultivation of lupins (ca. 70% of those farms in that group cultivated the crop).
- The other protein crops have not attracted the attention of many farmers. The farms growing field beans and field peas accounted for 12.6% and 8.5%, respectively, of the total number of protein crop growers.
- Due to the very fragmented farming structure, most producers are rather small; the modal group for numbers of holdings growing protein crops has a total UAA per farm of only 5-10 hectares.
- However, the modal group in terms of protein crop output is the category of the largest holdings, with a UAA of over 100 hectares.

Table PO.5: Protein crop area by farm size (2007)

	Total	**Farm size groups (UAA)**						
		0-1	1-5	5-10	10-20	20–50	50-100	>100 ha
				Area (in ha)				
Total	**53 132**	**210**	**6 064**	**8 761**	**10 863**	**10 346**	**4 462**	**12 427**
including:								
field peas	4 542	24	274	656	555	1 731	384	918
field beans	6 686	34	1 306	617	809	796	442	2 682
lupin	41 904	152	4 484	7 488	9 499	7 819	3 636	8 827
				No of farms				
Total	**31 276**	**939**	**8 222**	**8 576**	**7 639**	**4 451**	**856**	**598**
including:								
field peas	2 706	221	566	615	541	587	112	63
field beans	3 963	62	1 814	807	665	419	113	82
lupin	24 607	656	5 842	7 154	6 433	3 445	631	447

Note: These areas exclude mixtures of cereals with protein crops.

Source: CSO data

[9] The data analysed in Diagram PO.3 do not reveal whether there may be some double-counting in the sense that some farms may grow more than one protein crop. However, differences in the agronomic requirements of the different protein crops and the very small proportion of the total arable crop area that they occupy on a typical holding make is highly unlikely that any double-counting is at all significant in terms of the overall conclusions from the analysis.

Turning to the actual areas planted to protein crops per holding, Table PO.6 presents the results of an analysis of the data already summarised in Table PO.4. From this, we observe that:

- In 2007, small farms (with a UAA of up to 10 hectares) accounted for 28.3% of the total protein crop area. From examination of the corresponding data for 2005, we note that the 2007 percentage was 7.2% higher than that in 2005. This is an unusual development in that the general tendency revealed by the FADN database is that protein crop areas are becoming more heavily weighted towards larger holdings.
- At the same time, the share of the smallest holdings (with a UAA of less than 10 hectares) in the total number of farms growing protein crops was 56.7% in 2007 (a figure that was 7.9% up on 2005).
- Large farms (of over 100 hectares of UAA) accounted for 23.4% of the total area of protein crops in 2007 (which was 5.8% down on 2005).
- The share of these largest holdings in the total number of protein crop producers in 2007 was just 1.9% (0.5% down on 2005).
- This indicates that, over time, the structure of protein farming has become more fragmented, with the cultivation of protein crops is by no means the domain of large farms.
- This fragmentation is in marked contrast to the situation found with another important rotation crop, rapeseed, among which large holdings are relatively more important.
- In 2007 average size of protein crop plantation was 1.7 hectares, a level unchanged from 2005.

Table PO.6: Farm structure and size of protein crop plantings by holding (2007)

	Total	**Farm size groups (UAA)**						
		0-1	1-5	5-10	10-20	20–50	50-100	>100 ha
Area distribution (in %)								
Total	100.0	**0.4**	**11.4**	**16.5**	**20.4**	**19.5**	**8.4**	**23.4**
including:								
field peas	100.0	0.5	6.0	14.4	12.2	38.1	8.5	20.2
field beans	100.0	0.5	19.5	9.2	12.1	11.9	6.6	40.1
lupin	100.0	0.4	10.7	17.9	22.7	18.7	8.7	21.1
No farms distribution (%)								
Total	100.0	**3.0**	**26.3**	**27.4**	**24.4**	**14.2**	**2.7**	**1.9**
including:								
field peas	100.0	8.2	20.9	22.7	20.0	21.7	4.1	2.3
field beans	100.0	1.6	45.8	20.4	16.8	10.6	2.9	2.1
lupin	100.0	2.7	23.7	29.1	26.1	14.0	2.6	1.8
Average size of protein crop area (ha)								
Total	1.7	0.2	0.7	1.0	1.4	2.4	5.3	22.0
including:								
field peas	1.7	0.1	0.5	1.1	1.0	2.9	3.4	14.6
field beans	1.7	0.5	0.7	0.8	1.2	1.9	3.9	32.7
lupin	1.7	0.2	0.8	1.0	1.5	2.3	5.8	19.7

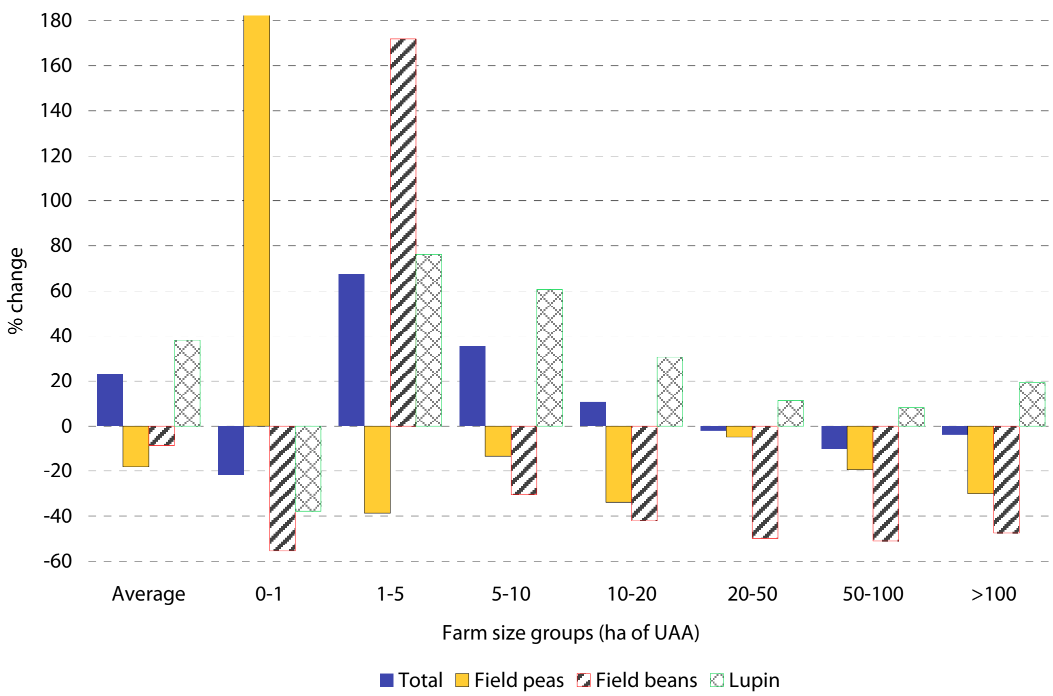
Source: Calculations derived from CSO data

3.1 Changes in the structure of protein crop production

In this section, we analyse the development of protein crop production between 2005 and 2007 in particular groups of farms, based on data illustrated in Diagrams PO.4 and PO.5.

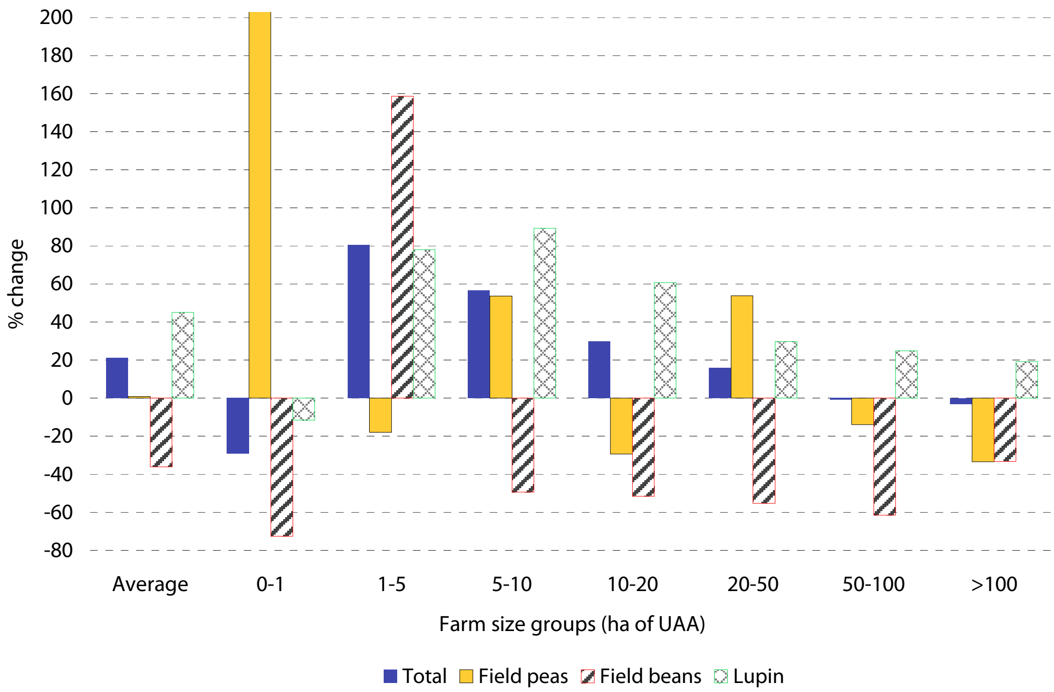
- Over this period, the total number of protein crop growers increased by 22.9%, driven by a 38.2% expansion in the number of lupin farmers, which more than offset the decline in the number of field pea and bean growers.
- The total number of growers grew in farms of up to 20 hectares of UAA, again led by sweet lupins. Lower interest in other protein crops (particularly field beans) was crucial as regards to the fall in the overall number of growers on farms exceeding 20 hectares of UAA.
- The smallest farms (with less than one hectare of UAA) recorded an exceptional increase in the number of field pea growers, while the cultivation of other protein crops declined.
- In farms with 1-5 hectares of UAA, the situation was the reverse (i.e., an increase in the number of growers of lupin and field beans).
- The remaining groups with larger farms tended to favour lupins in their farm plans. The production of this crop grew in every size category except for the very smallest category of smallholdings.
- Interviews revealed that on-farm feeding operation for pig rearing, in particular, was a crucial element in enabling Poland to continue to be unusual among individual MS in its large number of small holdings that grow protein crops.

Diagram PO.4: Percentage changes in the number of protein crop growers by farm size (2007 versus 2005)



Source: CSO

Diagram PO.5: Percentage changes in the area protein crop grown by farm size (2007 versus 2005)



Source: CSO

- After Poland joined the EU, several support schemes were introduced for organic farming, but the sector is still very small and the production of certified organic protein crops is still modest.
- At present, there are 11,000 holdings that have organic farming certificates. In relation to the total of more than 2 million farms, this still represents a very small proportion of the total. So their role is marginal.

4. The gross margins on protein crops vs. alternative crops

Protein crops account for a relatively minor share of farm output in Poland. Therefore, data on aspects such as production costs are not as detailed as they are for cereals, oilseeds or potatoes. In particular, there is no regular programme of research into production costs and incomes. From time to time, these topics are studied at the Institute of Agricultural and Food Economics – National Research Institute (IAFE-NRI). The results of the latest such research are the basis for the cost and gross margin analysis in this section.

In 2006, estimates were published of protein crop producers' incomes by the Accountancy Department of the IAFE-NRI for the system AGROKOSZTY within the Multiannual Research Programme "Economic and Social Conditions of Development of Polish Food Sector After the Accession to the EU" (*Wieloletni Program Badawczy: Ekonomiczne i społeczne uwarunkowania rozwoju polskiej gospodarki żywnościowej po wstąpieniu Polski do Unii Europejskiej*).

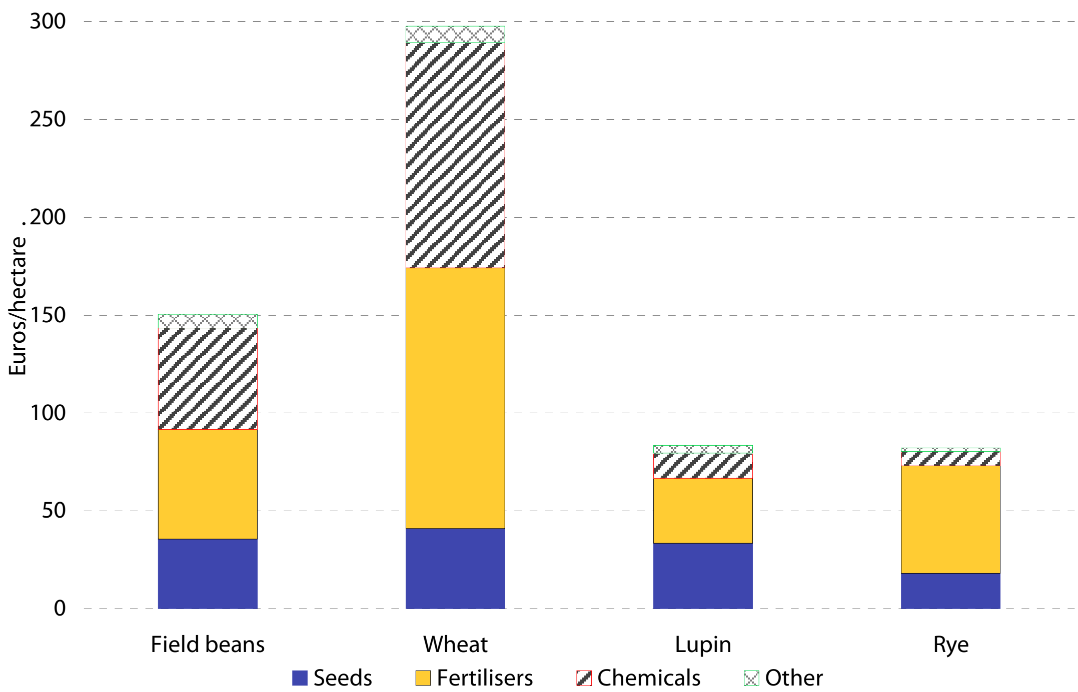
The sample was selected from farms providing data for the Polish component of the FADN and related only to 2005, and the composition of production costs per hectare is depicted in Diagram PO.6.

The analysis compared direct production costs and gross margins for protein crops and cereals, broken down between two pairs: contrasting field beans with common wheat and sweet lupins with rye.

The pairs for comparison were selected to reflect soil requirements and the competitive positions of the different crops, taking account of the crop rotation. More demanding field beans compete for soil with common wheat on good quality agricultural land, while sweet lupins compete with rye on poor land.

The analysis excludes all direct payments because in the SAPS and CNDP systems applied in Poland during the period in question, all direct payments were set at the same levels for cereals and protein crops.

Diagram PO.6: Direct costs of production of major arable crops, 2005 (€ per hectare)



Source: *Produkcja, koszty i dochody wybranych produktów rolniczych w 2005 r.",* IAFE-NRI

We observe from Diagram PO.6 and Table PO.7 that:

- Variable costs per hectare for field beans are only just over half those of wheat, but the difference in their variable costs in 2005 was almost exactly matched by the difference in their revenues per hectare (which include no special coupled payments for cereal or protein crops; hence, the zero values in the rows listing coupled aids).

- The variable costs per hectare of rye and lupins in 2005 were a mere €82-€83 per hectare, but rye generated a slightly higher gross revenue per hectare that year.

Table PO.7: Poland, Protein crop and cereal revenues and variable costs, 2005 (€/ha.)

	Field beans	Wheat	Lupin	Rye
Yield (tonnes/hectare)	2.8	5.1	1.5	3.0
Price, € per tonne	121	93	130	71
Coupled Cereal Crop Aids (€/ha)	0	0	0	0
Protein Crop Special Aid (€/ha)	0	0	0	0
Labour intensity (hours/ha)	17	17	9	14
Return per hectare				
Market sales	339	476	196	213
Coupled Payment	0	0	0	0
Total Revenue	**339**	**476**	**196**	**213**
Variable costs				
Seed	36	41	33	18
Fertiliser	56	133	33	55
Crop Protection	52	115	13	7
Other (e.g., irrigation, drying)	7	8	4	2
Total Variable Costs	**150**	**298**	**83**	**82**
Gross margins	**188**	**178**	**113**	**131**

Sources: Produkcja, koszty i dochody wybranych produktów rolniczych w 2005 r.", for Wieloletni Program Badawczy: Ekonomiczne i społeczne uwarunkowania rozwoju polskiej gospodarki żywnościowej po wstąpieniu Polski do Unii Europejskiej, Vol. No 33, IERiGŻ-PIB, Warszawa, 2006.
Note: CNDP estimates for protein crops not available in the FADN database.

- We conclude that there were no major differences between cereals and protein crops in their gross margins (revenues minus direct costs) per hectare. This may be seen from Diagram PO.7, below, which plots the gross margins for all four crops.

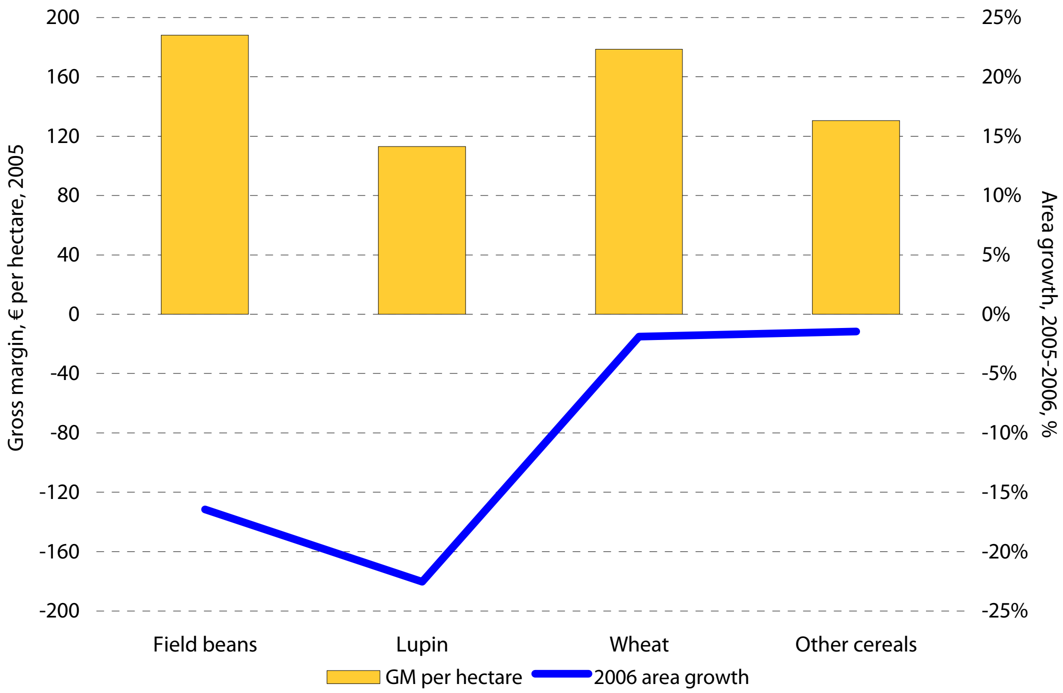
- In interpreting these results, there is one point to note. 2005 was a very good one for protein crop yields. In practice, these yields are much more volatile than those for cereals in Polish conditions, and so cereals are viewed as a less risky crop offering producers the assurance of a more stable level of incomes than protein crops.

In Diagrams PO.7 and PO.8, we contrast gross margins/hectare (if land is the main constraint) and per hour of labour time (if labour is the key constraint), respectively, in 2005 on the four crops with the proportional change in the planted areas in the following year. We note that:

- All these crops suffered some decline in their planted areas in 2006. The steepest area reductions occurred for the two protein crops (though it should be recalled that the largest single area planted to protein crops is planted to mixtures of cereals with protein crops for on-farm use, and these are not classified as protein crop areas).

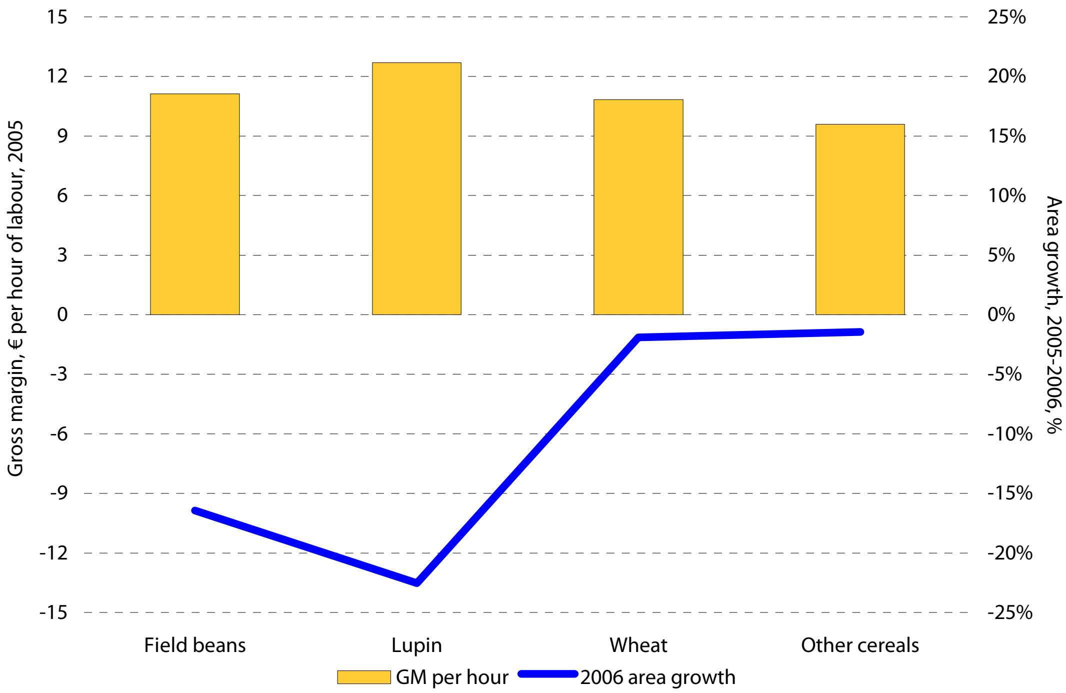
- This reduction occurred even though field beans returned the highest gross margin per hectare of these crops and lupins recorded the highest gross margin per hour of labour time, which would be relevant if the availability of labour were the key constraint.

Diagram PO.7: Poland, Differences between gross margins per hectare for cereals and protein crops, 2005 and the growth in crop areas the following year



Source: CSO

Diagram PO.8: Poland, Differences between gross margins per hour of labour for cereals and protein crops, 2005 and the growth in crop areas the following year



Source: CSO

5. The significance of protein crop production in farm incomes

In this section, we present four measures of profitability for protein crop farms and compare their values with the values of the same indicators for "other farms". These measures of profitability have been extracted from the FADN database; they are: gross farm income per hectare, farm net value added per annual working unit, farm family income per hectare and farm family income per farm working unit. We have classified protein crop farms on the basis of the share of farm UAA that is devoted to protein crops.

The aim of this analysis is to ascertain whether there are any structural differences in the profitability of farms that choose to grow protein farms relative to farms that do not grow these types of crops, *ceteris paribus,* i.e. when both sets of farms belong to the same type of farming.

When presenting data from the FADN database, a minimum number of 15 observations (farms) per year is required to ensure that the results presented meet a satisfactory degree of statistical precision. Within the FADN database of protein crop farms, the only UAA size category for which data for 15 or more farms are available is the category "Greater than 50 hectares". This means that no results are available for COP specialists, since the sample size from the FADN analysis falls below the threshold of 15. This means that results are presented only for Mixed crop and livestock specialists, who use their protein crops primarily on-farm as feed.

The results of this analysis are shown in Diagrams PO.9 to PO.16. They reveal that

- No clear pattern emerges with respect to the profitability of farms growing protein crops relative to "other" holdings for the different measures of income covered in our assessment.

- There are no clear indications that the size of the share of area devoted to protein crops is linked to increasing (decreasing) returns in any consistent fashion.

Mixed crops and livestock specialists

Diagram PO.9: Gross farm income per hectare

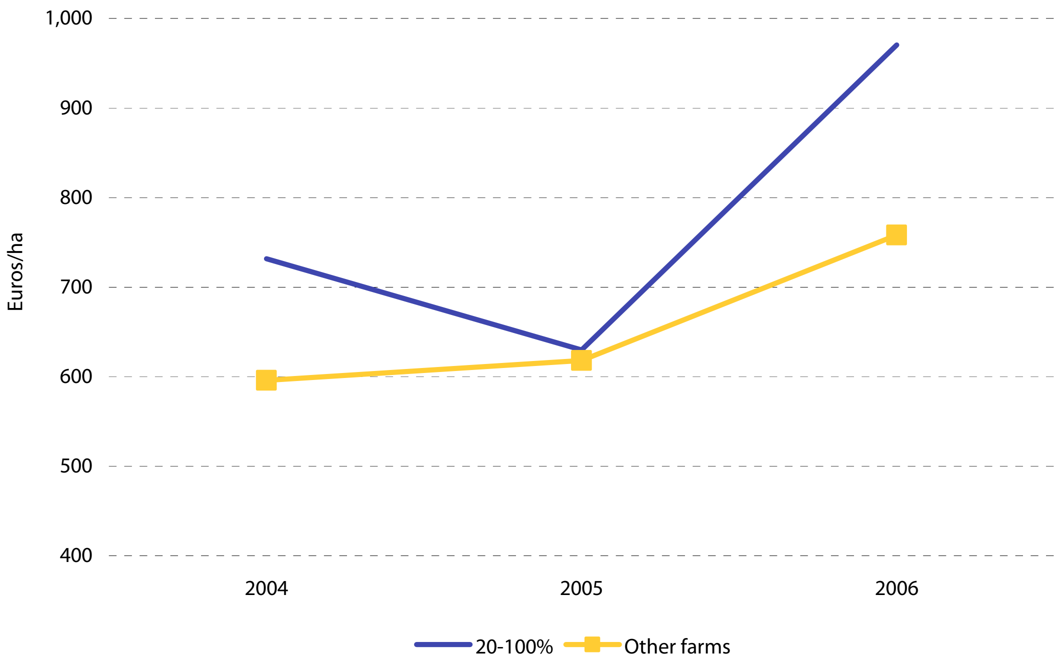


Diagram PO.10: Mean (plus and minus one standard deviation) of gross farm income per hectare, 2000-2006

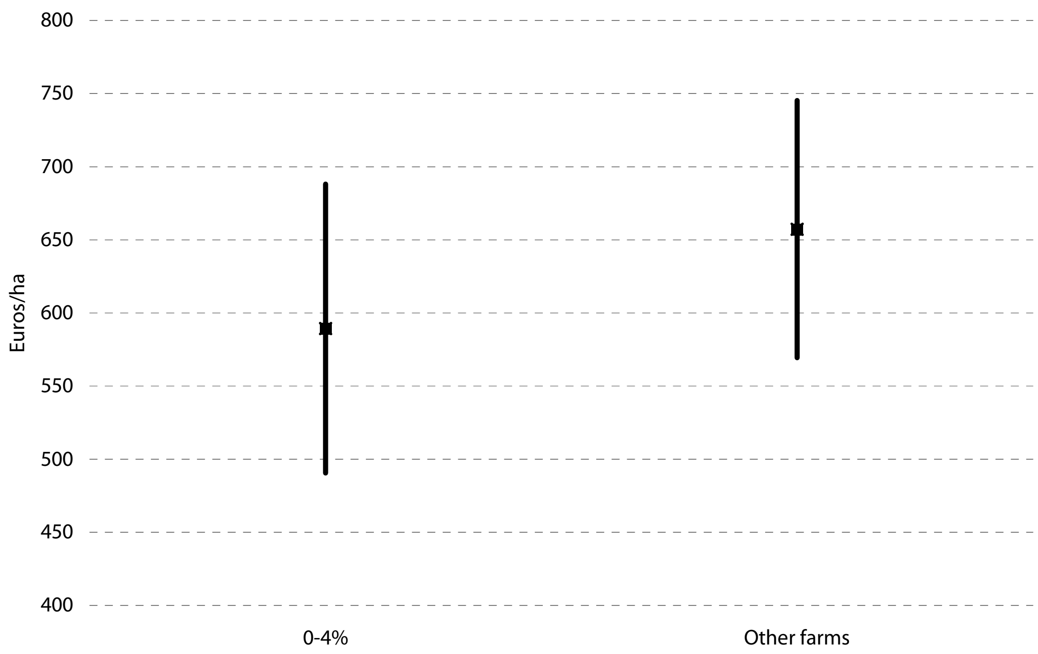


Diagram PO.11: Farm net value added per annual work unit

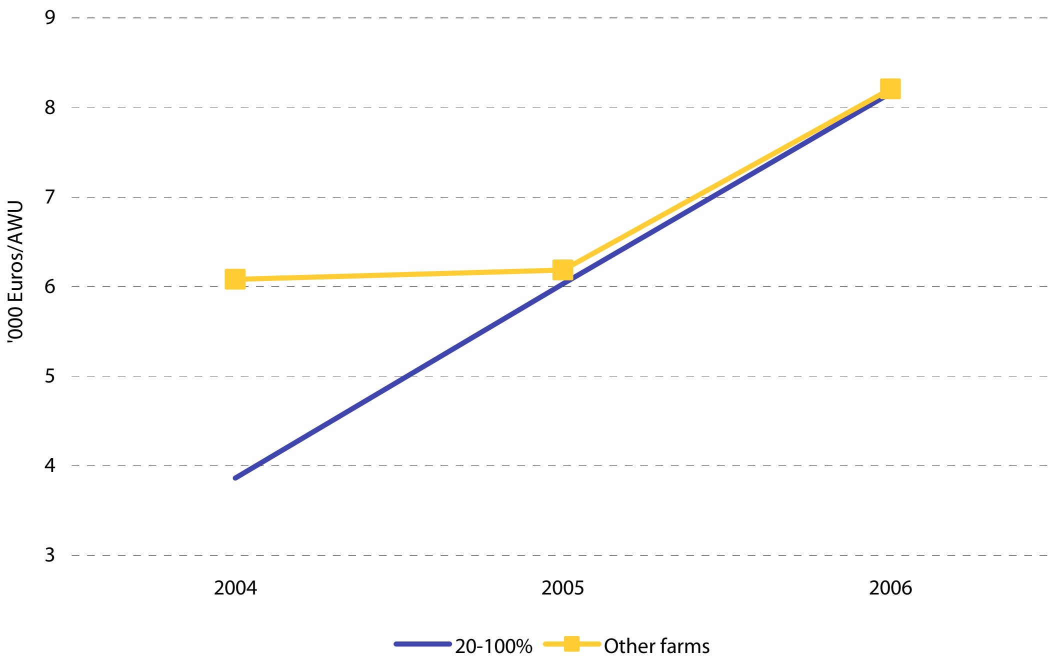


Diagram PO.12: Mean (plus and minus one standard deviation) of farm net value added per annual work unit, 2000-2006

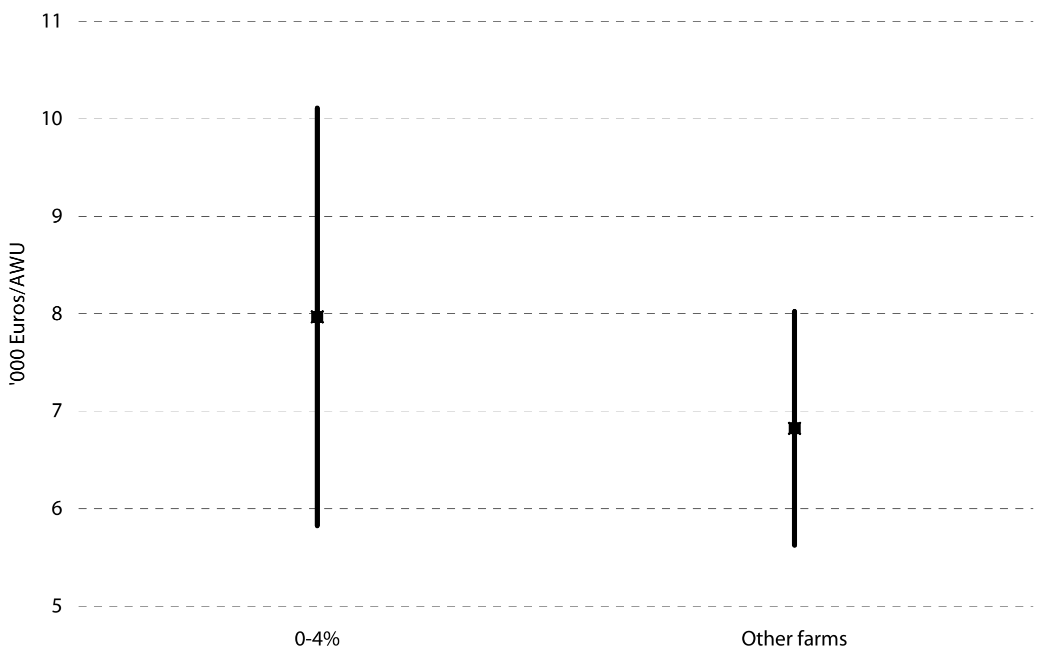


Diagram PO.13: Family farm income per hectare

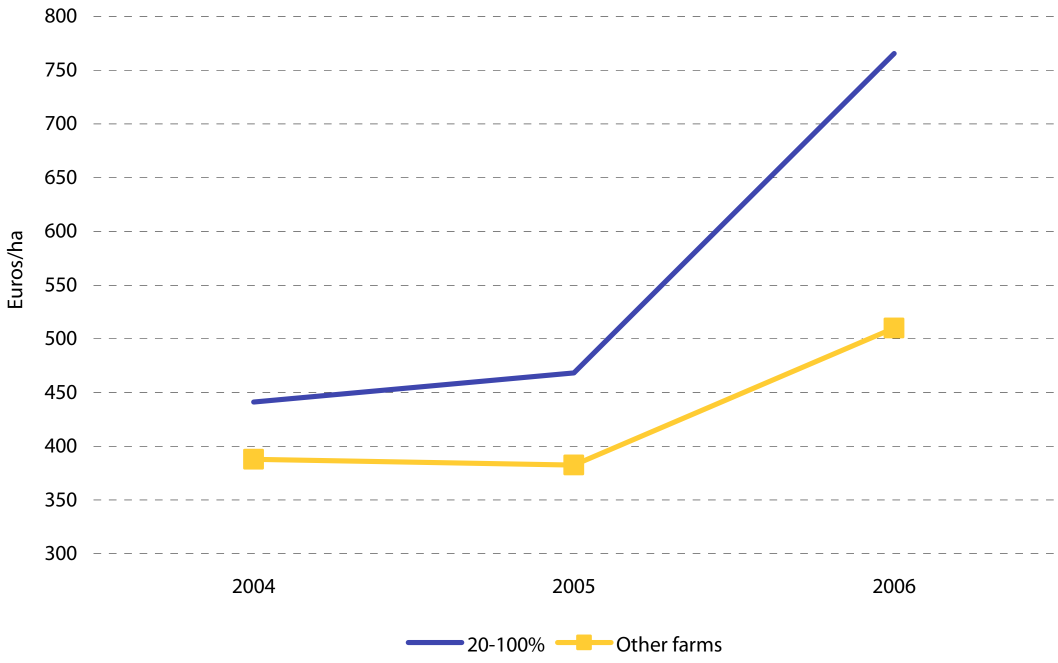


Diagram PO.14: Mean (plus and minus one standard deviation) of family farm income per hectare, 2000-2006

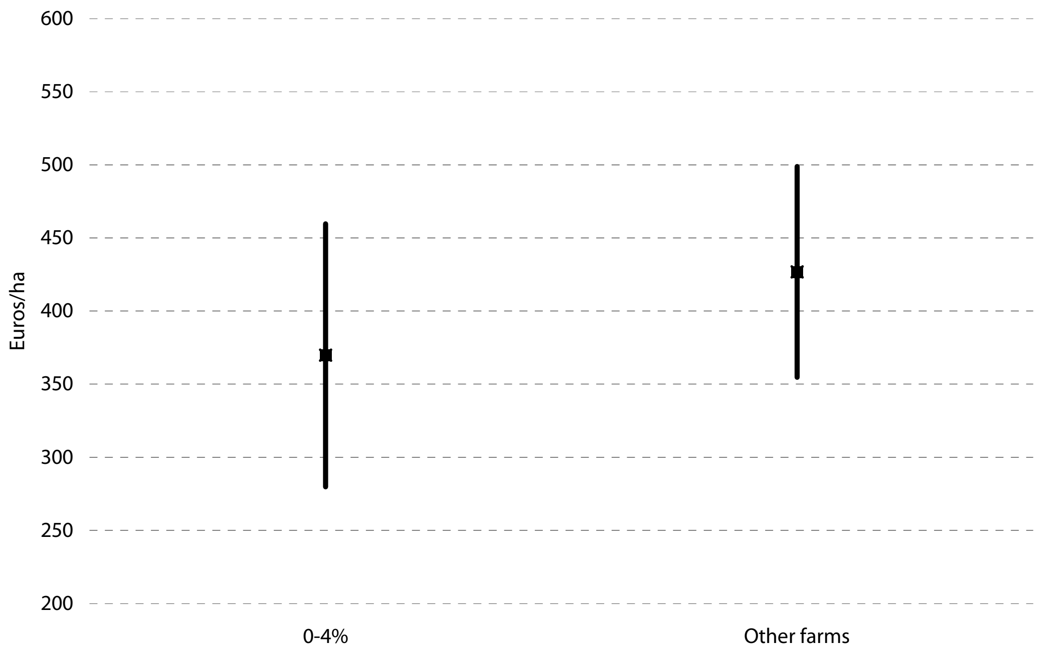


Diagram PO.15: Family farm income per family work unit

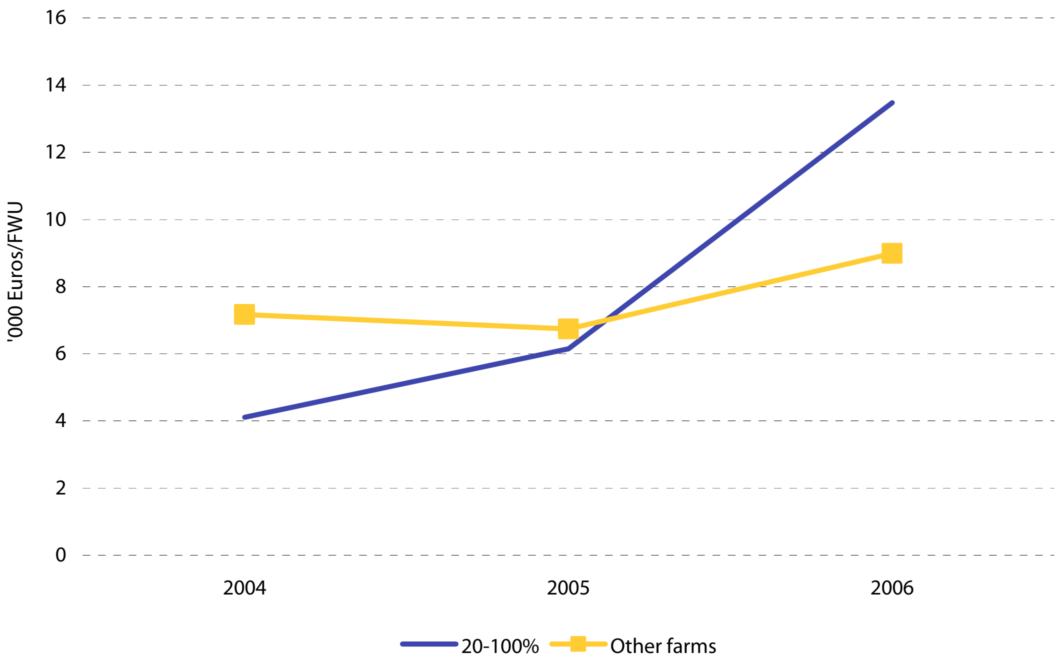
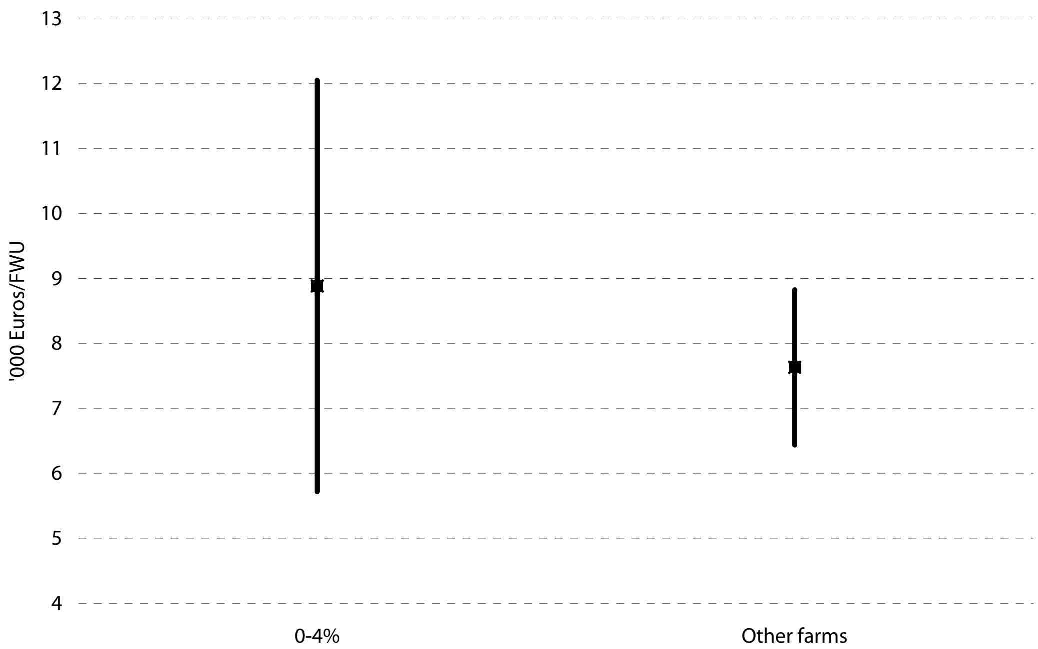


Diagram PO.16: Mean (plus and minus one standard deviation) of family farm income per family work unit, 2000-2006



6. The development of the local feed compounding industry

Table PO.8 describes the steady progress towards greater concentration and larger scale within the Polish feed compounding sector since 2004, using data published by FEFAC, which does not include Poland in its coverage prior to its accession.

We observe that:

- The number of compounders has fallen by over 16% between 2004 and 2007.
- National compound feed production has increased significantly during these three years, expanding by over 29%.
- As a consequence of this consolidation alongside much greater aggregate throughput by the industry, the average output per plant rose by 54% in only three years, to almost 62,000 tonnes per plant, which brought Polish plants up to the same average size as that found in the country's western neighbour, Germany.

Table PO.8: The number and annual output of Polish feed compounders, 2004-2007 ('000 tonnes)

	Number of compounders	Compound feed output ('000 tonnes)	Annual output per plant ('000 tonnes)
2004	136	5,464	40.2
2007	114	7,053	61.9
% change 2004-2007	-16.2%	29.1%	54.0%

Source: FEFAC Feed and Food Statistical Yearbook, 2007

6.1 The market for protein crops

Mention has been made earlier to the importance of on-farm feeding to the Polish protein crop sector, and in particular to the segment growing mixtures of cereals with protein crops. As a result, the volumes of protein crops that are recorded as entering the marketing chain are very small. Compounders, instead, stated in interviews that they prefer to use readily available, large scale inputs like oilseed meals, cereal milling by-products and potato protein.

Official data, the basis for Table PO.9, report that the annual procurement of protein crops in Poland amounts to a very modest 2,000-4,000 tonnes. This relates mainly to field beans and peas, with small quantities of lupin entering the formal marketing chain.

There is a growing niche for protein crops in pet food production, while small volumes of sweet lupins are traded in local open-air markets where the main customers are pigeon breeders, but these tonnages are still extremely small.

Average prices are reported and are included in the same table, with the highest levels observed in 2007, when cereal prices were also high. However, the volumes being traded are so small that little credence can be placed in some of the figures quoted.

The Central Statistical Office classifies protein crops by their final use, distinguishing between feed and food outlets. In view of the very large on-farm feed use of these crops, the official data should almost certainly be treated with a reservation.

CSO data, plotted in Diagram PO.17, imply that from 1995 to 2007, the edible protein crop area ranged from 33,000 to 49,000 hectares. In the same period, their data suggest that the area of protein crops destined for feed uses fluctuated between 53,000 and 100,000 hectares.

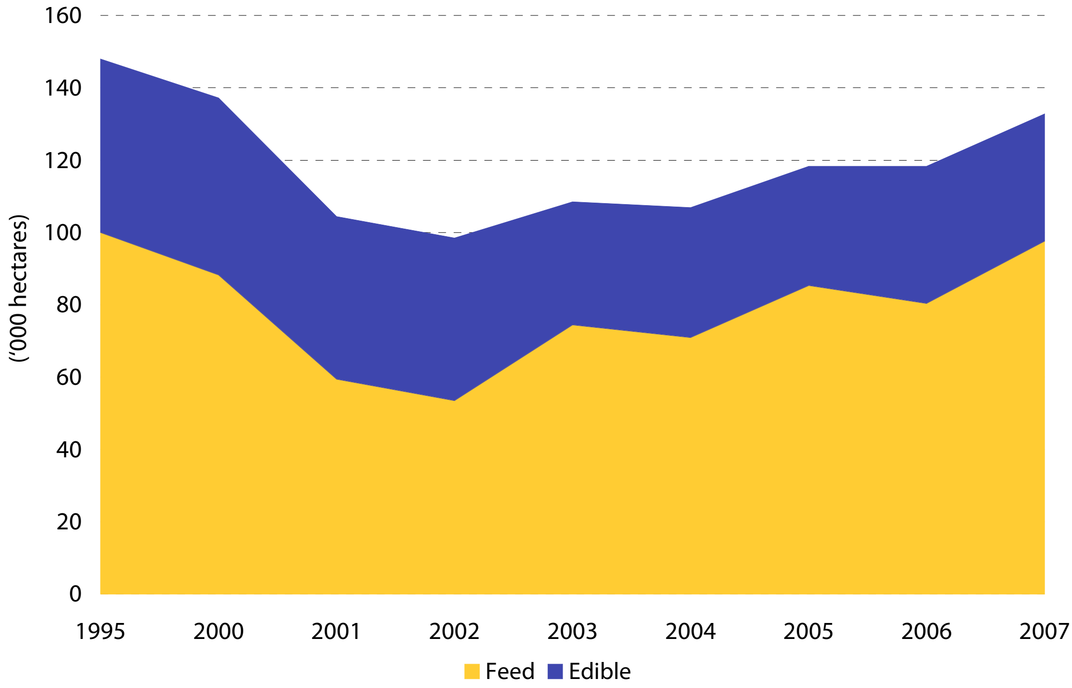
Other CSO data on household budgets reveal that monthly average demand for protein foods in 2008 was 0.06 kg per capita, which implies a national demand of 27,600 tonnes per annum. At the low national yields, this could be consistent with the areas plotted in Diagram PO.17.

Table PO.9: Procurement and producer prices of protein crops in Poland, 2002-2007

	2002	2003	2004	2005	2006	2007
Procurement (' 000 tonnes)						
Field beans	1.8	2.4	1.1	0.8	1.1	1.0
Lupin	0.8	1.1	0.4	0.8	0.8	0.4
Field peas	0.7	0.9	1.0	0.9	0.5	1.1
Other	0.5	0.3	0.2	0.5	0.2	0.1
Total	**3.8**	**4.7**	**2.7**	**3.0**	**2.6**	**2.6**
Producer prices (€ per tonne)						
Field beans	121	113	121	97	97	183
Lupin	152	152	178	133	135	179
Field peas	141	138	145	119	126	228
Other	202	226	287	198	168	276
Average	**142**	**134**	**150**	**130**	**120**	**205**

Source: CSO

Diagram PO.17: Protein crop areas in Poland, 1995- 2007 by use of the crop ('000 hectares)



Source: Central Statistical Office (CSO)

7. Evidence from interviews and questionnaires with stakeholders in the Polish protein crop sector

There are two main sources from which we drew evidence: one was through direct interviews with stakeholders and the other, analysis of individual questionnaires completed by 10 farmers. This is described in the following two sections. The questionnaires were lengthy and many respondents did not complete them in full. Given the relatively small sample of completed questionnaires, prudence should be exercised when interpreting the results.

Questionnaires for processors were fewer in number since many of them are transnational companies active in several Member States. The analysis for this is not presented in the individual case studies but can be found in the Main Report.

7.1 Interview evidence

Since Poland only joined the EU in 2004, its producers had no real basis on which to assess the impact of the 2003 reform. Therefore any comparison tends to be mainly one of "with CAP", as opposed to the previous situation of "without CAP".

Before 2004, there was intervention support for cereals, but no direct payments under Polish agricultural policies. The introduction of direct payments in 2004 had an undoubted impact on farmers' behaviour.

Farmers received single area payments (SAPS) from the EU budget. These increase by 5% every year.

This support **was not linked to the type of crops grown**. Moreover, Polish farmers receive supplementary CNDP payments that increase the SAP rates by 30%, where the funds for this purpose come from the national budget.

These CNDP payments are **linked to the type of crops grown**. All agricultural land maintained in good agricultural and environmental condition is eligible for payments and, in contrast to the EU-15 MS, there was no compulsory set-aside requirement.

In interviews, farmers appear uncertain about the influence of the SAPS and CNDP payments on their choice of crops. Their attitudes differ according to the type of farm and the crops they used to grow prior the EU enlargement. The main conclusions are as follows:

- The implementation of the CAP increased interest in the crops covered by intervention schemes, i.e., for cereals. At times of low cereal prices, the system slowed reductions in cereal areas in response to these prices.
- Direct payments had no influence on the choice of crops in small farms.
- In the case where farmers grew different crops from those specified in eligibility criteria for CNDP supplementary payments (the national top-up payments and the shift from the second pillar of the CAP), the legal framework had a large impact on the choice of crops .
- In general, large farms specialising in cereal production seem to be more sensitive to the influence of CAP support on the choice of crops grown on farm.
- The introduction of environmental payments on sweet lupins (under the agro-environmental measures included in the rural development programmes) supported interest in the cultivation of this crop.

- Recently many small- to medium-sized producers, mainly farming poor soils in North Eastern parts of Poland, have turned to cultivation of lupins as a crop to reduce their fertiliser purchases.
- In general, where producers sell lupin seeds, they tend to do so on a very small scale at local open-air markets to other farmers. Some of these producers have expressed an interest in expanding their lupin production via contracts with larger customers, such as traders and livestock farmers. To do so, they will have to be prepared to make lupin cultivation a regular feature of their commercial operations and harvest lupins for sale every year.

7.2: Summary of analysis of farmers' questionnaires

The following section summarises the key points that emerged from the analysis of questionnaires administered to protein crop farmers during the fieldwork carried out for this evaluation. While this evidence provides a valuable cross-section of the different conditions in the protein crops sector, the high frequency of no responses to some questions undermines the applicability of the survey's findings to the wider population of Polish farmers growing protein crops. Looking ahead, simulations of full decoupling, based on the results of the farmers' survey, are indicative of a fall in protein crop area of around 15% from 2008 levels.

7.2.1 Protein crop areas

- Around 60% of farmers reported a decrease of over 50% in their protein crop area between 2003/04 and 2008/09.
- Protein crops are planted in April and harvested in July/August.

7.2.2 Crop rotations

- 90% of respondents said that they had a rotation cycle for protein crops as they improve soil quality.
- Rye (80%), oats (80%) and wheat (70%) are most popular crops grown in rotation with protein crops.
- The most common crops which famers would use in a rotation cycle instead of protein crops are cereals such as oats (44%) and rye (33%).

7.2.3 Production of alternative (non-protein) crops

- Three fifths of respondents reported no change in total area of other crops (i.e. not protein crops) since 2003, with the balance reporting an increase.
- 40% of respondents said that protein crop area had been replaced by other crops. Rye was the most common substitute followed by wheat.

7.2.4 Protein crop quality

- Half of those interviewed said that the variety of protein crops they cultivated had changed over the last five years. The most popular reason for this decision was improved disease resistance. Other reasons are improved yield, higher selling price and processor requirements for specific varieties.
- 80% of farmers obtain seed from sources other than cooperatives and processors.

7.2.5 Outlets for your protein crops

- 40% of respondents said they used their protein crop output directly on-farm for feed. However, the proportion of crop used on farm has fallen significantly between 2003 and 2008.
- 60% of those interviewed said that the main buyers of their crops where agents other than cooperatives, traders and feed compounders.
- 50% of those interviews said that their protein crop was used mainly in feed, most farmers do not know whether the feed is used locally or sold on other markets.

7.2.6 Protein crop marketing

- More than 50% of growers have contracts with processors or traders.
- Of those who have contracts, around 25% said this was with cooperatives while almost twice as many said they had contracts with private companies. The most common elements fixed in the contract are quantity and price.
- Where they have a contract, 25% of farmers interviewed were permitted to sell protein crops to other processors outside the contract.
- Quality is measured through protein content, content of impurities and moisture.
- The average price received per tonne of sweet lupin in 2003 was €48 (s.d. 48.3) rising to €232 (s.d. 86.1) in 2007 and falling in 2008 to €218 (s.d. 67).

7.2.7 Use of inputs

- Input use has not changed significantly over the last five years.
- The majority of those interviewed (90%) do not grow their crops on irrigated land.

7.2.8 On-farm employment and labour used

- The majority of respondents (80%) stated that one member of farm household worked on the farm in 2008. this is also likely to be their main source of employment.
- 60% of those interviewed said that up to 20% of their household employment was derived from protein crop production in 2003. For half of these, this increased up to 60% in 2008.
- The share of farm revenue not affected by the choice of crop in 2008 is over 40 for 70% of farmers surveyed.
- The majority of farmers earn less than 20% of farm revenue from protein crops. This included the special area payment.
- Of those interviewed, the biggest proportion (60%) said they calculated farm profits as gross revenue minus cash costs. All of those interviewed said that profitability was judged per hectare.
- Wheat was regarded as the most profitable crop in 2008 by two fifths of the participant, followed by rapeseed.

- Around 60% believed that the ranking of crop profitability had changed in the last five years, with maize and sugar been being quoted as the previous most profitable crops.
- 50% of farmers contract out some specific farm operations. This included harvesting and spraying.
- The average cost of spraying and harvesting in 2003 was €6 and €35 per hectare. This increase to €7 and €44 per hectare in 2008.

7.2.9 The impact of reforms in the Common Agricultural Policy

- The introduction of a payment which is not tied to the choice of crop affected the area planted to protein crops for around 40% of farmers.
- 30% felt that the change in payment system for protein crops since 2003 had affected the area they plant to protein crops. Similar responses where recorded for the affect this payment had on input use.
- Our responses indicate that as the level of payment decreases, we see a decrease in the change area planted to protein crops.
- The main payments available to farmers for growing protein crops are agri-environmental programmes for sweet lupins, but this only affects slightly their decision to grow protein crops.
- Almost all respondents (90%) indicated that lower input use and higher yields for the following crops are an important influence when making their decision to grow protein. The price paid by the trader and processor and prices of other crops where also important influences.

8. Impact of the CAP measures upon the local protein crop sector

Aggregate protein crop area in Poland has increased by around 59% since the accession. Protein crop area averaged 44,000 hectares per year from 2004-05 to 2008-09, compared with 28,000 per year between 2000-01 and 2003-04. This is the result of a significant expansion in the area given over to sweet lupins, which rose from around 11,000 hectares per year between 2000-01 and 2003-04 to around 30,000 hectares per year in the period from 2004-05 to 2008-09. In contrast, areas covered by field peas and field beans fell by, respectively, around 1,000 hectares and 2,000 hectares on average over the same periods.

An interesting feature of the Polish crop sector is the cultivation of protein crops in mixtures with cereals. These mixtures are grown on a sizeable area (estimated at around 40,000 hectares per annum over the last few years) relative to the overall protein crop area; typically, protein crops account for 20-30% of these mixtures. Over the evaluation period, the area under mixtures has remained broadly stable. These mixtures are used on farm by mixed crop livestock operations.

Based on our assessment, there is no clear indication that the decline in protein crop area is a direct result of the changes introduced with the 2003 reform[10]. While interview evidence suggests that the increase in the sweet lupin area is the result of payments linked to agri-environmental programmes that are part of the rural development measures, the results of the questionnaires completed by farmers only provide weak support for this hypothesis.

In terms of demand, most protein crop output is used on farm. As a result, the annual procurement of protein crops in Poland is very limited and mainly confined to field beans and field peas. At the same time, interview evidence revealed that feed compounders prefer to use feed ingredients that are readily available on a large scale, such as oilseeds and cereals. There is no suggestion of a causal link between weak demand from the feed compounding sector and decline in the field pea and field bean area.

When the Polish experience is contrasted with that of other MS that are large producers of protein crops, the conclusion is a rosier one. The expansion in sweet lupin area and the maintenance of the area cultivated to mixtures means that, after the accession, the competitiveness of these segments has not suffered, relative to other segments within the protein crop sector. While it is impossible to make infallible predictions, this evidence indicates that protein crop production should be maintained where viable markets exist.

[10] These are the changes introduced by the Single Area Payment Scheme in new MS.

Spanish Protein Crop Sector

This monograph has the following structure.

- We consider, first, the development of the protein crop sector within Spain.
- Then, we review the development of alternative cereals, oilseed and protein (COP) crop production within the country.
- We describe the main production systems applied to protein crops, notably as regards crop rotations.
- We then analyse the gross margins on protein crops vs. those on alternative COP crops.
- We review the development of the local feed compounding sector and its attitudes towards the use of protein crops in their feed mixtures.
- We summarise the evidence collected during the fieldwork. The main tools of investigation consisted of questionnaires administered to protein crop farmers and interviews with feed compounders.
- We conclude with a discussion of the impact of the CAP measures upon the local protein crop sector.

1. Description of the development of the protein sector

1.1 Protein crop area

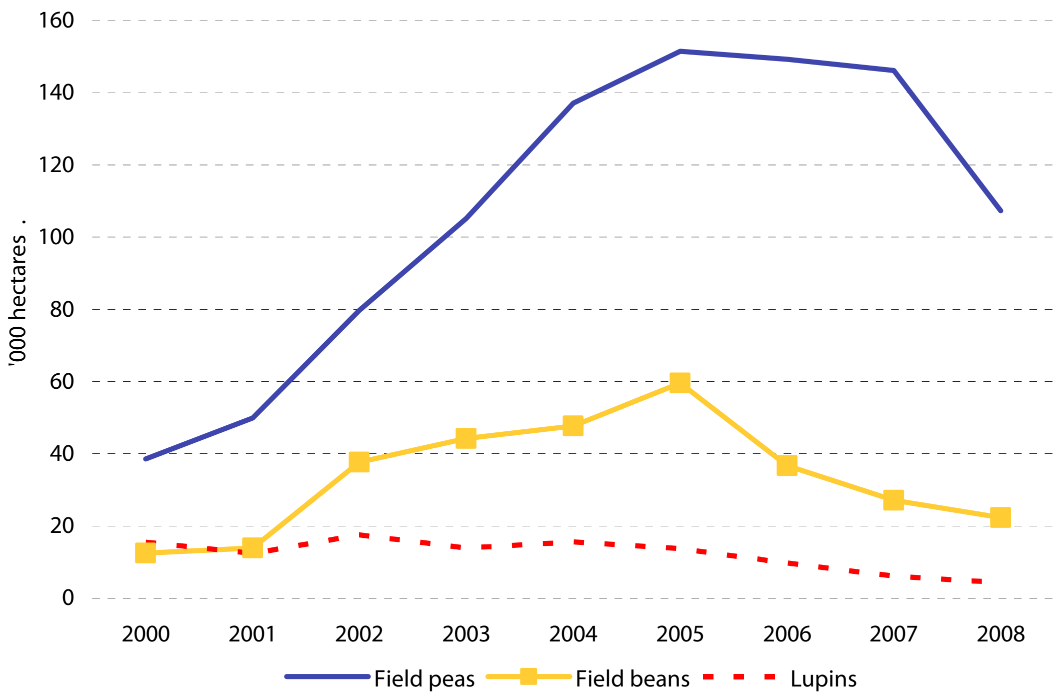
The protein crop area in Spain has witnessed two clearly different eras, in terms of their dynamics, since 2000. This may be seen from Table SP.1 and Diagram SP.1. The area under protein crops increased steadily until 2005, when it peaked at around 225,000 hectares. Since then, it has fallen back each year, to stand at 136,500 hectares in 2008. In that year, Spain occupied 23% of the total EU field pea area, 11% of the field bean and 8% of the lupin areas.

Among the protein crops, field peas currently account for the vast majority of the planted area, and it is followed in total area by field beans. Since 2000, the areas under these two crops have followed a similar pattern, expanding until 2005 and then dropping back. The area under sweet lupins has traced out a somewhat different pattern. It was fairly steady until 2005, but then fell back, to a low of 5,300 hectares in 2008.

A very special feature of the Spanish agricultural picture is the importance of grain legumes within the dry pulse sector. Until 2006, when grain legume coupled payments were incorporated into Spain's SPS payment, these crops received a maximum €181 per hectare. In 2005, the last year in which these special grain legume aids were paid, the Spanish area in receipt of these payments was 315,600 hectares. The only other MS that received these payments in 2005 were France (on 7,100 hectares) and Greece (on 4,300 hectares).

Since grain legumes and protein crops fulfil a similar role in crop rotations and nitrogen-fixing, they are potentially important substitutes for one another.

Diagram SP.1: Areas planted to the three major protein crops in Spain, 2000-2007 ('000 hectares)



Source: MAR

Table SP.1: Protein crop areas in Spain and the Spanish share of total EU protein crop areas, 2000-2008

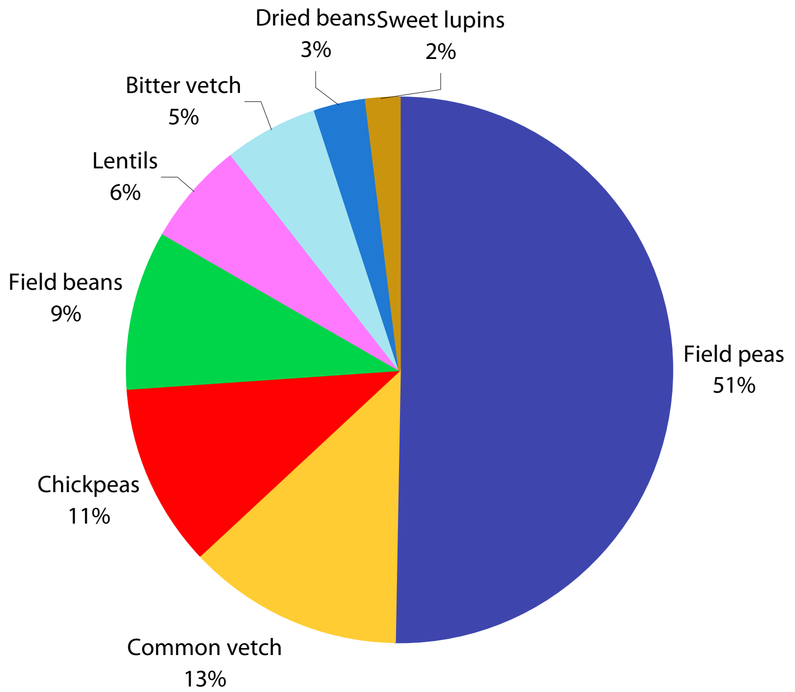
	Field peas		Field beans		Sweet Lupins		**Protein crops**
	Area hectares	Share of EU area %	Area hectares	Share of EU area %	Area hectares	Share of EU area %	**Area hectares**
2000	41,300	4%	12,400	5%	15,400	33%	**69,100**
2001	49,900	6%	13,900	4%	12,400	30%	**76,200**
2002	79,700	10%	37,600	10%	17,500	47%	**134,800**
2003	105,200	13%	44,200	12%	13,800	16%	**163,200**
2004	137,100	18%	47,700	13%	15,600	21%	**200,400**
2005	151,500	21%	59,500	12%	13,700	15%	**224,700**
2006	149,300	24%	36,600	11%	9,700	11%	**195,600**
2007	146,200	29%	27,100	10%	6,000	7%	**179,300**
2008	107,300	23%	23,900	11%	5,300	8%	**136,500**

Source: MARM – Agricultural Statistics Annual 2007. Monthly advances October 2008

Diagram SP.2 compares the areas planted to the main dry pulses in 2007. It shows that field peas take the lion's share of area. They are followed by common vetch and chickpeas.

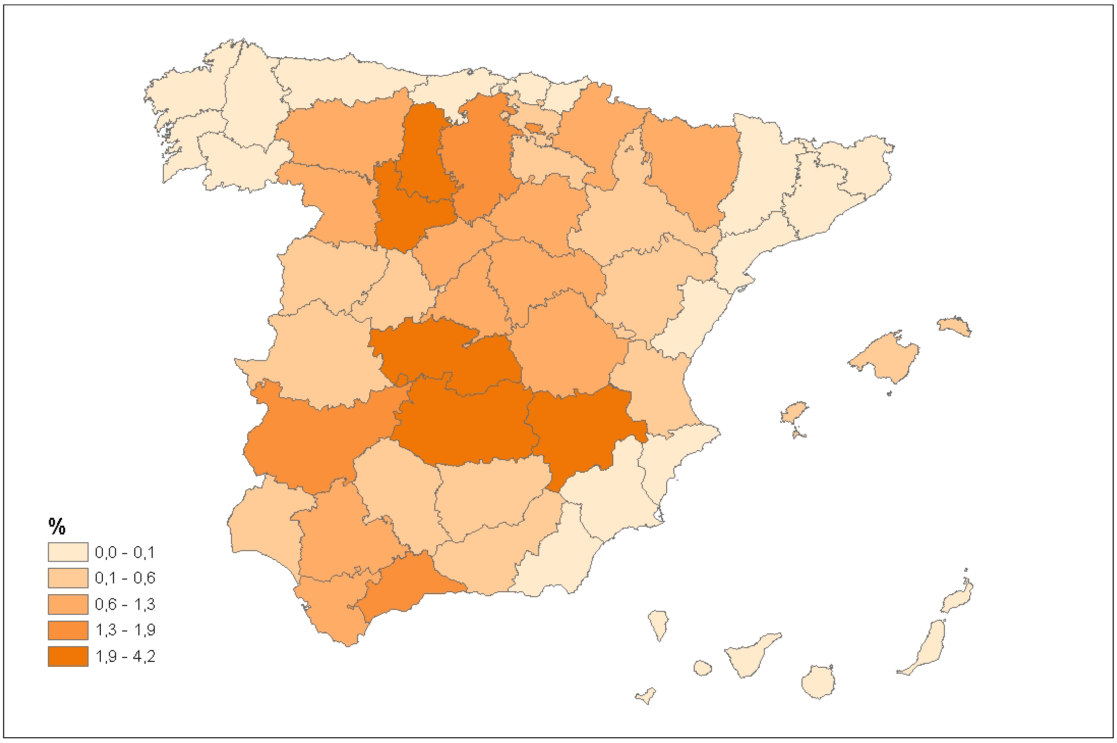
Virtually all the Spanish dry pulse areas, including protein crops, are concentrated in just four Autonomous Communities: Castilla León (54%), Andalucía (17%), Castilla-La Mancha (12%) and Extremadura (6%) Even in those regions, dry pulses occupy a low share of the utilisable land area. This is illustrated in Map SP.1.

Diagram SP.2: Area distribution for the main dry pulse crops in Spain, 2007



Source: MARM

Map SP.1: Dry pulse area as % of total UAA by region



Source: MARM

1.2 Yields of protein crops

Table SP.2 summarises the evolution of protein crop yields on rain-fed land since 2000. Yields tend to be highest for field peas and field beans, while they are lowest for lupins. Because protein crops can easily be damaged by unfavourable weather conditions, yields tend to vary significantly from year to year.

Table SP.2: Rain-fed protein crop yields, 2000-2008 (tonnes per hectare)

	Field peas	Field beans	Sweet Lupins
2000	1.4	1.1	0.8
2001	1.0	1.3	0.6
2002	1.3	1.2	0.7
2003	1.4	1.3	0.7
2004	1.5	1.4	0.7
2005	0.9	0.7	0.4
2006	1.3	1.3	0.7
2007	1.1	1.4	0.9
2008	1.3	1.3	0.8

Source: MARM – Agricultural Statistics Annual 2007. Monthly advances October 2008

1.3 Production

In terms of output, Table SP.3 reveals that protein crop production rose from 84,000 tonnes in 2000 to a peak just below 276,000 tonnes in 2004, but have since then fallen back to 174,000 tonnes in 2008.

Among protein crops, field peas account for the largest share of production.

- Despite low yields by EU standards, in 2008, Spanish field pea output represented 16% of the EU total. In the same year, Spain contributed 7% of EU field bean production and 6% of sweet lupin production within the Community.
- Table SP.4 reveals that Castilla León supplied 59% of Spain's field pea output and 65% of its sweet lupin production in 2007. Andalucía supplied 81% of the country's total production of field beans.

Table SP.3: Protein crop production

	Field peas		Field beans		Sweet Lupins		Protein crops
	Output tonnes	Share of EU output %	Output tonnes	Share of EU output %	Output tonnes	Share of EU output %	Output tonnes
2000	58,200	2%	13,300	2%	12,500	19%	84,000
2001	51,600	2%	17,700	2%	7,900	13%	77,200
2002	100,200	4%	45,700	4%	11,800	21%	157,700
2003	146,300	5%	57,000	5%	9,500	15%	212,800
2004	201,200	3%	64,400	6%	10,200	19%	275,800
2005	132,500	6%	40,600	2%	5,800	9%	178,900
2006	189,800	10%	47,900	5%	7,100	11%	244,800
2007	163,900	14%	36,700	9%	5,200	6%	205,800
2008	139,900	16%	30,000	7%	4,400	6%	174,300

Source: MARM – Agricultural Statistics Annual 2007. Monthly advances October 2008

Table SP.4: Output of main production regions as a share of total Spanish output, 2007

	Field peas	Field beans	Lupins
Castilla León	**59%**	--	**65%**
Castilla-La Mancha	12%	0,4%	1%
Andalucía	8%	**81%**	11%
Aragón	8%	2%	--
Extremadura	5%	6%	23%
Baleares	--	3%	--
Navarra	4%	4%	--

Source: MARM – Agricultural Statistics Annual 2007

1.4 Foreign Trade

The development of the Spanish livestock sector, notably for non-ruminants, and for pigs in particular, generated a substantial demand for protein ingredients, both protein crops and products with a higher protein content, such as soybean meal and sunflower meal, both of which could be secured in large quantities from local oilseed crushing plants.

This demand for protein crops was satisfied by large volumes of local output and of imports (both from within and from outside the EU). Table SP.5 provides details of the gross and net imports of the three protein crops from 2000 to 2007. It may be observed that:

- Field peas were consistently the most important imported protein crop over the period under review, with a peak level of net imports in excess of one milling tonnes in 2005. However, by 2007, the net import volumes had fallen very dramatically to little more than 60,000 tonnes.

- Net imports of field beans ranged between 40,000 and 60,000 tonnes between 2000 and 2005, but stood at only just over 10,000 tonnes in 2007.

- Sweet lupin net imports were very close to 100,000 tonnes in 2001, but had fallen to barely 1,000 tonnes by 2007.

The table does not give a breakdown of the main countries of origin for Spanish protein crop imports, but examination of the trade data reveal the main source of supply of these crops from outside the country.

- The main non-EU sources of supply of field peas have recently been Canada, Ukraine, the USA and Russia.

- Sweet lupin imports from outside the EU-27 were mainly shipped from Australia and Chile.

- Field beans differed form the other two protein crops in that most imports were bought from other MS.

Table SP.5: Spanish foreign trade, combining intra- and extra-EU trade, in protein crops, 2000-2007 (tonnes)

	Field peas			Field beans			Sweet lupins		
	Exports	Imports	Net Exports	Exports	Imports	Net Exports	Exports	Imports	Net Exports
2000	2,604	625,349	-622,745	3,103	45,468	-42,365	167	61,938	-61,771
2001	7,461	523,143	-515,682	1,695	61,149	-59,454	91	97,338	-97,247
2002	2,232	214,545	-212,313	2,867	51,696	-48,829	27	70,910	-70,883
2003	1,593	190,305	-188,712	1,865	56,358	-54,493	89	19,098	-19,009
2004	9,850	724,401	-714,551	2,342	54,062	-51,720	61	69,903	-69,843
2005	4,882	1,030,901	-1,026,019	1,717	50,311	-48,594	127	40,071	-39,944
2006	5,832	662,094	-656,262	2,539	31,604	-29,065	69	73,005	-72,936
2007	4,203	65,172	-60,969	1,847	12,216	-10,369	28	1,137	-1,110

Sources :FAO, COMEXT

2. The development of alternative crop production

We distinguish between two sets of alternative crops when analysing the shifts that have occurred in crop areas in Spain since 2000. First, we consider the changing balance between protein crops and grain legumes within the overall dry pulse sector. Then, we put the fluctuations in protein crop areas into the context of the variations in the plantings of other major cereals, oilseed and protein (COP) crops.

2.1 The development of grain legume production

Diagram SP.3 plots the changing areas under protein and grain legume crops from 2000 to 2008.

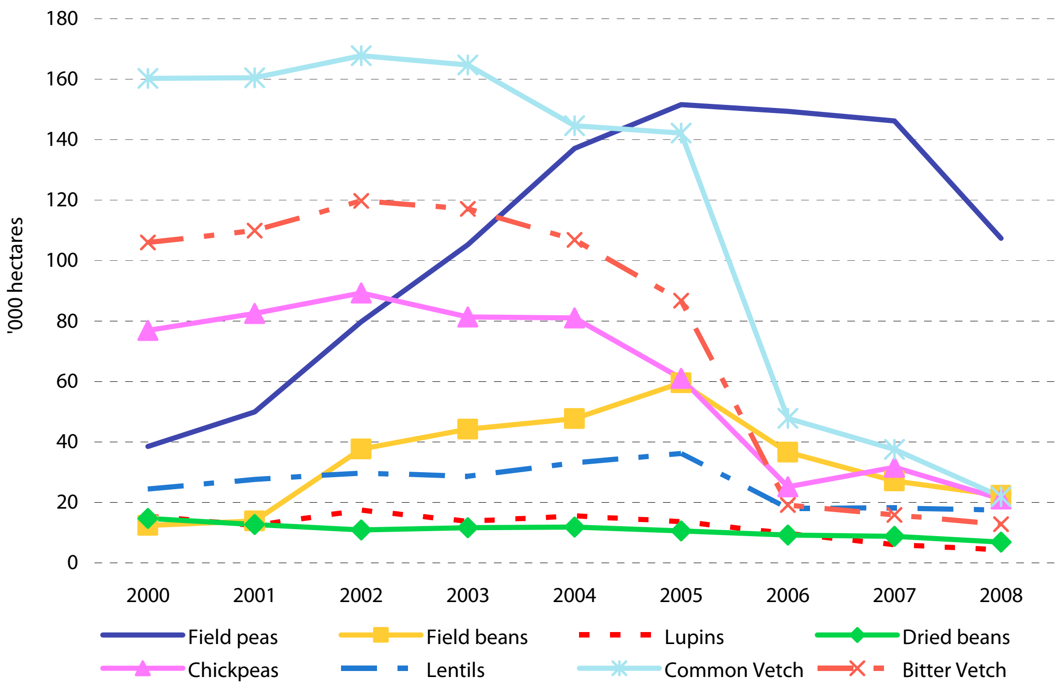
We observe from Diagram SP.3 that

- The two vetches (the common and bitter varieties) and chickpeas were the most important categories of dry pulses in terms of area until 2005.
- Field peas are now far and away the most important such crop.
- The trends in the areas of all major dry pulses have become increasingly weak in recent years; the field pea area was the last to turn down, which it did in 2007.

Table SP.6 provides details of the changes in the areas and outputs of the individual grain legumes since 2000, together with the cumulative changes since 2000. It will be seen that:

- With the sole exception of lentils (whose every dropped by over 28%), all grain legumes suffered a decline of over 50% in their planted areas from 2000 to 2008.
- For the two vetches, the declines were over 85%.

Diagram SP.3: Areas planted to protein crops and grain legumes



Source: MARM – Agricultural Statistics Annual 2007

Diagram SP.3 provides evidence that there was some substitution of field pea and bean areas for grain legume areas from 2002 to 2005. However, from 2006, when grain legume coupled payments ceased, the area under grain legumes fell sharply, and yet the area under protein crops also declined. In other words, field pea and field bean areas expanded before the end of coupled payments on grain legumes, and both protein crop and grain legume areas declined after 2005.

We conclude that the end of the grain legume coupled aid was unlikely to have been the main factor behind the changes that occurred in protein crop areas in Spain after the 2003 reform, and in particular after 2005, when the grain legume coupled aids ceased.

Table SP.6: Areas and output of leading grain legumes in Spain, 2000-2008

Year	Area (1000 ha)	% change over 2000	% change over previous year	Production (1000 t)	% change over 2000	% change over previous year
Dried beans						
2000	14,7			18,8		
2001	12,7	-13,73	-13,73	15,4	-17,98	-17,98
2002	10,9	-25,76	-13,94	13,1	-30,29	-15,01
2003	11,7	-20,67	6,84	14,8	-21,15	13,10
2004	11,8	-19,74	1,17	15,9	-15,49	7,18
2005	10,6	-27,80	-10,04	14,8	-21,20	-6,75
2006	9,2	-37,37	-13,27	14,0	-25,62	-5,62
2007	8,8	-40,14	-4,41	11,6	-38,30	-17,04
2008	6,9	-53,06	-21,59	10,0	-46,81	-13,79
Chickpeas						
2000	76,9			55,5		
2001	82,5	7,27	7,27	56,9	2,59	2,59
2002	89,3	16,16	8,28	70,5	26,94	23,74
2003	81,3	5,74	-8,97	51,1	-7,95	-27,48
2004	81,0	5,34	-0,38	59,4	6,99	16,22
2005	61,0	-20,64	-24,67	18,7	-66,31	-68,51
2006	25,2	-67,22	-58,69	19,8	-64,40	5,69
2007	31,6	-58,90	25,37	30,1	-45,78	52,30
2008	21,2	-72,43	-32,91	22,3	-59,83	-25,91
Lentils						
2000	24,4			22,0		
2001	27,6	12,86	12,86	19,1	-13,15	-13,15
2002	29,7	21,72	7,85	22,8	3,53	19,21
2003	28,7	17,51	-3,46	20,7	-5,81	-9,03
2004	33,1	35,53	15,34	27,4	24,57	32,26
2005	36,2	48,01	9,21	6,9	-68,60	-74,80
2006	18,1	-25,79	-49,86	12,0	-45,40	73,91
2007	18,2	-25,48	0,41	15,4	-29,93	28,33
2008	17,5	-28,35	-3,85	12,8	-41,76	-16,88
Common Vetch						
2000	160,2			132,7		
2001	160,5	0,16	0,16	88,2	-33,53	-33,53
2002	167,7	4,69	4,53	127,4	-4,02	44,40
2003	164,7	2,81	-1,79	140,3	5,71	10,14
2004	144,5	-9,78	-12,25	129,0	-2,78	-8,04
2005	142,1	-11,27	-1,65	44,4	-66,54	-65,58
2006	47,8	-70,17	-66,38	39,6	-70,14	-10,76
2007	37,5	-76,59	-21,53	35,1	-73,55	-11,41
2008	21,9	-86,33	-41,60	29,2	-78,00	-16,81
Bitter Vetch						
2000	106,0	0,00	0,00	92,0	0,00	0,00
2001	109,9	3,66	3,66	49,6	-46,11	-46,11
2002	119,7	12,94	8,95	92,1	0,07	85,70
2003	117,1	10,47	-2,19	77,9	-15,33	-15,39
2004	106,8	0,77	-8,79	88,0	-4,34	12,97
2005	86,7	-18,22	-18,84	19,2	-79,13	-78,18
2006	19,1	-81,98	-77,96	13,6	-85,18	-29,00
2007	15,9	-85,00	-16,78	14,6	-84,13	7,10
2008	12,8	-87,92	-19,50	12,5	-86,41	-14,38

Source: MARM – Agricultural Statistics Annual 2007. Monthly Bulletin, October 2008.

Table SP.7 contrasts the developments in grain legume and protein crop areas from 2002 to 2008. Table SP.8 contrasts the distribution of dry pulse and protein crop output over the period 2000-2008.

Table SP.7: Changes in individual grain legume and protein crop areas, 2002-2008

		2002	2003	2004	2005	2006	2007	2008
KIDNEY BEANS	Area (ha)	10,914	11,661	11,798	10,614	9,206	8,800	7,000
	Main producer area	GALICIA	GALICIA	GALICIA	GALICIA	C.LEON	C.LEON	C.LEON
	Area variation (ha)		747	137	-1184	-1408	-406	-1800
	% Variation		7%	1%	-10%	-13%	-4%	-20%
	Area change by 2008		2003-2008	-4,661	-40%	2005-2008	-3,614	-34%
LENTILS	Area (ha)	29,729	28,26	33,03	36,151	18,25	18,200	17,500
	Main producer area	C.LA MANCHA	C.LA MANCHA	C.LA MANCHA	C.LA MANCHA	C.LA MANCHA	C.LA MANCHA	C.LA MANCHA
	Area variation (ha)		-1,003	4,377	3,048	-18,026	75	-700
	% Variation		-3%	15%	9%	-50%	0%	-4%
	Area change by 2008	0	2003-2008	-11,226	-39%	2005-2008	-18,651	-52%
CHICKPEAS	Area (ha)	89,309	81,258	80,944	61,015	25,205	31,600	21,200
	Main producer area	ANDALUCIA	EXTREMADURA	EXTREMADURA	ANDALUCIA	ANDALUCIA	ANDALUCIA	ANDALUCIA
	Area variation (ha)		-8,051	-314	-19,929	-35,810	6395	-10,400
	% Variation		-9%	0%	-25%	-59%	25%	-33%
	Area change by 2008		2003-2008	-60,058	-74%	2005-2008	-39,815	-65%
COMMON VETCH	Area (ha)	167,718	164,708	144,529	142,140	47,791	37,500	21,900
	Main producer area	C.LA MANCHA	C.LA MANCHA	C.LEON	C.LA MANCHA	C.LEON	C.LA MANCHA	C.LEON
	Area variation (ha)		-3,010	-20,179	-2,389	-94,349	-10,291	-15,600
	% Variation		-2%	-12%	-2%	-66%	-22%	-42%
	Area change by 2008		2003-2008	-142,808	-87%	2005-2008	-120,240	-85%
BITTER VETCH	Area (ha)	119,719	117,085	106,812	86,685	19,105	15,900	12,800
	Main producer area	C.LA MANCHA	C.LA MANCHA	C.LA MANCHA	C.LA MANCHA	C.LA MANCHA	C.LA MANCHA	C.LA MANCHA
	Area variation (ha)		-2,634	-10,273	-20,127	-67,580	-3,05	-3,100
	% Variation		-2%	-9%	-19%	-78%	-17%	-19%
	Area change by 2008		2003-2008	-104,285	-89%	2005-2008	-73,885	-85%
	Area (ha)	417,389	403,438	377,186	336,605	119,432	112,000	80,400
	Area variation		-13,951	-26,252	-40,581	-217,173	-7,432	-31,600
	% Variation		-3%	-7%	-11%	-65%	-6%	-28%
	Area change by 2008		2003-2008	–323,.038	-80%	2005-2008	–256.,205	-76%
FIELD BEANS	Area	37,604	44,234	47,661	59,515	36,641	27,100	22,300
	Region	ANDALUCIA	ANDALUCIA	ANDALUCIA	ANDALUCIA	ANDALUCIA	ANDALUCIA	ANDALUCIA
	Area variation		6,630	3,427	11,854	-22,874	-9,541	-4,800
	% Variation		18%	8%	25%	-38%	-26%	-18%
	Area change by 2008		2003-2008	-21,934	-50%	2005-2008	-37,215	-63%
FIELD PEAS	Area	79,653	105,248	137,098	151,540	149,251	146,200	107,300
	Region	C.LEON	C.LEON	C.LEON	C.LEON	C.LEON	C.LEON	C.LEON
	Area variation		25,595	31,850	14,442	-2,289	-3,051	-38,900
	% Variation		32%	30%	11%	-2%	-2%	-27%
	Area change by 2008		2003-2008	2,052	2%	2005-2008	-44,240	-29%
LUPINS	Area	17,479	13,832	15,563	13,690	9,705	6,000	5,300
	Region	C.LEON	C.LEON	C.LEON	EXTREMADURA	C.LEON	C.LEON	C.LEON
	Area variation		-3,647	1,731	-1,873	-3,985	-3,705	-700
	% Variation		-21%	13%	-12%	-29%	-38%	-12%
	Area change by 2008		2003-2008	-8,532	-62%	2005-2008	-8,390	-61%
	Area	134,.736	163,314	200,322	224,745	195,597	179,300	134,900
	Area variation		28,578	37,008	24,423	-29,148	-16,297	-44,400
	% Variation		21%	23%	12%	-13%	-8%	-25%
	Area change by 2008		2003-2008	-28,414	-17%	2005-2008	-89,845	-40%
PROTEIN & LEGUMES	Area	552,125	566,752	577,508	561,350	315,029	291,300	215,300
	Area variation		14,627	10,756	-16,158	- 246,321	- 23,729	-76,000
	% Variation		3%	2%	-3%	-44%	-8%	-26%
	Area change by 2008		2003-2008	-351,452	-62%	2005-2008	-346,050	-62%

Source: MARM – Agricultural Statistics Annual 2000-2007, and other publication statistics from the Regional Ministries. 2007 correspond to provisional data. 2008 correspond to initial estimates. The leading production region is indicated each year.

Table SP.8: Production distribution for the main protein crops and dry pulses in Spain, 2000-2008, ('000 tonnes)

	Field peas	Field beans	Sweet Lupins	Dried beans	Chickpeas	Lentils	Common Vetch	Bitter Vetch
2000	58.2	13.3	12.5	18.8	55.5	22.0	160.2	106.0
2001	51.6	17.7	7.9	15.4	56.9	19.1	160.5	109.9
2002	100.2	45.7	11.8	13.1	70.5	22.8	167.7	119.7
2003	146.3	57.0	9.5	14.8	51.1	20.7	164.7	117.1
2004	201.2	64.4	10.2	15.9	59.4	27.4	144.5	106.8
2005	132.5	40.6	5.8	14.8	18.7	6.9	142.1	86.7
2006	189.8	47.9	7.1	14.0	19.8	12.0	47.8	19.1
2007	163.9	36.7	5.2	11.6	30.1	15.4	37.5	15.9
2008	139.9	30.0	4.4	10.0	22.3	12.8	21.9	12.8

Source: MARM – Agricultural Statistics Annual 2000-2007, and other publication statistics from the Regional Ministries. 2007 correspond to provisional data. 2008 correspond to initial estimates.

2.1.1 The policies applied to specific protein and legume crops

The CAP measures applied to the leading protein and legume crops produced in Spain differ in their degree of coupling. Prior to 2006, there were different specific coupled aids paid for protein crops and for grain legumes. In addition, a number of dry pulse crops were not included in any scheme that applied coupled aids.

Table SP.9 summarises the measures that applied to the leading dry pulses before and after 2006, and distinguishes between the main end-use of such crops, according to whether they are primarily destined for human consumption (the case with chickpeas, lentils and haricot beans) or animal feed (the remainder, including all three protein crops).

Table SP.9: The CAP measures applied to protein crops, grain legumes and dry pulses, before and after 2006

	Protein crop regime	Grain legume regime	No aids
Specific aids	Retained	Ended in 2006	Not applied
Human consumption		Chickpeas and lentils	Haricot bean
Animal feed	Field peas Field beans Lupines	Common vetch Bitter vetch	Carob bean Fenugreek Lathyrus

Source: MARM. Agricultural White Book 2007

2.2 The development of the areas planted to leading COP crops

Table SP.11 summarises the changing distribution of the areas under alternative COP crops, including protein crops. When comparing the pre-reform period (2000-01 to 2003-04) with the post-reform period (2004-05 to 2008-09), the main points to note are;

- The protein crop areas increased strongly, rising 100% for field peas, 44% for field beans and 69% in aggregate. Only sweet lupins (down 32%) failed to increase their areas.
- Besides these protein crops, the only crops that recorded an increase in areas after the reform were barley, the main local cereal, and "other cereals", such as oats, but the rates of advance were a modest 4% and 7%, respectively.
- Unlike the situation observed in most other EU-15 MS, common wheat and oilseeds

areas (including rapeseed areas, which in most countries benefited from the expansion of biodiesel production) declined after the reform.

- Another distinctive feature of the Spanish results was that the combined major COP crop areas in 2008-09, after the setting of a 0% compulsory set-aside level, was actually lower than the average area pre-reform.

- For irrigated land, the fallow area has been increased significantly since the 2003 reform, rising in the manner described in Table SP.7, from 195,000 to 525,000 hectares in just three years. The rain-fed area left fallow rose by 223,000 hectares, or over 7%, in the final year covered by the table, from 2005 to 2006.

Table SP.10: The allocation of dry and irrigated land by major use, 2002-2006 ('000 hectares)

Year	Use of agricultural land								
	Rain-fed land	Irrigated land	Rain-fed land	Irrigated land	Rain-fed land	Irrigated land	**Rain-fed land**	**Irrigated land**	**TOTAL**
2002	7,591.4	2,180.7	3,020.8	174.3	3,859.3	1,117.8	14,471.5	3,472.8	17,944.2
2003	7,497.0	2,167.3	3,158.5	194.6	3,846.2	1,117.6	14,501.6	3,479.5	17,981.1
2004	7,452.0	2,173.4	3,014.1	386.4	3,819.0	1,113.0	14,285.1	3,672.8	17,957.8
2005	7,278.2	2,135.2	3,056.5	443.2	3,782.3	1,148.8	14,117.0	3,727.2	17,844.2
2006	6,906.5	2,013.8	3,279.4	520.5	3,679.4	1,179.0	13,865.3	3,713.3	17,578.5

Source: MARM. Annual Statistics, 2007.

Table SP.11: Area under COP crops ('000 hectares)

	Protein crop	*Field pea*	*Field bean*	*Sweet lupin*	Rapeseed	Sunflower	Common wheat	Barley	Maize	Durum wheat	Other cereals	Total Area
2000-01	69	41	12	15	32	841	1,502	3,307	*425*	*868*	*578*	7,622
2001-02	76	50	14	12	25	858	1,320	2,994	*504*	*883*	*582*	7,241
2002-03	135	80	38	18	6	754	1,476	3,100	*463*	*925*	*650*	7,509
2003-04	163	105	44	14	6	790	1,311	3,089	*476*	*907*	*679*	7,422
2004-05	200	137	48	16	5	766	1,273	3,157	*480*	*918*	*624*	7,423
2005-06	225	152	60	14	5	521	1,350	3,144	*423*	*900*	*632*	7,200
2006-07	196	149	37	10	6	633	1,336	3,233	*354*	*622*	*695*	7,074
2007-08	179	146	27	6	17	600	1,334	3,220	*365*	*496*	*698*	6,909
2008-09	137	107	24	5	12	711	1,538	3,462	*363*	*529*	*665*	7,417
Average pre-reform	111	69	27	15	17	811	1,402	3,123	467	896	622	7,448
Average post-reform	187	138	39	10	9	646	1,366	3,243	397	693	663	7,205
Percentage change	69%	100%	44%	-32%	-48%	-20%	-3%	4%	-15%	-23%	7%	-3%

Source: DG Agri, FAO, COPA-COGECA for 2008/09 estimates. . It should be noted that the total protein crop areas listed here are consistently higher (by around 6-7% on average than the area on which special aids were paid from 2004/05 to 2008/09. It is believed that the difference represents areas that were planted, but which were not harvested as dried products.

2.2.1 Alternative crops in Castilla-La Mancha

In this section, we examine the alternatives available to protein crops in Castilla-La Mancha. The main crop in the region is cereals, which occupy 51% of the cultivated area, among which barley is the most important, followed by soft wheat and oats. Sunflowerseed is the main locally grown oilseed, while lentils and bitter vetch are the major grain legumes in the region.

Table SP.12 compares the trends in areas, output, yields and producer prices of the main alternatives to protein crops in Castilla-La Mancha from 2001 to 2008 (some of the data for the last two years are not yet complete). The producer prices are national prices.

The data in the table reveal that this region was closely in line with the national picture, in that barley, the crop that occupied the largest area, was the sole one among these alternatives to protein crops that recorded an increase in its area between 2001 and 2008.

Table SP.12: Area, production, yield and average producer price for major crops in Castilla-La Mancha, 2001-2008

	Castilla-La Mancha	Barley	Soft wheat	Oat	Sunflower	Lentils	Bitter vetch
2001	Area (hectares)	841,306	266,090	142,376	212,162	21,490	82,256
	Production (tonnes)	1,870,305	517,083	169,697	127,464	15,673	38,503
	Yield (tonnes/hectare)	2.22	1.94	1.19	0.60	0.73	0.47
	Average Price (€/100kg)	12.70	14.71	12.47	25.60	44.97	16.02
2002	Area (hectares)	864,357	279,963	140,604	197,222	23,115	89,087
	Production (tonnes)	2,730,315	744,610	274,857	149,326	17,690	73,374
	Yield (tonnes/hectare)	3.16	2.66	1.95	0.76	0.77	0.82
	Average Price (€/100kg)	11.80	13.02	12.62	26.10	42.77	14.47
2003	Area (hectares)	887,620	233,756	143,840	196,446	23,309	84,299
	Production (tonnes)	2,371,245	595,999	214,366	132,187	16,122	53,604
	Yield (tonnes/hectare)	2.67	2.55	1.49	0.67	0.69	0.64
	Average Price (€/100kg)	12.20	13.50	12.30	21.70	48.52	13.39
2004	Area (hectares)	914,184	211,421	140,619	192,566	27,127	76,450
	Production (tonnes)	3,123,379	623,927	298,894	170,445	22,118	65,184
	Yield (tonnes/hectare)	3.42	2.95	2.13	0.89	0.82	0.85
	Average Price (€/100kg)	12.60	14.13	12.50	23.00	41.96	13.46
2005	Area (hectares)	890,937	211,745	142,380	165,820	29,178	62,061
	Production (tonnes)	858,389	268,320	85,337	98,434	4,326	8,180
	Yield (tonnes/hectare)	0.96	1.27	0.60	0.59	0.15	0.13
	Average Price (€/100kg)	13.30	13.78	14.15	25.30	47.01	14.90
2006	Area (hectares)	893,630	197,456	150,748	172,341	13,904	8,377
	Production (tonnes)	2,233,197	496,868	250,369	98,290	9,158	6,381
	Yield (tonnes/hectare)	2.50	2.52	1.66	0.57	0.66	0.76
	Average Price (€/100kg)	12.60	13.95	12.80	22.11	60.85	17.97
2007	Area (hectares)	918,142	185,959	152,386	175,044	13,849	4,895
	Production (tonnes)	3,591,897	578,392	337,584	137,039	12,481	5,225
	Yield (tonnes/hectare)	3.91	3.11	2.22	0.78	0.90	1.07
	Average Price (€/100kg)	18.36	20.28	15.82	39.43	..	..
2008	Area (hectares)	930,034	186,003	129,834	183,492	8,117	2,766
	Production (tonnes)	..	..	..	147,119	..	..
	Yield (tonnes/hectare)	..	..	..	0.80	..	..
	Average Price (€/100kg)	16.97		17.11	38.71	..	..

Source: MARM. Source: MARM. Agrarian Statistics Annual 2000-2007.
Note: The average price reported in the table was the average received by farmers at a national level
Data from 2007 are estimates. Those for 2008 are estimates of the Agriculture Council of Castilla-La Mancha.

3. The production systems applied to protein crops

Grain legume and protein crops are recommended for sustainable agriculture systems, thanks to their good role in rotations, in which they reduce the use of nitrogenous fertilisers, boost the yields of the following crops and, by providing ground cover, help to control erosion. In addition, Spanish livestock farmers have been actively seeking vegetable sources of protein after the banning of the use of meat and bone meals in 2001.

In the next few paragraphs, we summarise the systems used in the production of the three protein crops in Spain, including their role in rotations.

3.1 Field beans[11]

Most field bean varieties are sensitive to frosts. They prefer places with uniform temperatures, warmer temperatures, and a coastal, rather than a continental, climate.

3.1.1. Field beans' place in rotations

On rain-fed land, they are planted before cereals, which benefit from higher yields and lower fertiliser requirements. On irrigated land, they tend to be followed by maize, sorghum, sunflower or soybeans in a double-cropping system.

3.2 Field peas[12]

The main producing regions in Spain are in three Autonomous Communities: Castilla y León (Valladolid, Palencia and Burgos), Andalucía (Málaga, Sevilla and Córdoba) and Castilla-La Mancha (Albacete, Guadalajara).

3.2.1. Field peas' place in rotations

Their rotation patterns are the same as those for field beans. They are planted before cereals on rain-fed land. On irrigated land, they are used with maize, sorghum, sunflower or soybean in a double-cropping system.

3.3 Sweet lupins

The areas where sweet lupins can be grown are limited because they cannot tolerate a pH level above 6.8 and/or which have a high calcium content.

In common with field beans, lupins are sensitive to frost. This determines its planting dates.

3.3.1. Sweet lupins' place in rotations

Lupins fix a larger quantity of nitrogen than field peas or field beans, and are rivalled only by alfalfa in this respect. They tend to be followed in the rotation by cereals, which benefit from the nitrogen in the soil.

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[11] (This is based on Guerrero, A. 1999. Extensive herbaceous cultures. Ed. Mundiprensa, Madrid, pp 579-608)
[12] (This is based on Guerrero, A. 1999. Extensive herbaceous cultures. Ed. Mundiprensa, Madrid, pp 609-622)

4. The gross margins on protein crops vs. those on alternative COP crops

4.1 Field pea revenue and costs

In this section, we analyse gross and net margin data for Castilla-La Mancha for protein crops and the main alternative crops. First, we present details of the calculation of margins for the 2007 harvest of the three main cereals and field peas in the Autonomous Community, under rain-fed and irrigated conditions. These initial comparisons are summarised in Table SP.13 and Table SP.14. They reveal that:

- At the level of both gross and net margins, field peas were the only one of the four crops that recorded a loss under both rain-fed and irrigated conditions.
- For field peas, fertiliser and seed costs were the two major input costs on rain-fed land. On irrigated land, the costs of water (combined with crop insurance) and of indirect cash costs were the two main components (Diagrams SP.4 and SP.5).

Table SP.13: Calculation of margins for rain-fed cereals and protein crops, Castilla-La Mancha, 2007

	Category	**Common wheat**	**Barley**	**Oats**	**Field peas**
P	- Nº of holdings	43	77	19	6
R	- Cultivated Area (ha)	17,69	26,92	14,19	6,04
O	- Production (kg/ha) (1)	2.126	2.483	2.392	816
D					
U	- Sales (*) (2)	309,38	314,74	344,49	138,52
C	- Subsidies (*) (3)	31,65	33,99	31,49	31,50
T	- Compensatory payments and other income (4)	2,12	0,69		
I	- Gross product (*) (5) = (2) + (3) + (4)				
O		343,15	349,42	375,85	170,02
N	- Sales price (€/100 kg) (6) = 100 x (2) / (1)	14,55	12,68	14,40	16,98
	- Final obtained price (€/100 kg) (7) = 100 x (5) / (1)	16,14	14,07	15,71	20,84
C	- Direct costs (*) (8)	137,75	142,67	154,80	182,91
O	- Standard gross margin (*) (9) = (5) - (8)	205,40	206,75	221,05	-12,89
S					
T	- Machinery + Labour (*) (10)	69,74	72,10	58,39	42,28
S					
	- Gross margin (*) (11) = (9) - (10)	135,66	134,65	162,66	-55,17
A					
N	- Indirect cash costs (*) (12)	78,80	48,97	91,05	45,19
D					
	- Available profit (*) (13) = (11) - (12)	56,86	85,68	71,61	-100,36
M					
A	- Depreciation (*) (14)	20,71	31,05	0,05	4,53
R					
G	- Net margin (*) (15) = (13) - (14)	36,15	54,63	71,56	-104,89
I					
N	- Other indirect costs (*) (16)	71,11	84,30	59,59	30,60
S					
	- Profit (*) (17) = (15) - (16)	-34,96	-29,67	11,97	-135,49

Source: MARM

Note: (*): €/hectare

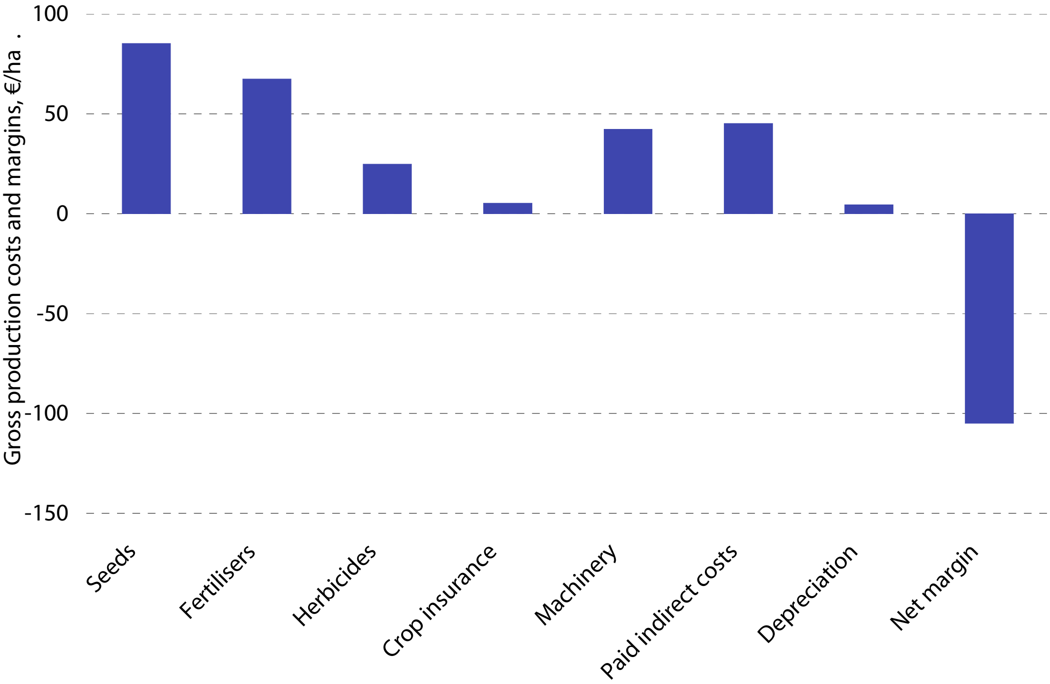
Table SP.14: Calculation of margins for irrigated cereals and protein crops, Castilla-La Mancha, 2007

	Category	Common wheat	Barley	Maize	Field peas
PRODUCTION	- Nº of holdings	28	41	10	8
	- Cultivated Area (ha)	14,77	15,92	8,44	8,40
	- Production (kg/ha) (1)	4.120	4.065	9.778	1.562
	- Sales (*) (2)	591,33	544,09	1.485,71	267,24
	- Subsidies (*) (3)	62,86	64,34	78,40	69,59
	- Compensatory payments and other income (4)				
	- Gross product (*) (5) = (2) + (3) + (4)	654,19	608,43	1.564,11	336,83
	- Sales price (€/100 kg) (6) = 100 x (2) / (1)	14,35	13,38	15,19	17,11
	- Average final income (€/100 kg) (7) = 100 x (5) / (1)	15,88	14,97	16,00	21,56
COSTS AND MARGINS	- Direct costs (*) (8)	299,68	300,02	1.185,08	343,38
	- Standard gross margin (*) (9) = (5) - (8)	354,51	308,41	379,03	-6,55
	- Machinery + Labour (*) (10)	64,77	60,00	51,54	67,40
	- Gross margin (*) (11) = (9) - (10)	289,74	248,41	327,49	-73,95
	- Indirect cash costs (*) (12)	159,67	142,43	319,32	88,83
	- Available profit (*) (13) = (11) - (12)	130,07	105,98	8,17	-162,78
	- Depreciation (*) (14)	2,82	3,62	3,74	4,90
	- Net margin (*) (15) = (13) - (14)	127,25	102,36	4,43	-167,68
	- Other indirect costs (*) (16)	145,17	151,22	308,02	86,06
	- Profit (*) (17) = (15) - (16)	-17,92	-48,86	-303,59	-253,74

Source: MARM

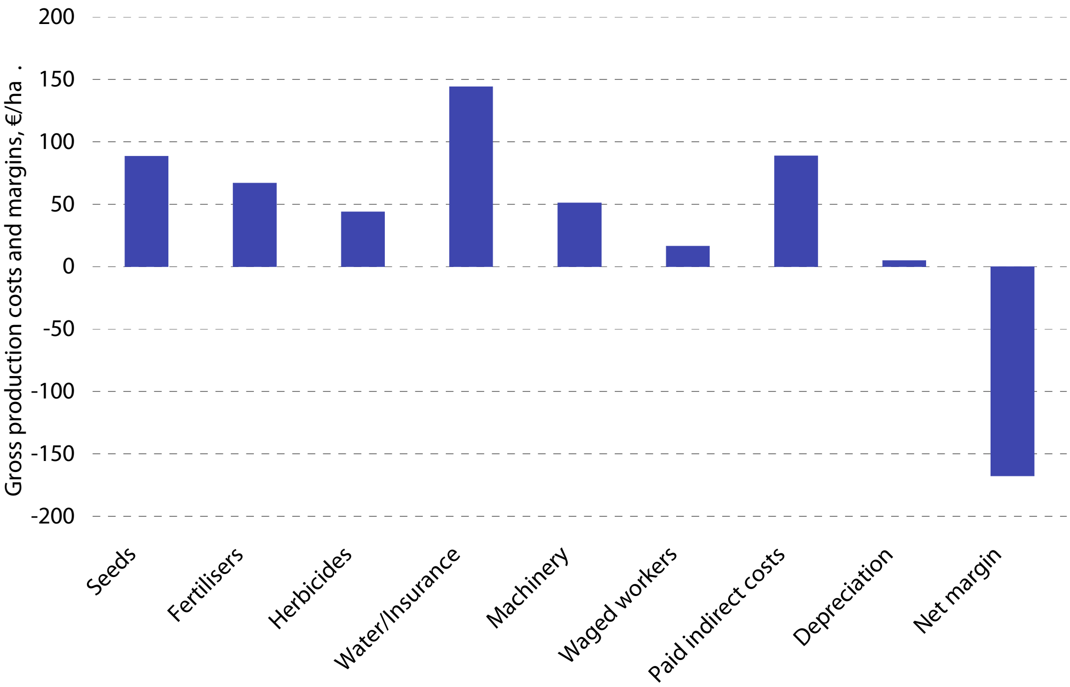
Note: (*): €/hectare

Diagram SP.4: Castilla-La Mancha, Rain-fed field pea production costs and net margins (2007)



Source: MARM – Agricultural Statistics Annual 2007
Note: Gross Output = 170,02 €/ha (816 kg/ha at 20,84 €/100 kg)

Diagram SP.5: Castilla-La Mancha, irrigated field pea production costs and net margins (2007)



Source: MARM – Agricultural Statistics Annual 2007

In the next few pages, we undertake a time series analysis of the costs of field pea production and a comparison of field pea gross margins with those for the major alternative crops.

Table SP.15 summarises the revenues and costs associated with growing field peas on non-irrigated areas in the region of Castilla-La Mancha. The data cover 2000-2004 and 2006. No data were available for 2005. The data on yields, prices and variable costs have been obtained from MARM (unfortunately, a detailed breakdown of variable cost components is not available). The coupled payment data are derived from analysis of the FADN data for the Centro region, within which Castilla-La Mancha lies. They are the average coupled payments per hectare of protein crops of those producers in the database who produced protein crops. The derivation of gross margins for the major alternative crops is shown in Table SP.16.

The table reveals that:

- With the full implementation of the 2003 reform in 2006, the coupled payments made for field peas totalled just below €150 per hectare (including 25% of the arable aid payment made under the previous regime) from around €180 prior to 2004.
- Total revenue per hectare (including coupled payments) for field pea farmers averaged just over €336 per hectare in the years prior to the reform (2000-2003). They fell to €287 per hectare in 2006, when the reform was implemented in full.
- Variable costs of field pea production have remained fairly stable over the period surveyed at around €250 per hectare, with the only exception of 2004, when they reached €324 per hectare.

Table SP.15: Castilla-La Mancha, rain-fed field pea revenues and production costs, 2000-2006 (€/hectare)

	2000	2001	2002	2003	2004	2005	2006
Yield (t/ha)	1.4	0.4	1.2	1.0	1.2		0.8
Field Pea Price per tonne	152	168	146	161	152		170
Protein Crop Arable Aid (€/ha)	173	181	180	180	214		95
Protein Crop Special Aid (€/ha)	0	0	0	0	56		54
Return per ha							
Field Pea Price	208	72	183	167	188		139
Coupled Payment	173	181	180	180	269		148
Total Revenue	381	253	363	347	457		287
Variable Costs*	260	235	242	258	324		255
Gross margins	121	18	120	89	134		32

Source: MARM, Annual Agricultural Statistics, 2007, and Agricultural Incomes. FADN database for estimates of coupled support.

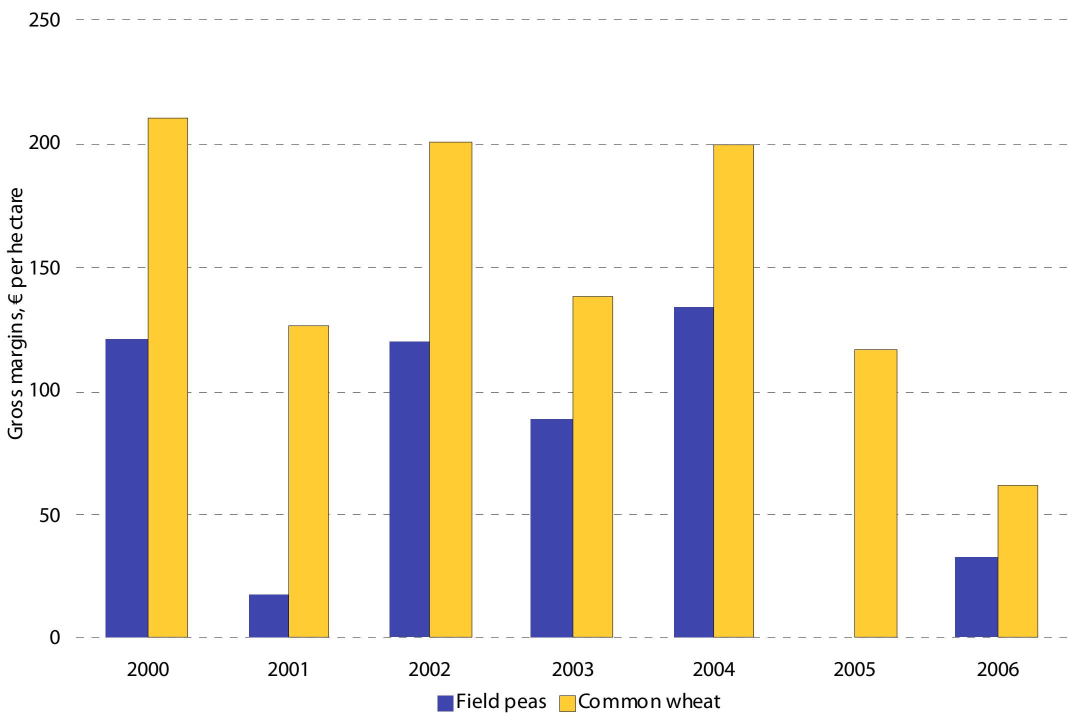
Note: *Variable costs do not include "amortisation", which is included in variable costs in the MARM data summarised in Table SP.13. The value of amortisation is assumed to be the depreciation figure for protein crop producers among COP specialists in the region from the FADN database.

4.2 Field pea gross margins

The evolution of the gross margins for field peas when contrasted with the main alternative COP crops (common wheat, barley, oats, sunflower and bitter vetch, which is included as the main grain legume crop cultivated in the region) is pictured in Diagrams SP.6-SP.10.

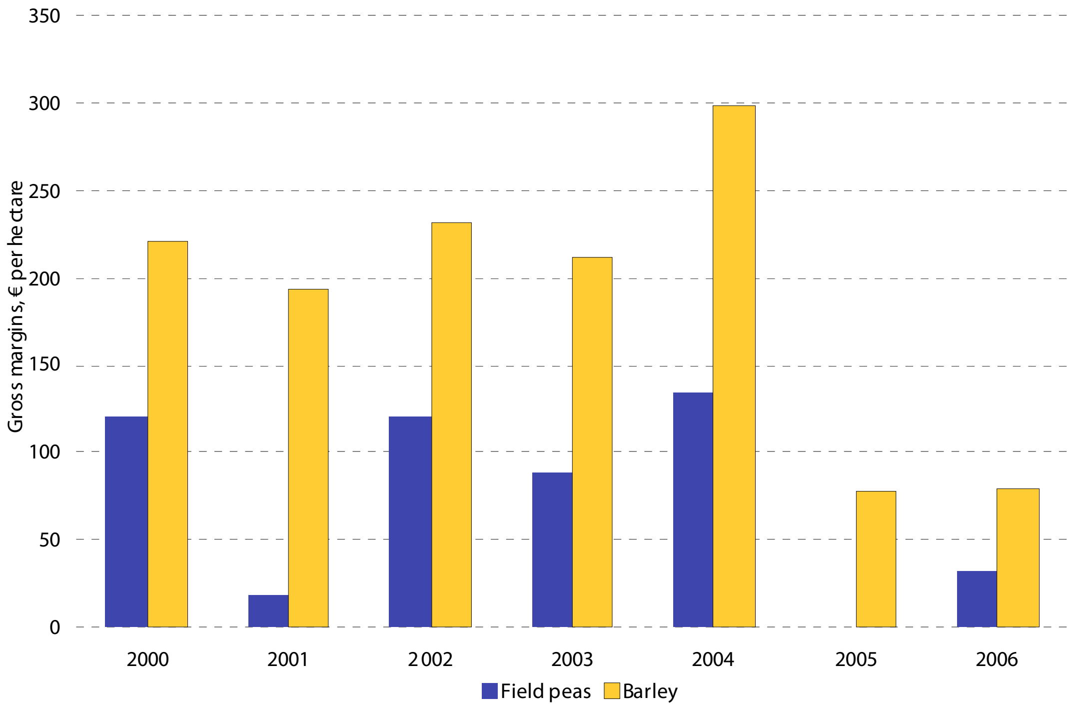
- Gross margins varied significantly in 2000-2006, but were low for all crops in 2006.
- Field peas consistently recorded a lower gross margin than the cereal crops, with the sole exception of oats in 2001.
- Against sunflower and bitter vetch (both of which recorded negative gross margins in 2006), field peas offered a higher return to producers in 2006.

Diagram SP.6: Castilla-La Mancha, Field pea gross margins vs. common wheat, 2000-2006



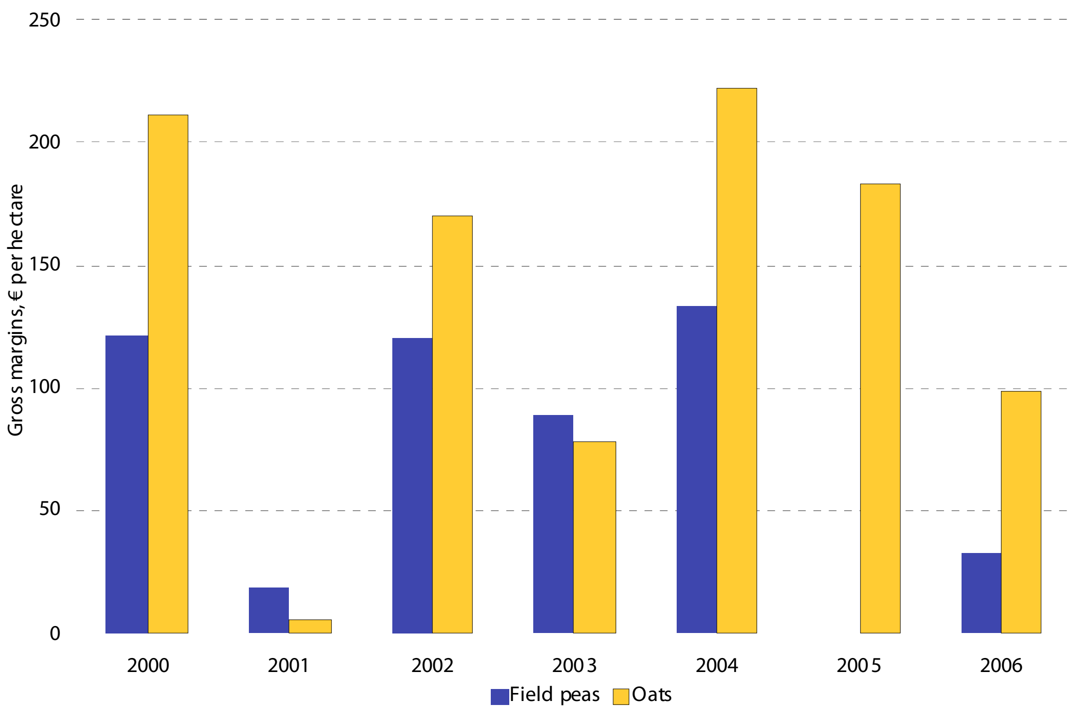
Source: MARM, Annual Agricultural Statistics, 2007, and Agricultural Incomes
Note: There are no data on field pea costs and margins for 2005

Diagram SP.7: Castilla-La Mancha, field pea gross margins vs. barley, 2000-2006



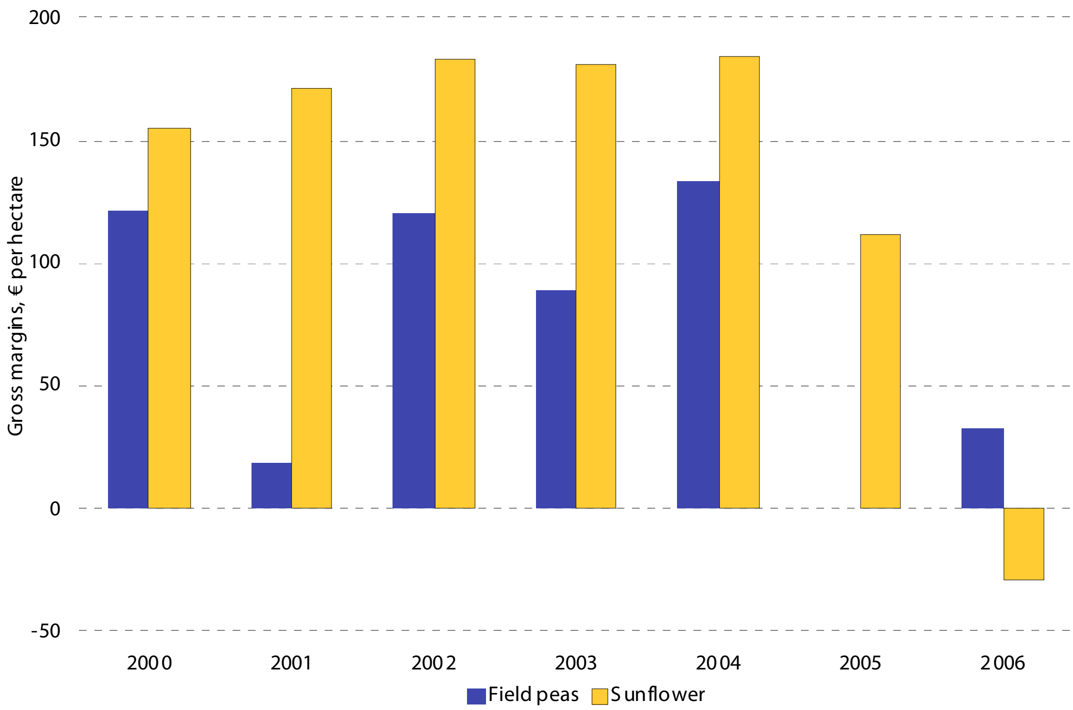
Source: MARM, Annual Agricultural Statistics, 2007, and Agricultural Incomes
Note: There are no data on field pea costs and margins for 2005

Diagram SP.8: Castilla-La Mancha, field pea gross margins vs. oats, 2000-2006



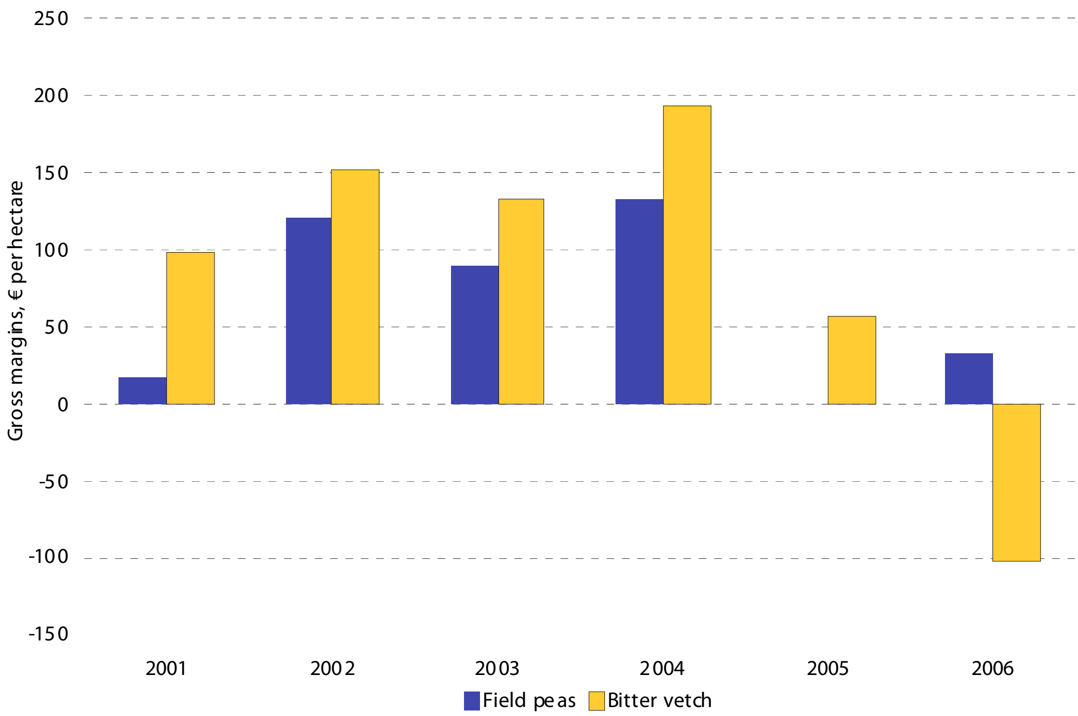
Source: MARM, Annual Agricultural Statistics, 2007, and Agricultural Incomes
Note: There are no data on field pea costs and margins for 2005

Diagram SP.9: Castilla-La Mancha, field pea gross margins vs. sunflower, 2000-2006



Source: MARM, Annual Agricultural Statistics, 2007, and Agricultural Incomes
Note: There are no data on field pea costs and margins for 2005

Diagram SP.10: Castilla-La Mancha, field pea gross margins vs. bitter vetch, 2000-2006



Source: MARM, Annual Agricultural Statistics, 2007, and Agricultural Incomes
Note: There are no data on field pea costs and margins for 2005

Table SP.16: Castilla-La-Mancha, revenue and variable costs of alternative crops (€/hectare)

	2000	2001	2002	2003	2004	2005	2006
Common wheat							
Price	306	213	287	251	330	220	309
CAP support	155	156	154	158	159	155	39
Total revenue	461	369	441	409	489	375	348
Variable Costs*	251	243	241	270	289	258	286
Gross margins	211	127	201	138	200	117	62
Barley							
Price	310	274	313	310	429	199	315
CAP support	155	156	154	158	159	155	39
Total revenue	465	430	467	468	588	354	354
Variable Costs*	244	235	234	257	289	277	274
Gross margins	220	194	232	211	299	77	79
Oats							
Price	283	110	256	158	309	318	345
CAP support	155	156	154	158	159	155	39
Total revenue	438	266	410	316	468	473	384
Variable Costs*	227	261	241	238	245	290	285
Gross margins	211	5	170	78	223	184	99
Sunflower							
Price	60	106	178	177	181	104	90
CAP support	223	179	150	163	161	157	39
Total revenue	283	285	328	341	341	262	130
Variable Costs*	128	114	145	160	157	150	160
Gross margins	154	171	183	181	184	111	-30
Bitter vetch							
Price		89	169	130	208	72	48
CAP support		178	151	164	181	145	0
Total revenue		267	320	294	389	217	48
Variable Costs*		168	168	161	196	160	150
Gross margins		98	152	133	193	58	-102

Source: MARM, Annual Agricultural Statistics, 2007, and Agricultural Incomes. FADN database for estimates of coupled support.
Note: *Variable costs do not include "amortisation", which is included in variable costs in the MARM data summarised in Table SP.13. The value of amortisation is assumed to be the depreciation figure for protein crop producers among COP specialists in the region from the FADN database.

4.3 Alternative crops

The main alternative crops considered are common wheat, oats, barley, sunflower and bitter vetch. This latter crop is of particular interest in the context of this analysis as the changes that occurred after 2003 in measures in the grain legume sector (to which bitter vetch belongs to) might have affected the impact of the reform in the protein crop sector. These measures had previously provided a coupled aid of €181 per hectare on grain legumes, but these grain legume coupled payments ended in 2006, and Spain, which accounted for well over 95% of the total EU crop area in receipt of grain legume coupled aids, would have been expected to have been particularly sensitive to the change in that set of special measures.

Since grain legumes and protein crops share the beneficial effects in a rotation, it is likely that policy changes in the grain legume sector would have led Spanish producers to respond in a different way from producers elsewhere after the 2003 reform. This is considered below.

Revenues and costs of the competing crops are based on those in Castilla-La Mancha, as are the field pea data, and the revenues incorporate all coupled support for particular crops.

Table SP.17 and Diagram SP.11 compare the gross margins on field peas with the weighted average gross margins on common wheat, barley, oats and sunflower from 2001 to 2006, allocating the values to three periods: the first, prior to the reform (2001-2003); the second, immediately after the reform (2004 alone, since full 2005 data are not available for field peas); and the third, after the reform was complete, including the adoption of the SPS (in 2006).

The table and diagram contrast the differences in average gross margins between field peas and the major COP crops as a group with the annual change in the proportion of field peas in total COP crop areas one year later. The lag is intended to reflect the adaptive expectations of farmers responding to the outcome of the previous harvest.

Table SP.17: Difference between gross margins on field peas and the weighted average gross margins on other COP crops vs. annual changes in the following crop year in the field pea share of the combined area of major COP crops, Castilla-La Mancha, 2001-2006

	2001-2003	2004-2005	2006
GM difference, field peas vs. other COP crops, € per hectare	-110	-129	-33
GM difference without extra coupled aids for protein crops	-134	-182	-88
Annual % change in field pea area as share of COP crop area	0.2%	-0.1%	-0.1%

Sources: MARM; Eurostat; FADN database

Note Gross margin data are not available for field peas in 2005. Also, bitter vetch is not included in the calculation of the .weighted average gross margins for other major COP crops.

- The average disadvantage of field peas vs. the weighted average of the main alternative crops, in terms of gross margins, fluctuated from one period to another. It deteriorated from €110 per hectare in 2001-2003 to €129 in 2004-2005 but then improved to a disadvantage of only €33 in 2006, largely because the competitive position of sunflower was weak in 2006.

- The absence of coupled payments for protein crops would have worsened the relative competitiveness of protein crops. In this context, it is interesting to note that the low reference yields applied to Spain prior to the 2003 reform meant that the average added value of the coupled aids specifically tied to protein crops in 2001-2003 was only €24/hectare (the difference between €134 and €110 in the first column of Table SP.17.

- The competitive disadvantage for field peas would have been €134 per hectare in 2001-2003. It would have deteriorated to €182 in 2004-2005, before shrinking to €88 in 2006.

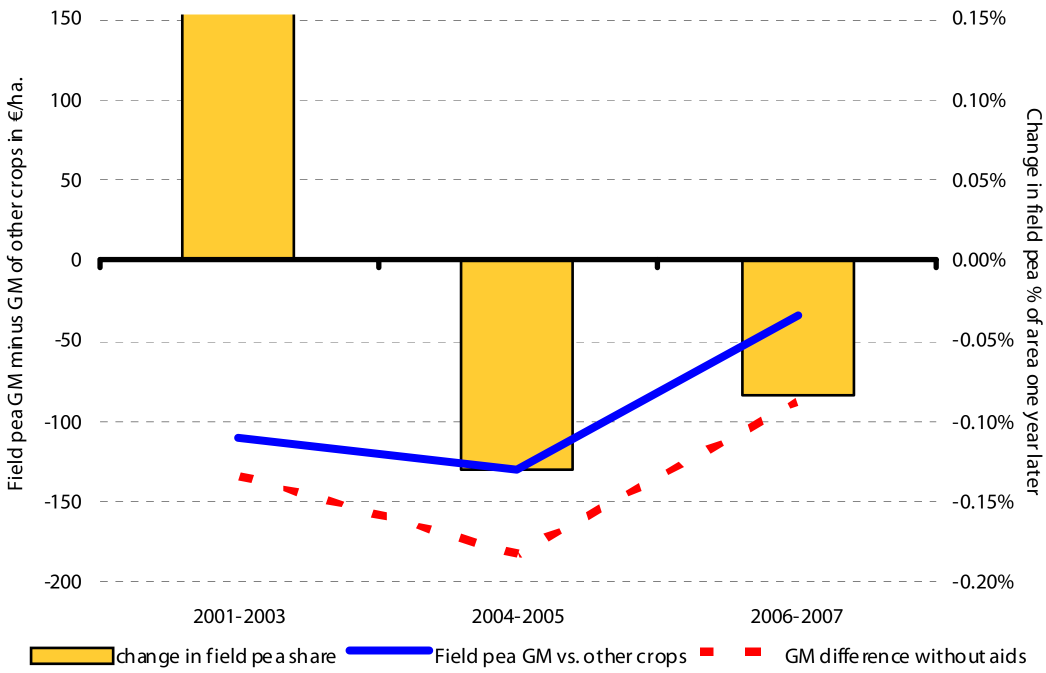
- Table SP.17 describes the changes that occurred in the field pea share of the COP crop area over the same period. The same changes are illustrated in Diagram SP.11.

- The field pea share increased at an annual rate of 0.2% (from 2002 to 2004) in response to the gross margins observed in 2000-2003. The share then fell by an annual 0.1% in response to the gross margins experienced in 2004-2005 and by a further 0.1% in response to the outcomes of the 2006 crop.

One possible explanation of the failure to establish a clear inverse relationship between relative gross margins on cereals in one period and changes in field pea areas in the next period could have been the changes that occurred after 2003 in measures in the grain legume sector. The ending of these coupled payments would have been expected to have enhanced the attractions of protein crops, which retained their coupled aids, and which could also replace grain legumes as a beneficial crop in a rotation.

To investigate this, we analyse relative margins and area changes for bitter vetches (a major grain legume) vs. field peas. Annual gross margins were depicted in Diagram SP.10. Table SP.18 summarises the development of coupled payments, gross margins and areas (for areas, the data refer to the following year to allow for the producers' response) for the two crops, from 2001 (when gross margin data for the vetches became available) to 2006.

Diagram SP.11: Annual changes in the field pea share of areas under major COP crops, 2001-07 vs. field pea gross margin competitiveness in relation to the weighted average for other major COP crops, with and without protein crop aids, Castilla-La Mancha



Source: MARM, Annual Agricultural Statistics, 2007, and Agricultural Incomes
Note: The "with aids" calculations include the special aid of €55.57/ha. The "without aids" case excludes this aid.
"Field pea GM vs. other crops" measures the difference between the gross margin on field peas and the weighted average gross margin on the other major COP crops (apart from bitter vetch).,The weights are the areas under the different crops.
The average percentage area changes relate to the period one year after the gross margin calculations.

We observe that field pea areas rose while bitter vetch areas fell in the middle period, after the initial implementation of the 2003 reform, when coupled aids for grain legumes ended. In the final period, field pea areas fell, even though bitter vetch areas collapsed to under 5% of its level immediately before the reform, and bitter vetch gross margins became negative.

Between 2002-2004 and 2007 (these dates reflect the one year lag between the gross margin data and the area data in Table SP.18), the area under field peas increased by less than 1,000 hectares in Castilla-La Mancha, while the area under bitter vetches slumped by over 79,000 hectares. This suggests that any benefit in areas and production that field pea areas secured from the loss of the coupled payments on bitter vetches was modest.

Table SP.18: Coupled payments, gross margins and areas (in the following year), for field peas and bitter vetches in Castilla-La Mancha, 2001-2006 (hectares and € per ha.)

		2001-2003	2004-2005	2006
Area following year	Field peas	17,840	25,428	18,298
Area following year	Bitter vetch	83,279	35,219	3,831
Coupled payment	Field peas	180	210	95
Coupled payment	Bitter vetch	164	72	0
Gross margin	Field peas	76	134	32
Gross margin	Bitter vetch	128	-22	-102

Sources: MARM; Eurostat; FADN database

Note Gross margin data are not available for field peas in 2005. For bitter vetches alone, we show the average coupled payment and average gross margin data for 2005-2006 in the column labelled 2004-2005. This is because producers planting in 2006 would be well aware that they no longer received the coupled payment on this crop.

5. The significance of protein crop production in farm incomes

For four of the six selected member states studied in the case study monographs[13], it is possible to use the FADN database to compare four measures of profitability for protein crop farms. These measures of profitability have been extracted from the FADN database. They are: gross farm income per hectare, farm net value added per annual working unit, farm family income per hectare and farm family income per farm working unit. Their values are compared with values of the same indicators for "other farms", i.e., farms that do not cultivate these crops.

In these analyses, protein crop farms are classified on the basis of the share of farm UAA that is devoted to protein crops. The data used for this analysis have been extracted from the FADN database.

The aim of this form of analysis is to ascertain whether there are any structural differences in the profitability of farms that choose to grow protein farms relative to farms that do not grow these types of crops, *ceteris paribus,* i.e. when both sets of farms belong to the same type of farming.

The preferred approach has been to conduct the analysis separately for the two types of farming to which most protein crops farm belong, namely the categories of "COP specialists" and "Mixed crops and livestock".

However, a very important restriction upon the use of the FADN database is that the strict confidentiality of individual respondents is maintained. Hence, analysis is only permitted when a minimum threshold of 15 producers in the relevant combination of size of holding and specialisation is exceeded each year.

This threshold is also required to ensure that the results presented meet a satisfactory degree of statistical precision.

- Unfortunately, in the case of Spain, there is no single size class and no single specialisation that exceeds this minimum threshold of 15 respondents.
- Accordingly, it is regretted that it is not possible to prepare an analysis of the significance of protein crops in farm incomes in Spain using FADN data.

[13] These four are France, Germany, Poland and the United Kingdom, although, even for these MS, the analysis can only be undertaken for a small number of size classes of holdings and a limited number of farm specialisations.

6. The development of the local feed compounding industry

The blending of feed ingredients for the local livestock sector is determined by least cost formulations. However, there are specific fixed costs, for example, the development of separate storage capacities, for each ingredient. Therefore, feed compounders favour ingredients that are available in large quantities and throughout the year.

A large number of cereals, oilseed meals, protein crops, dairy by-products and industrial by-products (such as corn gluten feed or wheat bran) of the processing of agricultural products can be used. All of them are substitutes for some feed ingredients, and the use of one of them depends to a great extent on their cost competitiveness in providing a given set of properties, such as fibre, carbohydrate/energy and individual amino-acids.

Table SP.19 describes the ingredients used by Spanish feed compounders from 1999 to 2007.

In the last few years, the proportion of cereals in the compound feed has varied between 50% and 60%, while the use of tapioca, a major cereal substitute, has tumbled. The volume of oilseed meals has risen by approximately 75%, and the use of animal processing by-products fell after the ban on meat and bone meal use in 2001. The incorporation of protein crops into compound feed in 2007 was 40% below its level in 1999-2000.

Table SP.19: Ingredients used by the Spanish feed compounding industry 1999-2007 ('000 tonnes)

	1999	2000	2001	2002	2003	2004	2005	2006	2007
1. Cereals	9,500	9,790	10,250	10,400	9,850	10,811	11,258	10,686	12,200
2. Tapioca	1,050	1,050	950	600	755	975	300	177	455
3. By-products	920	955	1,050	1,150	1,325	1,428	1,715	1,650	1,000
4. Oils and fats	320	350	300	260	295	300	312	298	250
5. Oilseed meals	2,950	3,190	3,980	4,600	4,980	4,700	5,075	4,900	5,200
6. Animal meals	180	200	112	125	155	145	151	145	125
7. Dairy by-products	60	60	60	60	70	70	73	69	70
8. Dry forage	490	490	750	850	770	780	430	700	470
9. Protein crops	480	500	665	250	335	272	383	315	295
10. Minerals, additives, proteins	340	350	380	405	395	419	524	410	470
11. Others	190	190	310	400	435	400	500	450	350
12. TOTAL	**16,480**	**17,125**	**18,808**	**19,100**	**19,365**	**20,300**	**20,721**	**19,800**	**20,885**

Source: Derived from CESFAC Market Statistic 2007, with initial estimates for 2007.
Note: The data exclude pet food.

Table SP.20 describes the trends reported by FEFAC in the number and scale of Spanish compound feed plants since 1997. The table includes separate data for the years immediately before and after the 2003 reform. We observe that:

- The reported number of compounders fell between 1997 and 2003, and again between 2004 and 2007.
- Between 2003 and 2004, the number is reported to have i more than tripled. This is understood to reflect the use of a different methodology in surveying the sector.
- Annual output per plant was calculated to be 63,500 tonnes in 2003 and 23,100 in 2007.
- National compound feed production rose 33% between 1997 and 2007, but the growth ceased after 2004.

Table SP.20: The number and annual output of Spanish feed compounders, 1997-2007 ('000 tonnes)

	Number of compounders	Compound feed output ('000 tonnes)	Annual output per plant ('000 tonnes)
1997	1,011*	15,260	15.1
2003	964	19,425	20.2
2004	922	20,339	22.1
2007	880	20,300	23.1
% change 1997-2007	-13.0%	33.0%	52.8%

Source: FEFAC Feed and Food Statistical Yearbook, 2007.
Notes: These totals differ very slightly from the CESFAC data that was the source of the preceding table. FEFAC is the source used in other MS analyses, and therefore is retained here for consistency.

*Estimate

6.1 Consumption of protein crops

Table SP.21 describes the division of Spanish field pea and bean demand between food and feed use. Sweet lupin demand was stated to be 100% for feed. The table reveals that food use of the two main protein crops represented under 5% of the total in 2007.

Table SP.21: Allocation of protein crop output between food and feed, 2000-2006

	Feed		Food	
	Area 000 ha	Production 000 tonnes	Area 000 ha	Production 000 tonnes
Field peas				
2000	34.3	51.0	7.0	7.2
2001	49.7	51.3	0.3	0.3
2002	76.0	95.1	3.6	5.1
2003	104.4	147.3	0.9	1.0
2004	125.3	184.5	11.8	16.7
2005	141.3	127.9	0.2	0.2
2006	134.1	171.3	7.0	9.3
Field beans				
2000	11.9	12.8	0.6	0.5
2001	13.2	17.0	0.7	0.7
2002	36.7	44.9	0.9	0.8
2003	41.5	55.5	2.8	1.4
2004	46.4	62.7	1.3	1.7
2005	58.5	39.8	0.9	0.8
2006	36.4	47.6	0.2	0.2

Source: MARM – Agricultural Statistics Annual 2007

7. Evidence from interviews and questionnaires with stakeholders in the Spanish protein crop sector

There are two main sources from which we drew evidence: one was through direct interviews with stakeholders and the other, analysis of individual questionnaires completed by 25 farmers. This is described in the following two sections. The questionnaires were lengthy and many respondents did not complete them in full. Given the relatively small sample of completed questionnaires, prudence should be exercised when interpreting the results.

Questionnaires for processors were fewer in number since many of them are transnational companies active in several Member States. The analysis for this is not presented in the individual case studies but can be found in the Main Report.

7.1: Interview evidence

7.1.1 Interviews with farmers

Some differences in opinion were expressed about the trends in the protein crop areas:

- *On the one hand, for some farmers in some areas, protein crop areas have gained from being substituted for grain legumes in the years immediately after 2005, when coupled aid for these dry pulses was removed[14]. One of the reasons for this is the specific protein crop aid, where protein crops are considered as the best substitute for grain legume crops.*
- *Since grain legume crops lost their specific aid, their cultivated area has decreased considerably.*
- *Another reason is the changes in demand for protein as feed for livestock. Initially, after 1999-2000, increases in the animal population in Spain contributed to expansion in the area cultivated for protein crops as a protein for the feed compounders. However in the last few years, livestock numbers have fallen, thus contributing to a fall in demand for protein crops and a decline in their cultivation.*
- *At the same time, the high cereal prices in 2008 have meant that these crops have become an attractive substitute for protein crop in that year.*
- *There is a significant proportion of producers who state that their choice of protein crops is not much affected by the CAP reforms. Their decision to grow these crops is based on their benefits within the full farming system, taking account of rotations.*
- *In practice, such farmers view protein crops as a small part of their farm activities, assessing it primarily as a better alternative than leaving the land fallow.*

The main points raised in relation to the production systems applied to protein crops were that:

- *Protein crops are heavily dependent on soil and climatic conditions. Lupins, for example, require acid lands and reasonable rainfall, and thus are cultivated in Castilla León and Galicia. Field peas can be cultivated in dry areas found in Castilla León, Castilla-La Mancha or Aragon. Field beans fare well in Andalucía in the South of Spain,.*

[14] At an aggregate level, the data presented in Section 2 indicate that area under protein crops declined marginally in the years immediately after the ending of the coupled aid for dry pulses.

- *Sometimes protein crops are being used as silage crops, for example field peas. In these cases, the specific aids for protein crops are not paid.*

- *The timing of labour use on protein crops often clashes with that for cereals, and specialised machinery is needed, that a cereal farmer will not own. So the protein crop farmer is either a mixed crop livestock holding or may contract the production and cultivation of the crop with a livestock farmer.*

- *Field peas used as a silage crop is harvested before cereals, and so specific problems with weeds (like poppies or wild oat) do not appear, which is an advantage. So, although specific aid is not paid, herbicide treatments are avoided, which sometimes can be more costly than the value of the aid. Against this, harvesting field peas as a silage crop has to be done at night, in order to avoid the lodging of the crop, which is a harder work.*

- *Larger farms have reduced the area planted to protein crops more than smaller farmers, who usually incorporates protein crops into a rotation as a tradition.*

- *The use of inputs and the production methods have not changed in recent years. Fertiliser requirements of protein crops are less than those of competing cereal and oilseed crops. At the same time, phytosanitary treatments are minimal; hence, the higher prices of the inputs achieved in recent years have had little effect on production methods. Herbicides are not applied in many cases because the cost of the treatment exceeded the value of the benefits they provided.*

- *When protein crops are not cultivated as silage, their production methods are very similar to those of cereals. It requires less labour, mainly because it is not fertilised.*

- *They are not irrigated, unless they are in an irrigated rotation and they can be given a small irrigation in May or June. Irrigation raises yields substantially, and is particularly valuable in dry years.*

- *Protein crops (notably field peas) are often grown organically, but are often integrated in cereal rotations, which are not organic. In such cases, their production is not termed organic. The truly organic share of production is said to represent a very small share of total Spanish protein crop output, but is reported to be increasing thanks to specific aids for the production of organic crops.*

- *Protein crops are not well suited to conditions in Spain. Targeted breeding programmes have not been developed, and so varieties are not adapted to local conditions, resulting in poor yields.*

- *If one compares protein crop with barley, for example, the latter can achieve yields of 2.5-3.5 tonnes per hectare, whereas yields for field peas and field beans vary between 1.0 and 1.3 tonnes per hectare, and for lupins they vary between 500 and 700 kg per hectare.*

- *If we compare yields in Spain for protein crops with other European countries, Spain has one of the lowest yields and is very sensitive to the weather conditions. This causes yields and output to be particularly volatile.*

7.1.2 Interviews with feed compounders

- *Lupins and field beans (of the Variety minor) are only used for feed. Field beans (of the Variety major) and field peas, are destined partly for food uses. Field beans are fed to fighting bulls and horses, but tannin content limits their use. On-farm feed use is a minor share of demand, but the questionnaires reveal an important minority of producers who mix on-farm feed.*

- Compounders tend to use feed formulations adopted by the US feed compounding industry. This reinforces the preference for soybean meal and sunflower meal over protein crops on account of their much greater and readier availability.

7.2 Summary of analysis of farmers' questionnaires

The following section summarises the key points that emerged from the analysis of questionnaires administered to protein crop farmers during the fieldwork carried out for this evaluation. Looking ahead, simulations of full decoupling, based on the results of the farmers' survey, are indicative of a fall in protein crop area of around 15% from 2008 levels.

7.2.1 Protein crop areas

- There are no apparent trends on the changes in area dedicated to protein crops over the period 2003/04-2008/09. In terms of output, a decrease of more than 50% accounts for the largest frequency.
- Plantings take place throughout the winter, while the crop is mainly harvested in July and August.
- The average reported proportion of arable area planted to protein crops was 18%.

7.2.2 Crop rotations

- Nearly 90% of those interviewed said they had a rotation cycle for protein crops.
- Barley was is the crop mostly used in rotation with protein crops.
- The most popular reason for using protein crops in the rotation cycle is their nitrogen fixing quality. Other reasons are that they help improve soil quality and control weeds.
- Sunflower, followed by rapeseed and common vetch, is the main alternative to protein crop in a rotation cycle.

7.2.3 Production of Alternative (non-protein) Crops

- 60% of farmers said that the total area dedicated to other protein crops had not changed since 2003.
- Just below 50% said that protein crops have been replaced by other crops. Common vetch and barley were the most popular replacements.

7.2.4 Protein crop quality

- 40% of farmers have changed the variety of protein crops over the last five years to improve yields and increase disease resistance.
- 56% of farmers obtained seed from sources other than cooperatives and processors. 36% said they obtained protein crops seed from cooperatives while 16% said that processors was their source.

7.2.5 Outlets for your protein crops

- The use of protein crops for on farm feed is very limited.
- Traders are the main buyers of protein crops, followed by cooperatives and other agents.
- 80% of farmers said that protein crops were used in feed outlets. Of these, the majority reported that this was destined for the national market.

- In contrast, only 4% said that their protein crop was to be used within food outlets.

7.2.6 Protein crop marketing

- Supply contracts include price and, in some cases, quantity (specified as fixed depending on the area cultivated and the yield).
- 50% of farmers said that where they had a contract, they were permitted to sell their protein crops to other processors outside the contract.
- Impurity was commonly quoted as an indicator of quality, followed by humidity.
- Nearly 90% said that they received a premium or incentive from the processor for improved quality of protein crops.
- The average price received per tonne of field peas increased from €130 (s.d. 63.8) in 2003 to €181(s.d. 66.8) in 2007 and €189 (s.d.87) in 2008.

7.2.7 Use of inputs

- The majority of respondents reported no change in the use of seeds, fertilisers, sprays, irrigation and labour. However, over three quarters said that they were using new phytosanitary products.
- Organic farming accounts for less than 10%
- Protein crops are mainly grown under non-irrigated conditions.
- Most farmers have not made any investments linked to protein crop farming in the last five years.

7.2.8 On-farm employment and labour used

- Around 75% of farmers said that less than 20% of household employment is derived from protein crop production.
- 16% of farmers indicated that less than 20% of employed (i.e. non-family) labour time is spent on protein crop production.
- Just under half said that they contracted all or some of their operations, in particular harvesting.
- Nearly 75% of those interviewed derived their income completely from farm activities. For the majority, protein crop production contributes less than 20% of farm revenue.
- Profitability is mainly judged per hectare.
- Barley, soft wheat and cereal were commonly reported as the most profitable crops in 2008.
- Over 50% of farmers responded that crop profitability had changed over the last five years. Cereals where still commonly reported as the most profitable crops in both 2003 and 2008.

7.2.9 The impact of reforms in the Common Agricultural Policy

- Just below 50% of farmers stated that the introduction of decoupled payments had not affected the area they had plant to protein crops. Around a third said that it had a slight impact while 16% said that had impacted greatly.

- More than half of respondents said the change in payment system for protein crops since 2003 had affected the area they planted to protein crops. Of these, the effect was great for around 40%. A third of respondents said that this payment had affected input use.

- Our responses indicate that as the level of payment tied to protein crops decreases, area planted to protein crop decreases. If coupled payments were completely removed, area under protein crops would fall by 14%. If coupled payments rose to €100, area under protein crops would fall by over 30%.

- Agri-environmental programmes are the most common additional payments available for growing protein crops. Two thirds of framers said that these payments were important in their decision to grow protein crops.

- The most common influences taken into consideration in the decision to grow protein crops were the benefits when farming other crops (higher yield, lower input use); other considerations include protein crop area payment and the price paid by the trader/processor.

- More than half of respondents indicated that their reasons for growing protein crops had changed since 2003. The main reasons were the reduction of protein crop payments and the lower price received.

8. Impact of the CAP measures upon the local protein crop sector

Area given over to protein crops rose sharply after the 2003 reform. The average area dedicated to protein crops was 187,000 hectares per annum over the period 2004-05 to 2008-09, compared with 111,000 hectares per annum over the period 2000-01 to 2003-04. The areas given over to field peas and field beans increased over the same period, by 100% and 44%, respectively. In contrast, the area covered by sweet lupins fell by 32%, albeit from a smaller starting point than the other two protein crops.

An interesting point to note, however, is that, if we restrict our analysis to the trend in protein crop area since the introduction of the changes brought about by the 2003 reform[15], there is clear evidence of a downward trend. Area given over to all protein crops peaked in 2005-06, to decline steadily in the subsequent years. Aggregate protein crop area stood at 137,000 hectares in 2008-09, compared with 225,000 hectares in 2005-06.

Based on our assessment, it is doubtful whether these trends are the consequence of the 2003 CAP measures relating to protein crops. Rather, there is evidence that a number of exogenous factors seem to have affected the production of these crops.

In terms of the profitability of protein crops relative to competing COP crops, our analysis reveals that, in the case study region of Castilla-La-Mancha, field peas have been at a disadvantage to common wheat, barley and oats, throughout the entire evaluation period. This disadvantage was not affected by the changes brought about by the 2003 reform. When the competitive position of field peas is contrasted with that of sunflower and bitter vetch (a type of grain legume), the only year when gross margins were in favour of field peas was 2006.

Protein crops and grain legumes share the same beneficial effects in a rotation. Until 2006, this latter group of crops benefited from a special regime of coupled aid. There is weak evidence to support the hypothesis that, in Castilla-La-Mancha, cultivation of field beans benefited from the termination of the grain legume payment (at the expense of bitter vetch) in the years immediately following the ending of this support. At an aggregate level, however, there is no strong evidence to support the hypothesis that the end of the grain legume coupled aid played a significant role in the changes that occurred in protein crop areas in Spain after the 2003 reform, and in particular after 2005, when the grain legume coupled aids ceased.

[15] These are the partial integration of the previous aid for protein crop production into the Single Payment Scheme and the special aid for protein crops set at €55.57 per hectare.

UK Protein Crop Sector

At a farm level, interview evidence indicates that the farmer's choice of growing protein crops is mainly dictated by rotational reasons. The CAP support and the price paid by the end users have less of an influence. However, within the CAP measures applicable to protein crops (but outside the scope of this evaluation), agro-environmental programmes were cited as being relevant, for a sizeable share of the sample of farmers surveyed.

At the same time, there is strong evidence of a decline in the use of protein crops by the feed compounding sector. This is due to a number of reasons. The 2001 meat and bone meal ban, following the outbreak of BSE, has meant that incorporation rates of protein crops (the typical complement to this feed ingredient) have fallen. Also, the adoption of American feed formulas, privileging oilseed meals such as soybean and sunflower meal, which are readily available in the EU market, has been to the detriment of protein crop use.

This monograph has the following structure.

- We consider, first, the development of the protein crop sector within UK
- Then, we review the development of alternative cereals, oilseed and protein (COP) crop production within the country.
- We describe the main production systems applied to protein crops, notably as regards crop rotations.
- We then analysis gross margins on protein crops vs. those on alternative COP crops.
- We present analysis from the FADN database of the significance of protein crops in UK farm incomes.
- We summarise the evidence collected during the fieldwork. The main tools of investigation consisted of questionnaires administered to protein crop farmers and interviews with feed compounders.
- We conclude with a discussion of the impact of the CAP measures upon the local protein crop sector.

1. The development of the protein crop sector

This section examines the changes that have occurred since the reforms of 2003 in the area, output and yields of protein crops in the United Kingdom.

1.1 Total protein crops

The most popular protein crops in the UK in recent years have been field beans. A distinction is typically made between spring and winter beans, according to their time of planting.

Field peas (which are today planted almost exclusively in spring) are some way behind field beans in plantings.

Sweet lupins make a negligible contribution to the protein crop area, as Diagram UK.1 reveals. The diagram also shows that:

- Peas: The spring pea area has declined consistently over the past decade, falling by 70% since 2000. The field pea area is now close to 25,000 hectares for the UK, after peaking earlier this decade at over 95,000 hectares.

- Spring field beans: The area planted to field beans in the springtime has declined considerably in the past couple of years, from a level close to 100,000 hectares from 2002 to 2006 to one below 60,000 hectares in 2007 and 2008.

- Winter field beans: The area planted to winter beans has held up a little better than in spring beans in the past two years, and the acreage expanded during the period from 2000 to 2006. This growth reversed abruptly in 2007, with the crop area falling from a level of more than 80,000 hectares in 2006 to one of less than 60,000 hectares in both 2007 and 2008, which was very similar to the trend observed in spring planted field bean areas.

- Sweet lupins: The area under sweet lupins increased from 2,000 to 6,000 hectares between 2000 and 2003. Since then it has not changed.

Diagram UK.1: UK protein crop areas, 2000-2008

Source: PGRO

The recent declines in UK protein crop areas can be put into a longer term context by considering the trends in plantings from the 1980s onwards. We can also broaden the scope of our enquiry by introducing yield and output data in Diagram UK.2, where we plot the combined field pea and field bean data. The diagram yields the following conclusions:

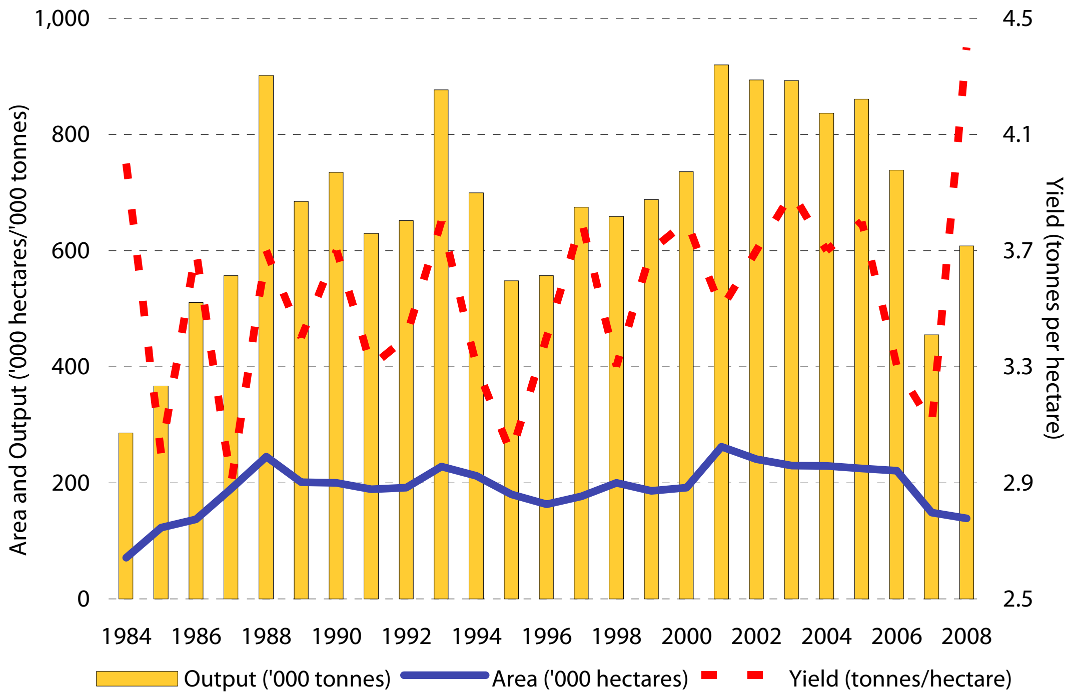
- Area: Despite the evidence of Diagram UK.1, we now see that, with the notable exceptions of 2007 and 2008, total area under field peas and field beans has in fact been rather stable in the UK since the late 1980s, averaging 210,000 hectares per annum from 1987 to 2006. In fact, a small peak emerged in the early 2000s, exaggerating the rate of decline apparent in the last two years in Diagram UK.1.

- The decline in 2007 and 2008 is, however, dramatic, with the combined areas falling by over a third from its average level to below 140,000 hectares. Within the total, we observe that, while field pea areas declined in the early to mid 2000s, this was largely offset by expansion in winter bean plantings, which postponed the decline in the overall area until 2007, when both field pea and field bean areas declined.

- Yields: The story of protein crop yields is one of volatility and stagnation. Annual fluctuations are commonplace, and the yield trend over the entire period registers only 0.3% annual growth, pulled up considerably by the 2008 yield. Rather startlingly, the highest yield in the series before the excellent yields of 2008 were achieved occurred in the very first year in the diagram, 1984!

- Production: The broadly flat trend in the combined field pea and field bean crop areas observed over the two decades between 1987 and 2006 meant that it was largely yield volatility that has generated the annual fluctuations in UK protein output. Output in fact climbed quite impressively from 1995 to 2001, but then reached a plateau before plummeting in 2007 as the combined area declined sharply. The excellent 2008 yields offset the impact of further declines in the area under the two crops.

Diagram UK.2: UK protein crop area, output and yields, 1984-2008



Source: DEFRA

Having reviewed the overall protein situation, we now describe the separate experiences of field peas and field bean sectors over the past two decades.

1.1.1 Field peas

Diagram UK.3 illustrates the development of the national output, areas and yields of field peas in the UK in the years after 1984. Observations from the diagram include:

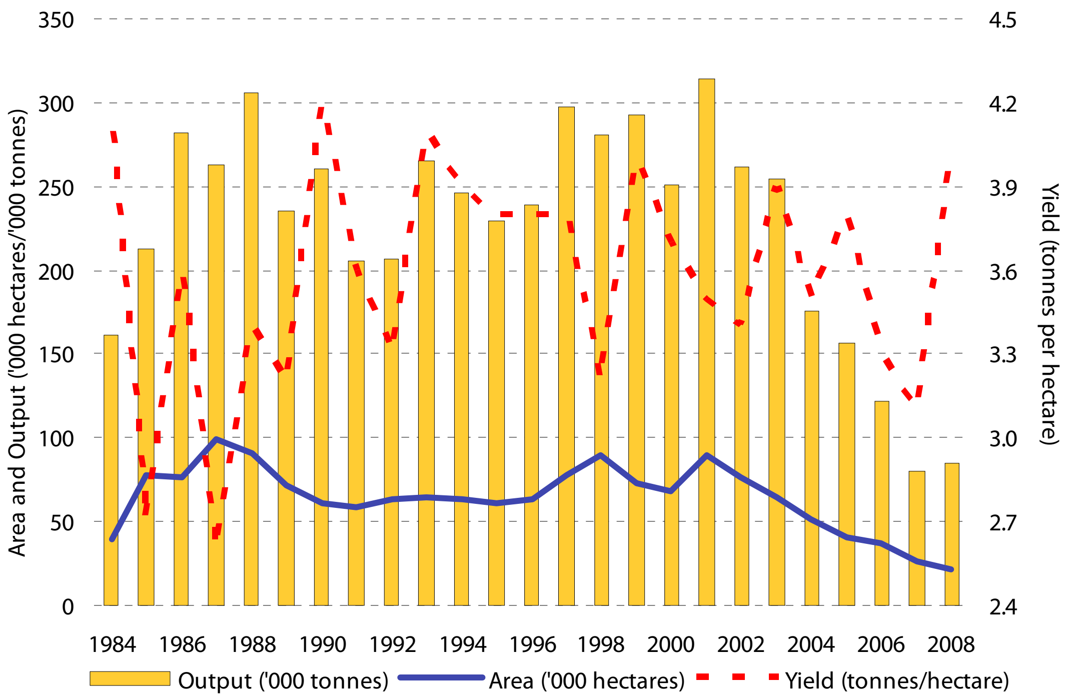
- Area: the total field pea area peaked in the mid-1980s and again just over a decade later in the late 1990s, with the all-time peak recorded in the early 2000s.

- Since 2001, however, seven years of uninterrupted and persistent declines have occurred. As a result, the total area stood at its lowest levels in the past 25 years in 2007 and 2008.

- Yields: The variability of yields has been reduced in the past decade, but there is little evidence of yield growth. In fact, yields have increased at an annual rate (fitting an exponential time trend) of only 0.3% over the period since 1984. The excellent yield achieved in 2008 was actually below the peak yields observed in 1984, 1990 and again in 1993. The yields obtained on field pea crops are very sensitive to the weather conditions at the time of harvesting. Pod splitting can cause heavy crop losses, while the lodging of crops after strong winds and rain can create difficulties during harvesting.

- Production: Output has declined precipitously since 2001, as the declining area and weak yields have occurred simultaneously. By 2007, output (at 80,000 tonnes) was 75% down from its 2001 peak, and 65% below its average for the whole period (227,000 tonnes) since 1984. The high yields of 2008 offset the effect of further declines in the field pea area.

Diagram UK.3: UK field pea area, output and yields, 1984-2008



Source: DEFRA

1.1.2 Field beans

For field beans, separate data are not available for the whole period for winter and spring beans, but as we have seen, winter beans have fared better in the latest decade than spring beans. After 2006, however, areas contracted substantially for both crops. Data on areas, yields and output are illustrated in Diagram UK.4.

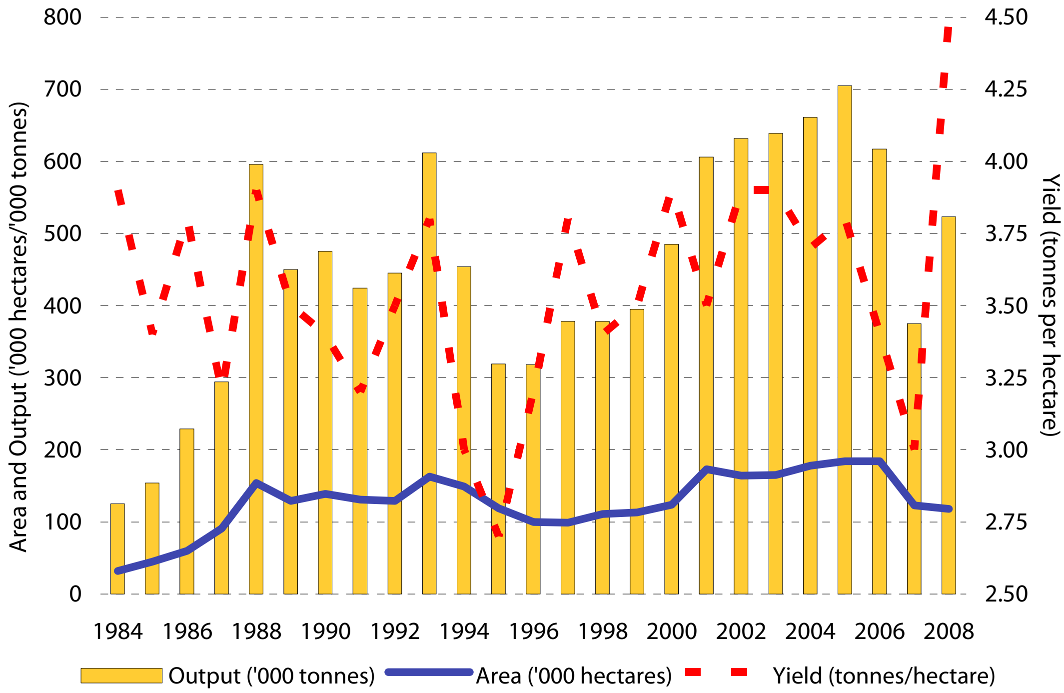
- Area: The total field bean area in 2008 was well over five times the area of field peas in the UK, with close to 120,000 hectares of beans versus just over 20,000 hectares of peas. In the 1980s, however, the field pea area was the larger. In the 2000s, the area gap widened considerably in favour of beans, with a degree of displacement of the field pea area by winter beans in particular. Nonetheless, as with peas, the collapse in areas after 2006 has been severe for beans.

- The peak in the field bean area in 2005 and 2006 was helped considerably by the introduction of a very good new variety, which many farmers tried. However, farmers lost interest in field beans when the prices of all COP crops increased after 2006, making benefiting yielding crops more than low yielding field beans.

- Yields: Field bean yields have fluctuated about a fairly stable mean over this period, with zero trend yield growth from 1984 to 2007. This improves to 0.2% when the excellent 2008 yield is included.

- Production: The decline in both acreage and yields in the past few years caused field bean output to fall below 400,000 tonnes in 2007, a decline of over 45% from only two years previously. The high 2008 yields pulled output back above 500,000 tonnes. Prior to 2007, UK bean output from 2001 to 2006 was consistently maintained above 600,000 tonnes.

Diagram UK.4: UK field beans area, output and yields, 1984-2008



Source: DEFRA

1.1.3 Foreign trade

Table UK.1 describes the development of the country's export, import and net export flows in the three protein crops, combining intra-and extra-EU volumes.

The UK is consistently a large exporter of field beans. Net exports approached 160,000 tonnes in both 2000 and 2003, but were just below 100,000 tonnes in 2007.

In field peas, the UK has swung from being a net exporter of almost exactly 40,000 tonnes in 2002 to a net importer of 31,700 tonnes in 2007. It has continued to make exports throughout the period after 2004 when its net trade balance slipped into a deficit. It is an exporter of higher value food grade field peas, as well as of premium pet food grade peas, but is mainly an importer of field peas of a lower quality.

For sweet lupins, the net foreign trade is negligible, with both imports and exports only once ever exceeding 100 tonnes since 2000.

Table UK.1: UK Foreign Trade, Combining Intra- and Extra-EU Trade, in Protein Crops, 2000-2007 (tonnes)

	Field peas			Field beans			Sweet lupins		
	Exports	Imports	Net Exports	Exports	Imports	Net Exports	Exports	Imports	Net Exports
2000	32,124	10,226	21,898	159,488	428	159,060	5	5	0
2001	35,041	14,897	20,144	75,728	351	75,377	30	93	-63
2002	69,082	29,107	39,975	97,028	1,365	95,663	15	344	-329
2003	61,608	25,942	35,666	159,737	2,079	157,658	68	75	-6
2004	39,488	19,741	19,747	113,499	542	112,957	70	37	34
2005	32,313	32,397	-84	95,598	647	94,951	139	9	130
2006	25,651	33,937	-8,286	108,735	705	108,030	27	33	-6
2007	14,422	46,115	-31,692	100,394	1,320	99,074	91	3	88

Sources: FAO, COMEXT

2. The development of alternative crop production

Table UK.2 summarises the trends in the areas under each of the major cereals, oilseed and protein (COP) crops since 2000-01, before the 2003 reform. The bottom rows of the table permit one to compare areas before and after the reform. The main points to note are:

- The protein crop sector as a whole has contracted in its overall area since 2000 as indicated in Diagram UK. 2. Between the period from 2000-01 to 2003-04 to the period from 2004-05 to 2008-09, the total protein crop area declined by 15%, and the decline gathered pace towards the last year, 2008-09.

- Within the sector, field peas were the only protein crop to have experienced a decline in area (of 49%) comparing pre-and post-reform periods, averaging 42,000 hectares in the post-reform era, but occupying only 26,000 hectares in the last year.

- Field beans increased their area after the reform, albeit, by a mere 2% between the two periods. The combined area under winter and spring field beans covered 112,000 hectares in 2008-09, the lowest field bean area in the table.

- Sweet lupin areas rose by 41% between the two periods, but the area is not large, and was stable at 6,000 hectares after 2003-04.

- The other major COP sector that lost ground after the reform was barley, whose average area was down 16% after the reform.

- Among the more significant COP crops, the main gainers from producers' decisions to respond to the energy crop measures by adapting their choice of crops, were rapeseed (with an area increase of 29% after the reform and common wheat (with an advance of a more modest 2%).

The combined area under the major COP crops declined by just 1% after the reform. However, in 2008-09, when the compulsory set-aside was set at 0%, the combined area was at its highest level since the turn of the century.

Table UK.2: Areas of the major cereals, oilseeds and protein crops in the UK, 2000-2008 ('000 hectares)

	Protein crop	*Field pea*	*Field bean*	*Sweet lupin*	Rapeseed	Sunflower	Common wheat	Barley	Maize	Durum wheat	Other cereals	Total Area
2000-01	208	84	122	2	402	2	2,085	1,128	*0*	*1*	*136*	3,962
2001-02	273	96	173	4	452	0	1,635	1,245	*0*	*1*	*133*	3,739
2002-03	248	82	161	5	432	1	1,994	1,101	*0*	*2*	*148*	3,926
2003-04	234	68	160	6	542	0	1,836	1,072	*0*	*2*	*146*	3,832
2004-05	256	59	191	6	557	0	1,991	1,005	*0*	*1*	*129*	3,939
2005-06	238	50	182	6	593	1	1,870	941	*0*	*2*	*117*	3,762
2006-07	227	40	181	6	511	1	1,833	882	*0*	*2*	*147*	3,603
2007-08	156	34	116	6	682	1	1,816	898	*0*	*0*	*157*	3,710
2008-09	144	26	112	6	600	0	2,075	1,036	*0*	*0*	*198*	4,053
Average pre-reform	241	83	154	4	457	1	1,888	1,137	0	2	141	3,865
Average post-reform	204	42	156	6	589	1	1,917	952	0	1	150	3,813
Percentage change	-15%	-49%	2%	41%	29%	-14%	2%	-16%		-38%	6%	-1%

Source: For non-protein crops, the sources were FAO, Eurostat, and for 2008-09, the data have been derived from estimates prepared by COPA-COGECA. For protein crops, the data have been obtained from DEFRA. It should be noted that the DEFRA data (which are consistent with the areas on which the protein crop special aids were paid) are much higher than the FAO data for the same crops.

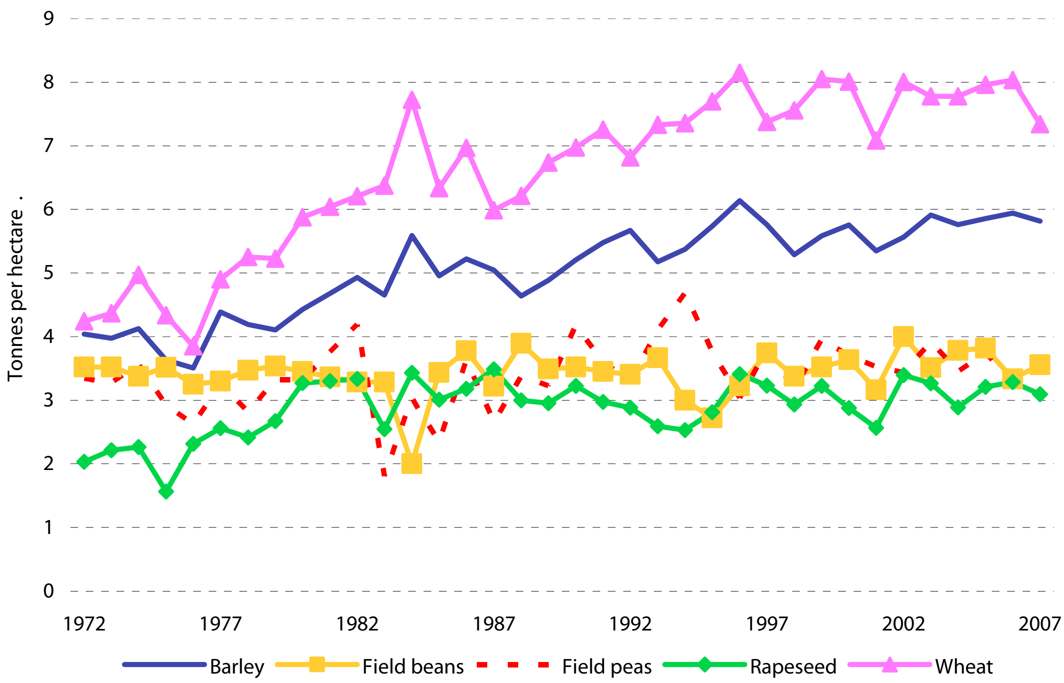
Note: Pre-reform is the period from 2000-01 to 2003-04; post-reform is the period from 2004-05 to 2008-09

3. The production systems applied to protein crops

Protein crops are a comparatively low input-low output COP crop. Not only are their yields lower than those of most other COP crops, other than rapeseed, whose unit value is typically significantly higher by virtue of its oil content, but the growth in yield tends to be low when contrasted with other major arable crops in the UK.

To illustrate the differences in the growth rates in yields, we have prepared Diagram UK.5. If one fits an exponential time trend to the yields, one finds that the average rate of growth in field pea yields from 1972 to 2007 was 0.6% and that of field beans 0.2%, while the average growth rates for common wheat, barley and rapeseed were 1.8%, 1.3% and 1.0%, respectively.

Diagram UK.5: Yields of major UK arable crops, 1972-2007



Source: DEFRA

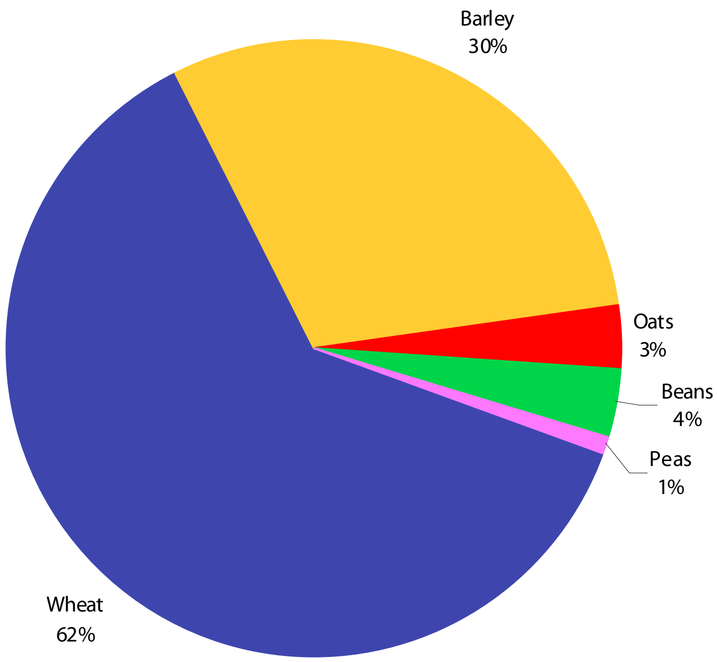
One possible explanation for the poor yield performance of the two protein crops is the difference in scale of the areas sown to the alternative arable crops. The potential returns for seed breeding companies are much higher from the major cereal and oilseed crops, with vast acreages on offer in wheat, barley and rapeseed. Also field peas and field beans are suitable for planting farm-saved seed, since the seed does not need treatment before planting. The retention of seeds in this manner works to the detriment of seed breeders. Winter beans are said to be the biggest culprit in this respect, as far as seed breeders are concerned.

With these observations in mind, it is difficult for major seed developing companies to commit resources to the development of protein varieties with the same vigour as they would to wheat, for example. Diagram UK. 6 clarifies this point. It indicates that field pea and bean sales of seed by weight accounted for only 5% of the total volume of seed sales in 2008, even for a leading protein seed manufacturer.

A further disadvantage often mentioned for field peas and beans is that yields are volatile, with large areas vulnerable to rain and wind damage to stalks, particularly in peas. Diagram UK.7 supports this view.

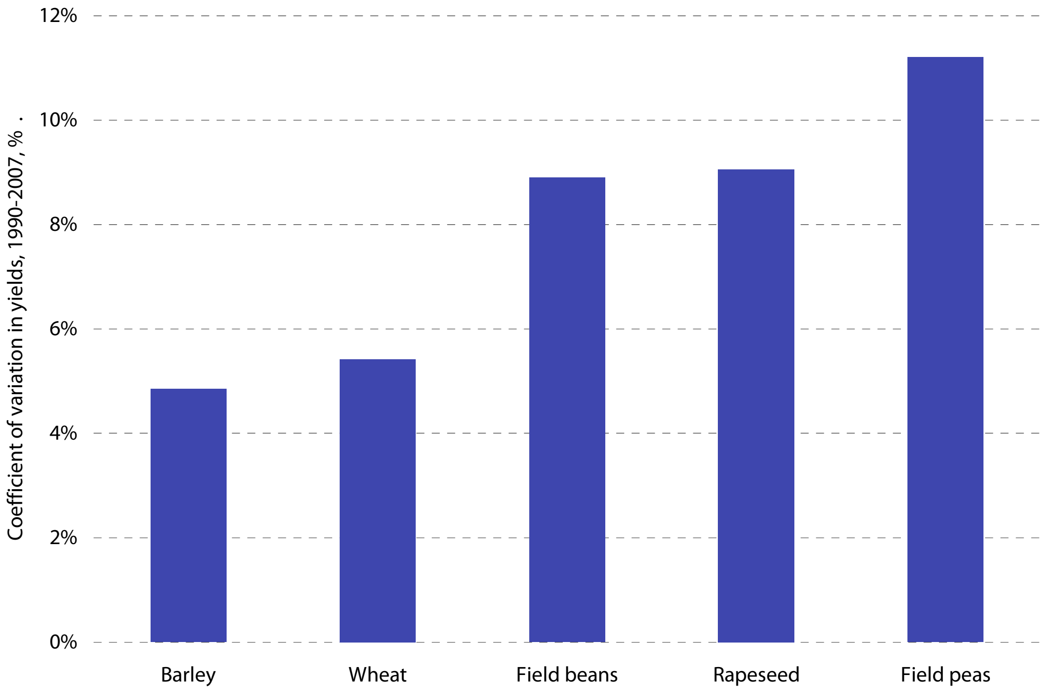
Since 1990, field pea and bean yields, particularly the former, have been more volatile, in terms of their coefficients of variation (their standard deviation divided by their mean value) than other COP crops, though rapeseed displayed similar yield volatility to field beans.

Diagram UK.6: Proportion of seed sales from major crops for leading UK seed developer



Source: interviews

Diagram UK.7: UK variability in yields of major crops, as measured by coefficient of variation, 1990-2008



Source: FAO

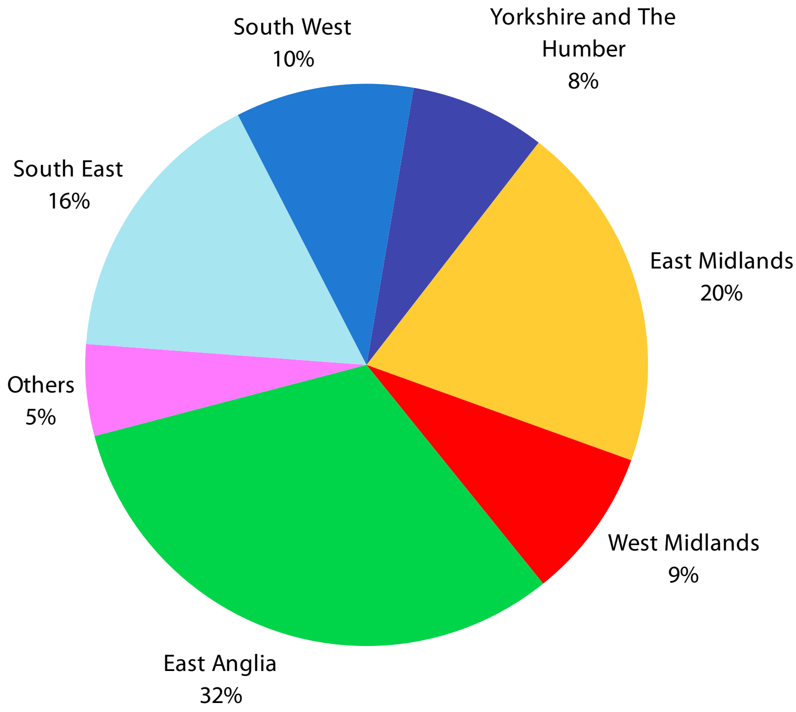
In the East Anglia region of the UK, the largest protein crop growing region in the UK, evidence from producers suggests that field pea and bean crops are primarily grown for rotational and opportunistic reasons.

- Rotational reasons include the benefits of natural control of pests and grasses, plus the value of nitrogen-fixing, which is greater in beans, and the boost to the yields obtained on the subsequent cereal crop.
- Opportunistic reasons include plantings after wet summers, when winter crops have not been able to be sown in time, and plantings to take advantage of nitrogen fixation when fertiliser prices are high.

4. Gross margins

The region selected for a focus in this monograph is East Anglia, the largest single protein crop producing region in the UK (Diagram UK.8 describes the regional distribution of protein crop areas in the UK, 97% of which is situated in different parts of England). East Anglia is the only region for which comprehensive time series data are available for protein crops and the main alternative COP crops on production costs, revenues and gross margins. These data are available for both field peas and field beans. We consider them separately later in this section.

Diagram UK.8: Protein crop areas in the UK, by region



Source: DEFRA

4.1 Comparative gross margins and prices for COP crops

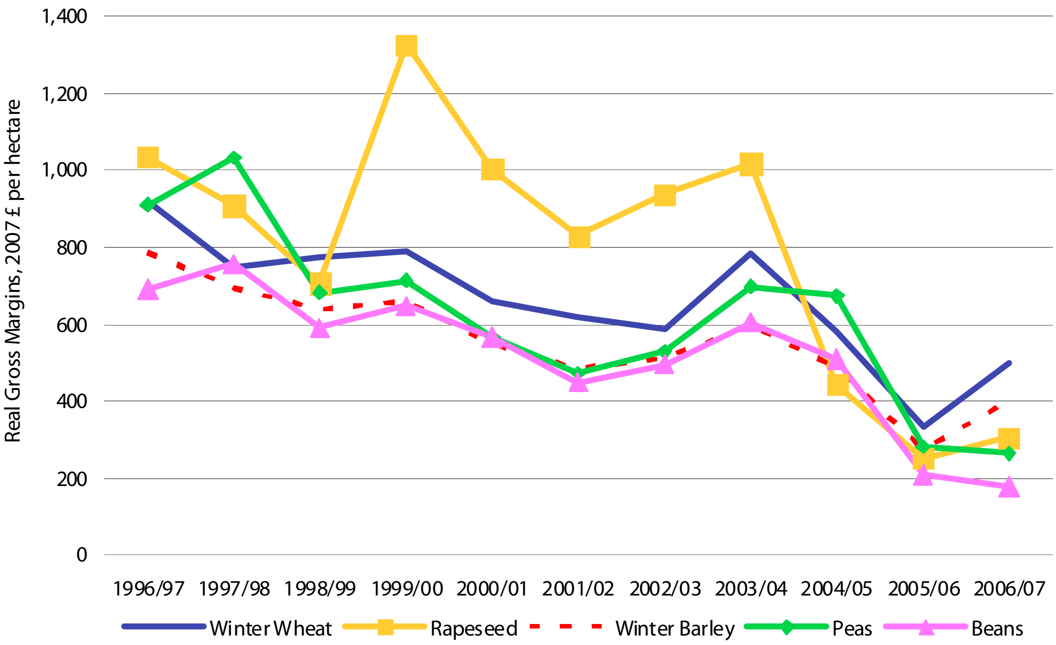
Before turning to the detailed cost and margin data for protein crops in East Anglia, which are presented in Euros, we first provide a less detailed review of the development of real margins and relative prices for arable crops in England from 1996/97 to 2006/07. All these margins are expressed in real UK pounds, applying the UK agricultural price deflator provided by DEFRA.

Diagram UK.9 reveals that rapeseed margins were especially strong from the mid 1990s to 2003/04, but since then there has been a convergence among crop margins. The general direction of real margins is downward, but this is somewhat misleading, as the data include coupled payments. As these payments have declined and become increasingly decoupled, this has had a significant impact on gross margins.

In order to reflect the choices facing individual producers, who make their decisions regarding the areas to plant to individual crops on the basis of the comparative returns from the alternatives available to them, we have prepared Diagram UK.10.

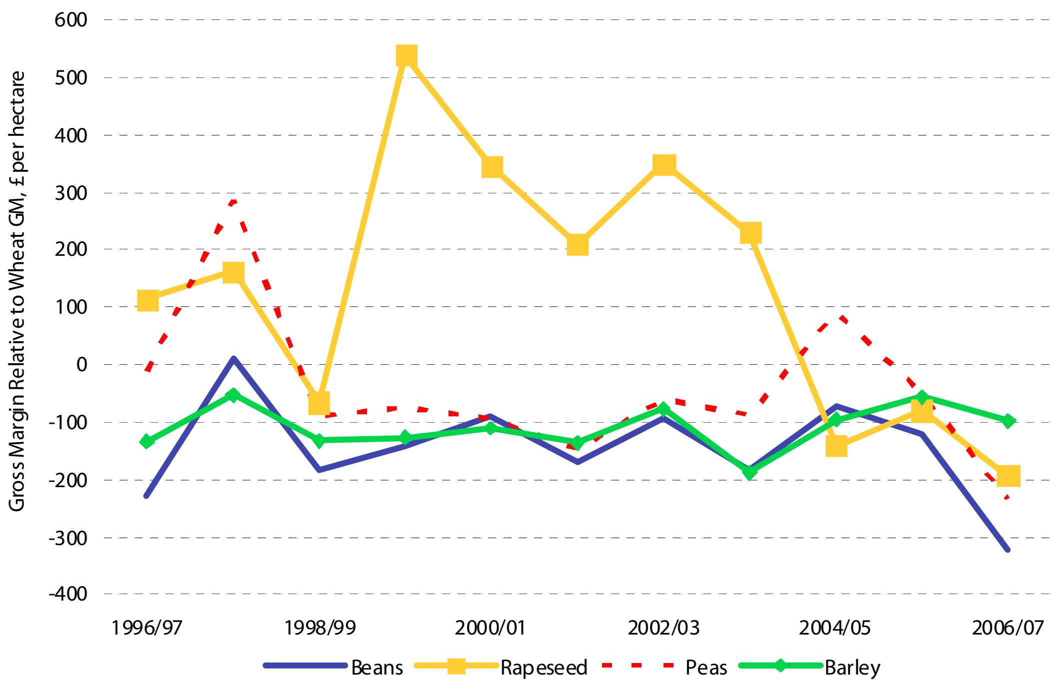
This diagram compares each alternative crop's gross margins against the gross margin on the most important single crop, common wheat, in the same year, thereby focusing upon the farmers' crop choice in the face of the general downward trend brought about by declining coupled payments. The comparison of relative gross margins over this period reveals that, after five years in which rapeseed was the most profitable option, and one year when field peas yielded the highest gross margin, winter wheat has been most profitable choice, with field beans the least profitable, in terms of gross margin comparisons.

Diagram UK.9: Real gross margins for major COP crops in England (including coupled support where applicable), 1996/97- 2006/07



Sources: Cambridge University, DEFRA

Diagram UK.10: Real gross margins for leading arable crops in England, expressed as differentials from the winter wheat gross margin (including coupled support where applicable), 1996/97-2006/07



Sources: Cambridge University, DEFRA

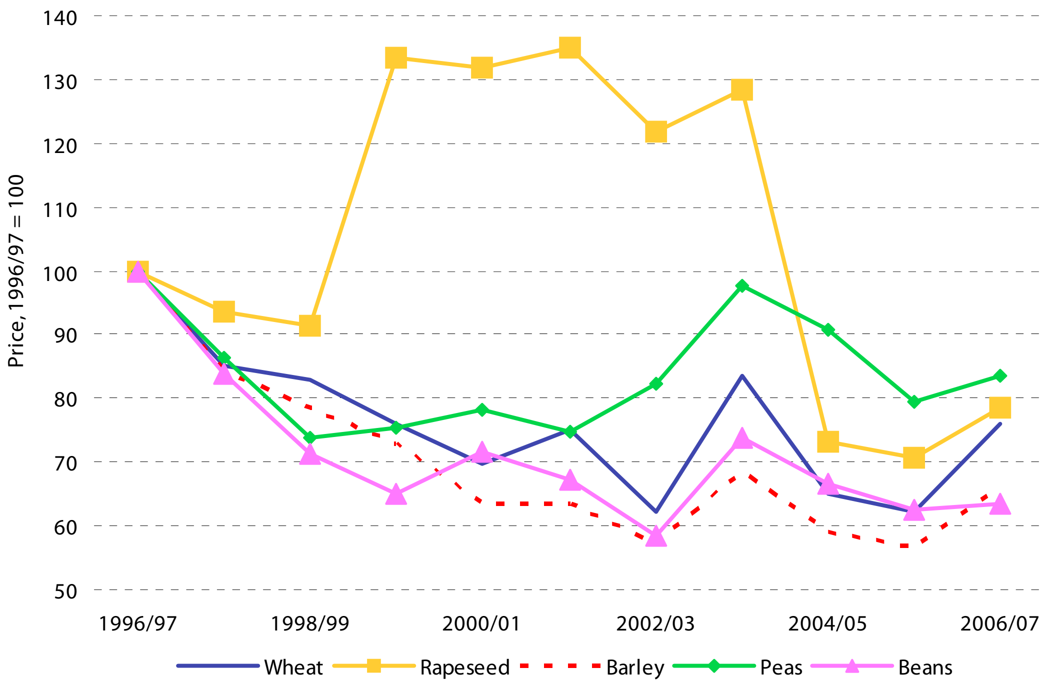
As costs per hectare for the different crops tend to move in parallel over time, annual fluctuations in margins are linked closely with movements in revenues per hectare, which in turn depend on yields and farm-gate producer prices.

We have already seen how yields fluctuate from year to year, but they have not been as volatile as prices in recent years.

Diagram UK.11 plots farm-gate prices for the main COP crops in East Anglia from 1996/97. Price have been indexed to identify the *relative* price changes over the period, using 1996/97 as the base year.

- Rapeseed farm-gate prices were relatively stronger than those for other COP crops for most of the period under review.
- Indeed, only the prices of field peas (from 2004/05 to 2006/07) were stronger in some years than those of rapeseed.
- It is interesting to observe that field pea prices were either in first or second place in the rankings from 2000/01 to 2006/07, while field bean prices were among the weakest ones in the comparison.
- Yet, the field pea area contracted sharply, at the same time as the field bean areas tended to expand.

Diagram UK.11: Farm-gate price indices for major arable crops in East Anglia, 1996/97-2007/08 (where 1996/97 prices =100)



Sources: Cambridge University, DEFRA

4.2 Field pea revenues and costs

Table UK.3 lists the revenues and variable costs of field pea producers in East Anglia. The data on yields, prices and the components of costs are from Cambridge University. The coupled payment data are derived from analysis of the FADN data for East Anglia. They are the average coupled payments per hectare of protein crops of those producers in the database who produced protein crops. The derivation of gross margins for alternative crops is shown in Table UK.4.

The table reveals that:

- The changes in the regime, which were implemented in two stages, with the change in the coupled special aid for protein crops introduced in 2004, while the application of the SPS form of single farm payment occurred in 2005.
- This caused the coupled support for field peas to decline from an average of €415 per hectare in the three years immediately prior to the reform to €50 per hectare from 2006 (this is what is reported in the FADN database).
- These changes caused total field pea revenue to tumble from a peak of €1,244 per hectare in 2004, the year before the introduction of the SPS to €709 in 2005.
- Variable costs for field peas have remained fairly stable since 2001, ranging between a low of €294 (in 2005) and a high of €319 per hectare in 2002.

Table UK.3: East Anglia, revenue and variable costs of field pea production (€/ha.)

	1999	2000	2001	2002	2003	2004	2005	2006
Yield (t/ha)	4.4	3.8	3.3	3.5	4.0	4.4	3.8	3.5
Field Pea Price per tonne	174	184	174	181	206	191	173	190
Protein Crop Arable Aid (€/ha)	*452*	452	411	419	416	349		
Protein Crop Special Aid (€/ha)						52	52	50
Return per ha								
Field Pea Price	771	703	571	637	818	842	656	664
Coupled Payment	452	452	411	419	416	402	52	50
Total Revenue	**1,223**	**1,155**	**982**	**1,056**	**1,235**	**1,244**	**709**	**714**
Variable costs per ha								
Seed	137	143	124	129	126	120	133	127
Fertiliser	26	26	21	24	15	15	18	27
Crop Protection	166	168	140	161	161	167	130	145
Other (e.g. irrigation, drying)	8	8	10	5	7	10	13	12
Total variable costs	**337**	**345**	**295**	**319**	**309**	**311**	**294**	**311**
Gross margins	**886**	**809**	**687**	**737**	**926**	**933**	**414**	**403**

Sources: Cambridge University; FADN database for estimates of coupled support.

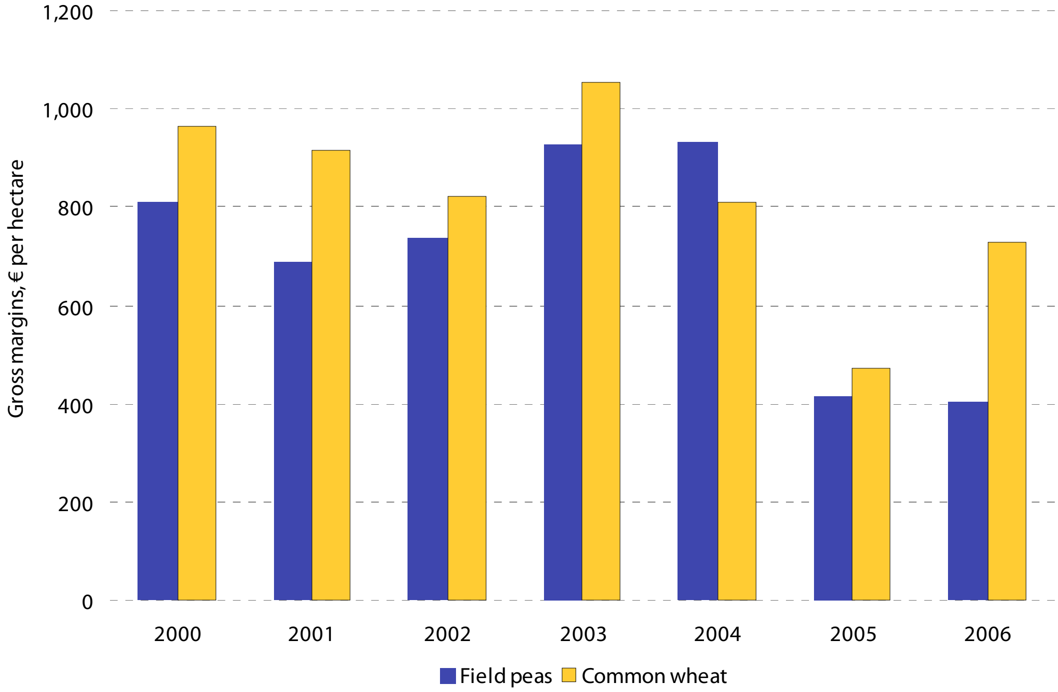
4.2.1 Field pea gross margins

The evolution of the gross margins for field peas when contrasted with the main alternative COP crops (common wheat, barley and rapeseed, as well as field beans, their competitor among the protein crops) is illustrated in Diagrams UK.12-UK.15. The main points to note from the comparison are consistent with those described in the preceding section.

- Gross margins varied between 2000 and 2006, but were low for all crops in 2005 and 2006, as a result of the implementation of the SPS and the decoupling of a large number of arable crop payments.

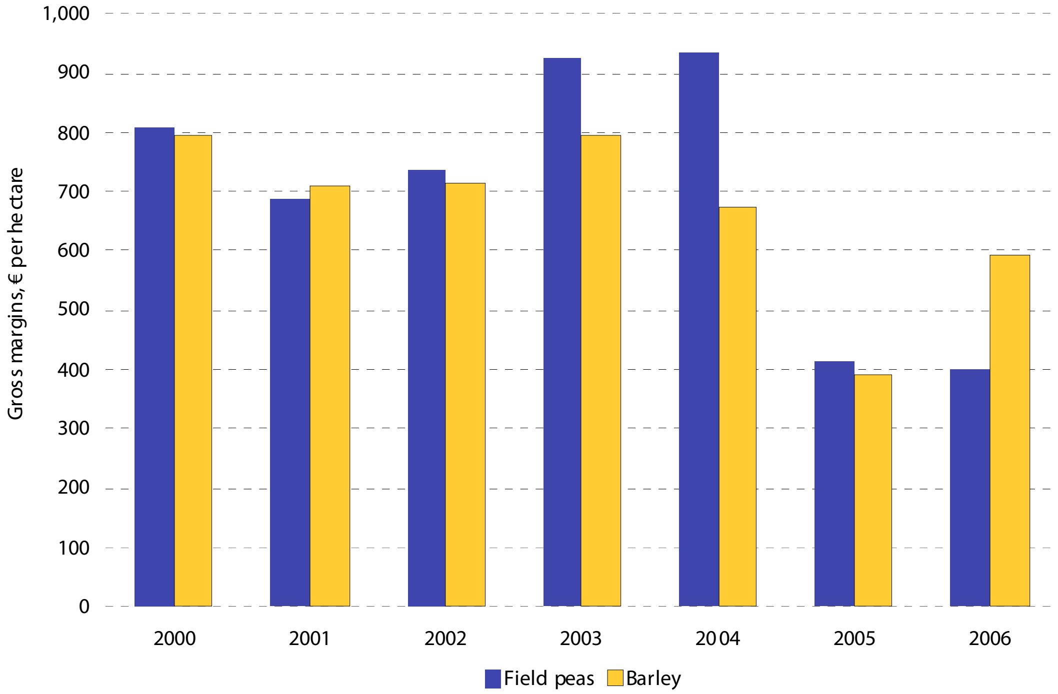
- Field peas recorded the highest gross margin of all the crops in 2004, but had a lower margin than the two cereal crops and rapeseed in 2006.
- Field peas consistently achieved a slightly higher gross margin than field beans.

Diagram UK.12: East Anglia, field pea gross margins vs. common wheat, 2000-2006



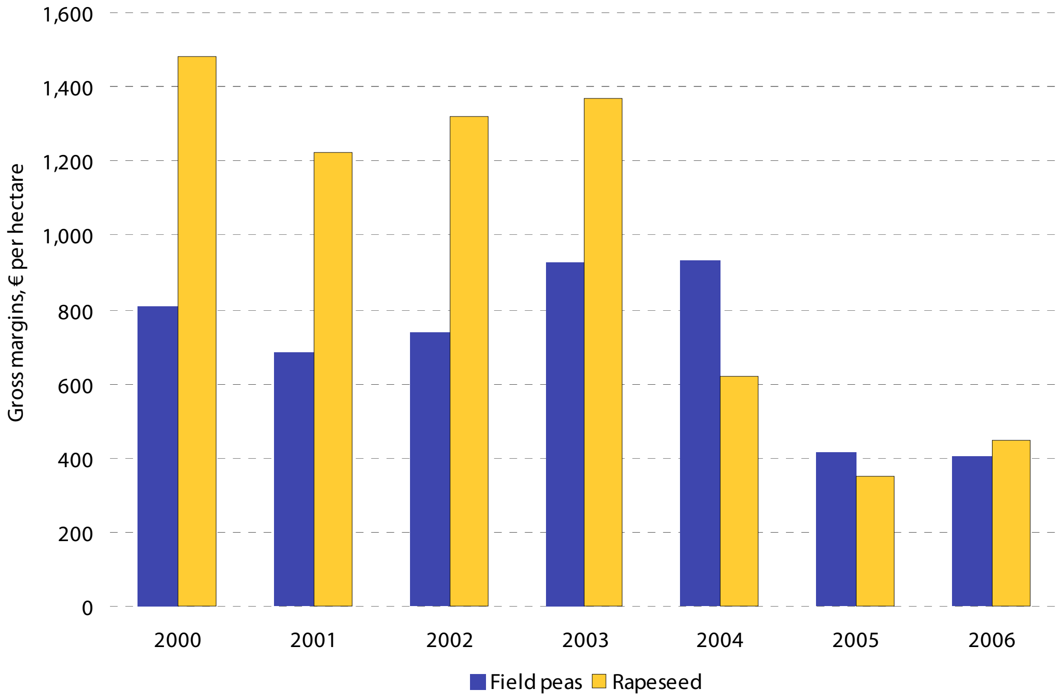
Source: Cambridge University

Diagram UK.13: East Anglia, field pea gross margins vs. barley, 2000-2006



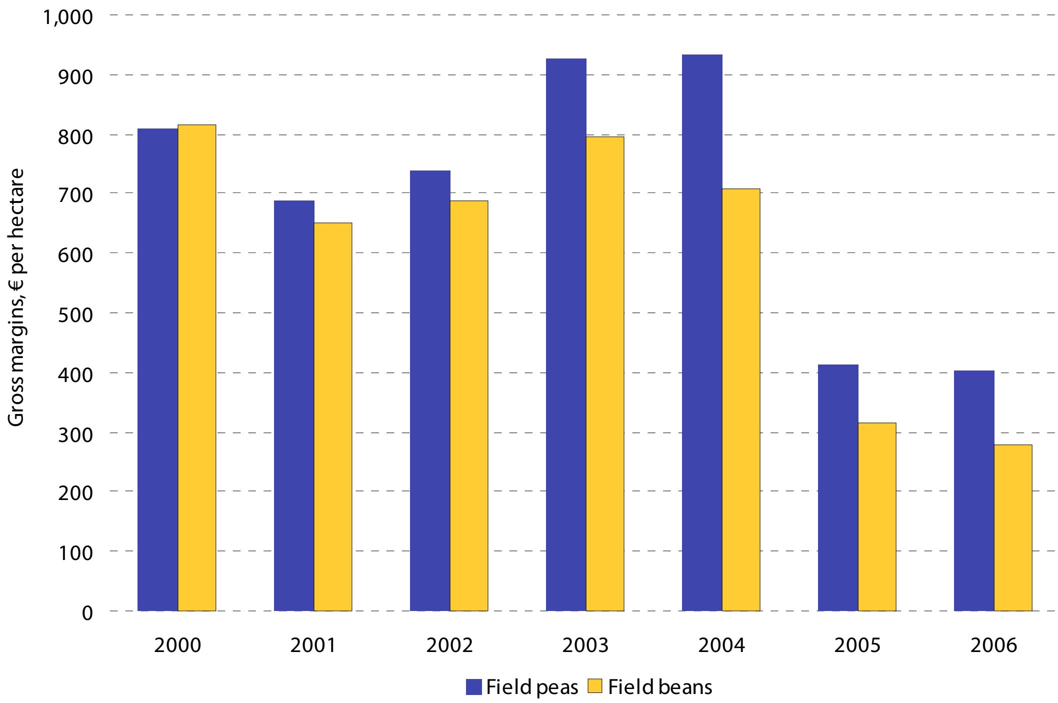
Source: Cambridge University

Diagram UK.14: East Anglia, field pea gross margins vs. rapeseed, 2000-2006



Source: Cambridge University

Diagram UK.15: East Anglia, field pea gross margins vs. field beans, 2000-2006



Source: Cambridge University

Table UK.4: East Anglia, revenue and variable costs of alternative crops (€/hectare)

		2000	2001	2002	2003	2004	2005	2006
Wheat	Price	1,023	978	863	1,067	848	868	1,140
	CAP support	366	357	364	362	349	0	0
	Total Revenue	1,389	1,334	1,227	1,430	1,197	868	1,140
	Variable costs	423	419	405	376	389	397	412
	Gross margins	966	915	822	1,054	809	471	728
Barley	Price	778	690	659	730	633	715	936
	CAP support	366	357	364	362	349	0	0
	Total Revenue	1,144	1,047	1,023	1,092	982	715	936
	Variable costs	347	337	309	297	307	322	342
	Gross margins	797	710	713	795	676	393	594
Rapeseed	Price	1,310	1,175	1,327	1,344	621	723	838
	CAP support	521	418	364	362	349	0	0
	Total Revenue	1,831	1,593	1,691	1,706	970	723	838
	Variable costs	352	367	369	336	349	372	393
	Gross margins	1,479	1,225	1,322	1,370	621	351	445

Sources: Cambridge University; FADN database for estimates of coupled support.

4.2.2 Alternative crops

For the UK, the main alternative crops considered in the analysis are those compared in the previous four diagrams, namely common wheat, barley, rapeseed and field beans. Revenues and costs of these crops have been estimated from detailed data for East Anglia. For all these crops, changes in the levels of coupled support have been accounted for in the analysis.

Table UK.5 and Diagram UK.16 contrast the gross margins on field peas with the weighted average gross margins on common wheat, barley, rapeseed and field beans from 2000 to 2006. In keeping with the methodology adopted for the other MS, values have been estimated for three periods: the first, prior to the 2003 reform (2001-2003); the second, immediately after the reform (2004-2005); and the third (2006), after the reform was complete, including the adoption of the SPS (in 2005).

The table and diagram compare the differences in average gross margins between field peas and the major COP crops as a group with the annual change in the proportion of field peas in total COP crop areas one year later. The lag is included in order to reflect the adaptive expectations of farmers responding to the outcome of the previous harvest.

Table UK.5: Difference between gross margins on field peas and the weighted average gross margins on other COP crops vs. annual changes in the following crop year in the field pea share of the combined area of major COP crops, East Anglia, 2001-2006

	2001-2003	2004-2005	2006
GM difference, field peas vs. other COP crops, € per hectare	-126	92	-223
GM difference without extra coupled aids for protein crops	-175	43	-271
Annual % change in field pea area as share of COP crop area	-0.4%	-0.2%	-0.2%

Sources: Cambridge University; Eurostat; FADN database for estimates of coupled support.
Note The area data refer to the entire UK.

- The average disadvantage of field peas vs. the weighted average of the main alternative crops, in terms of gross margins, fluctuated tremendously from one period to another.

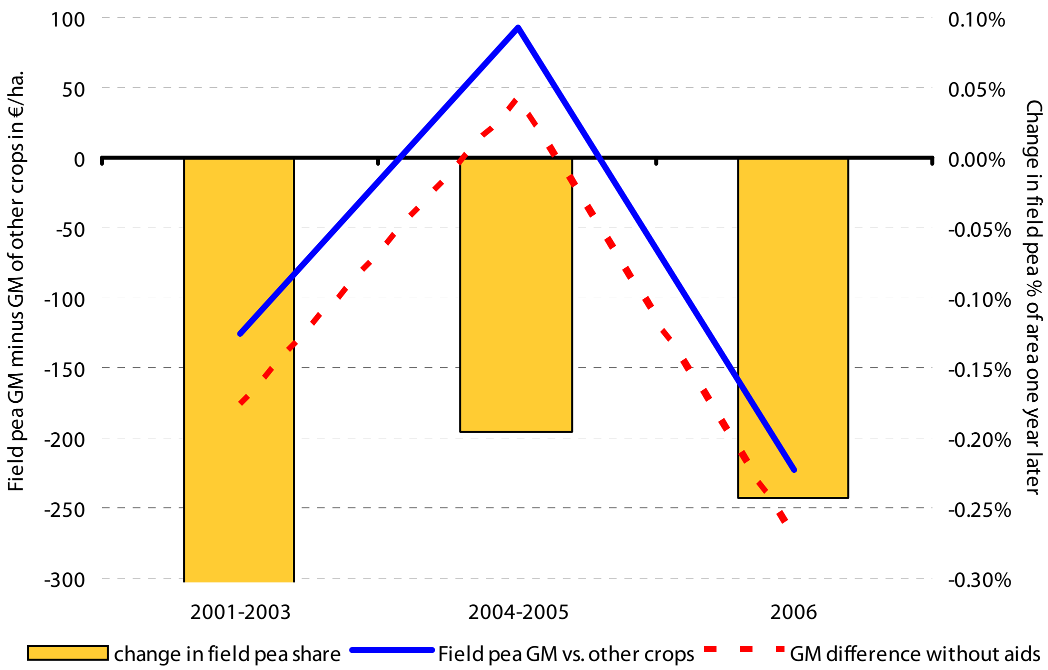
- From a disadvantage of €134 per hectare in 2001-2003, field peas' position changed, thanks to its very good 2004 performance, to enjoyed a gross margin €89 higher than the weighted average for the other crops in 2004-2005. Its competitive position was vey much worse in 2006, when its gross margin disadvantage leapt to €234 per hectare.

- The absence of coupled payments for protein crops would have worsened the relative competitiveness of field peas. Its competitive disadvantage would have been €185 per hectare in 2001-2003, but it would have retained its small gross margin advantage in 2004-2005 (though it would have shrunk to €37). Its disadvantage would have returned with a vengeance in 2006, at €283 per hectare.

- Table UK.5 also describes the changes that occurred in the field pea share of the COP crop area over the same period. The same changes are illustrated in Diagram UK.16.

- The field pea share fell at an annual rate of 0.1 % (from 2001 to 2004) as producer responded to the gross margins observed in 2000-2003. The share then fell by an annual 0.2% in response to the gross margins experienced in 2004-2005 and by yet another 0.2% in response to the outcomes of the 2006 crop.

Diagram UK.16: Annual changes in the field pea share of the UK area under major COP crops, 2001-07 vs. field pea gross margin competitiveness in relation to the weighted average for other major COP crops, with and without protein crop aids, East Anglia



Source: Cambridge University

Note: The "with aids" calculations include the special aid of €55.57/ha. The "without aids" case excludes this aid. "Field pea GM vs. other crops" measures the difference between the gross margin on field peas and the weighted average gross margin on the other major COP crops, where the weights are the areas under the different crops. The average percentage area changes relate to the period one year after the gross margin calculations.

4.2.2 Field bean revenues and costs

Table UK.6 lists the revenues and variable costs of field bean producers in East Anglia.

Table UK.6: East Anglia, revenue and variable costs of field bean production (€/ha.)

	1999	2000	2001	2002	2003	2004	2005	2006
Yield (t/ha)	4.1	3.7	3.1	4.0	3.9	3.9	3.6	3.2
Field Bean Price per tonne	140	158	147	120	146	132	127	135
Protein Crop Arable Aid (€/ha)	452	452	411	419	416	349		
Protein Crop Special Aid (€/ha)						52	52	50
Return per ha								
Field Bean Price	569	587	447	482	576	513	458	431
Coupled Payment	452	452	411	419	416	402	52	50
Total Revenue	1,021	1,039	858	901	992	915	511	481
Variable costs per ha								
Seed	72	75	79	77	60	61	59	56
Fertiliser	19	29	19	21	16	23	28	27
Crop Protection	123	111	95	108	110	111	91	95
Other (e.g. irrigation, drying)	22	8	15	8	10	10	18	24
Total variable costs	**236**	**223**	**208**	**214**	**196**	**206**	**195**	**202**
Gross margins	**785**	**816**	**650**	**687**	**796**	**708**	**316**	**280**

Sources: Cambridge University; FADN database for estimates of coupled support.

- From the table, we note that variable costs of production of field beans were low and stable in the region of €200 per hectare.
- Total revenues per hectare were comparatively stable, averaging over €900 per hectare until 2004. Following the introduction of the SPS, however, the revenues (excluding decoupled payments) settled close to €500 per hectare in both 2005 and 2006.

Since Diagram UK.15 revealed that the differential between field pea and field bean gross margins per hectare does not vary much from year to year, we have not prepared a separate series of diagrams to contrast annual field bean gross margins with the gross margins on other crops, since the diagrams would appear similar to those prepared for field peas, but with the difference that, with the exception of 2000, field beans have a slightly lower gross margin each year than field peas.

Table UK.7 and Diagram UK.17 contrast gross margins on field beans with the weighted average gross margins on common wheat, barley, rapeseed and field peas from 2000 to 2006. These values are estimated for three periods: the first, before the reform (2001-2003); the second, just after the reform (2004-2005); and the third (2006), after the reform was complete.

The table and diagram compare the differences in average gross margins between field beans and the major COP crops as a group with the annual change in the proportion of field beans in total COP crop areas one year later. The lag is included in order to reflect the adaptive expectations of farmers responding to the outcome of the previous harvest.

- The average disadvantage of field beans vs. the weighted average of the main alternative crops, in terms of gross margins, was not at all stable.
- The disadvantage was €205 per hectare in 2001-2003; it improved to €74 in 2004-2005, but then deteriorated to €358 per hectare in 2006.
- The absence of coupled payments for protein crops would have worsened the relative

competitiveness of field peas. Its competitive disadvantage would have been €258 per hectare in 2001-2003, €125 in 2004-2005 and €407 per hectare in 2006.

- The field bean share of the COP crop area fluctuated over the same period, as may be seen in Diagram UK.17. The field bean share barely rose from 2002 to 2004, as farmers reacted to the gross margins observed in 2001-2003. The share then rose at an annual rate of 0.3% in 2005-2006, but then fell by 0.1% in 2007, as producers responded to the outcome of the 2006 crop.

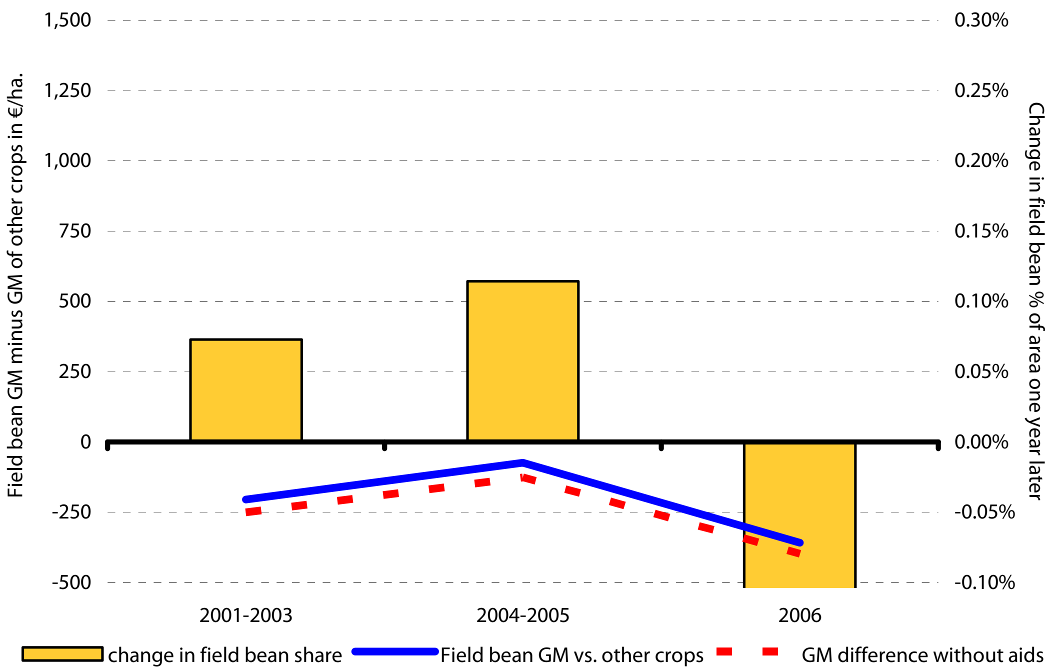
Table UK.7: Difference between gross margins on field beans and the weighted average gross margins on other COP crops vs. annual changes in the following crop year in the field bean share of the combined area of major COP crops, East Anglia, 2001-2006

	2001-2003	2004-2005	2006
GM difference, field beans vs. other COP crops, € per hectare	-205	-74	-359
GM difference without extra coupled aids for protein crops	-251	-127	-399
Annual % change in field bean area as share of COP crop area	0.1%	0.1%	-1.2%

Sources: Cambridge University; Eurostat; FADN database for estimates of coupled support.

Note The area data refer to the entire UK.

Diagram UK.17: Annual changes in the field bean share of the UK area under major COP crops, 2001-06 vs. field bean gross margin competitiveness in relation to the weighted average for other major COP crops, with and without protein crop aids, East Anglia



Source: Cambridge University

Note: The "with aids" calculations include the special aid of €55.57/ha. The "without aids" case excludes this aid. "Field bean GM vs. other crops" measures the difference between the gross margin on field beans and the weighted average gross margin on the other major COP crops, where the weights are the areas under the different crops. The average percentage area changes relate to the period one year after the gross margin calculations.

5. The significance of protein crop production in farm incomes

In this section, we present four measures of profitability for protein crop farms and compare their values with the values of the same indicators for "other farms". These measures of profitability have been extracted from the FADN database; they are: gross farm income per hectare, farm net value added per annual working unit, farm family income per hectare and farm family income per farm working unit. We have classified protein crop farms on the basis of the share of farm UAA that is devoted to protein crops.

The aim of this analysis is to ascertain whether there are any structural differences in the profitability of farms that choose to grow protein farms relative to farms that do not grow these types of crops, ceteris paribus, i.e. when both sets of farms belong to the same type of farming.

When presenting data from the FADN database, a minimum number of 15 observations (farms) per year is required to ensure that the results presented meet a satisfactory degree of statistical precision. Within the FADN database of protein crop farms, the only UAA size category for which data for 15 or more farms are available is the category "Greater than 50 hectares". In this section, we show the results for this UAA size class only, distinguishing between the two types of farming most protein crops farm belong to: "COP specialists" and "Mixed crops and livestock".

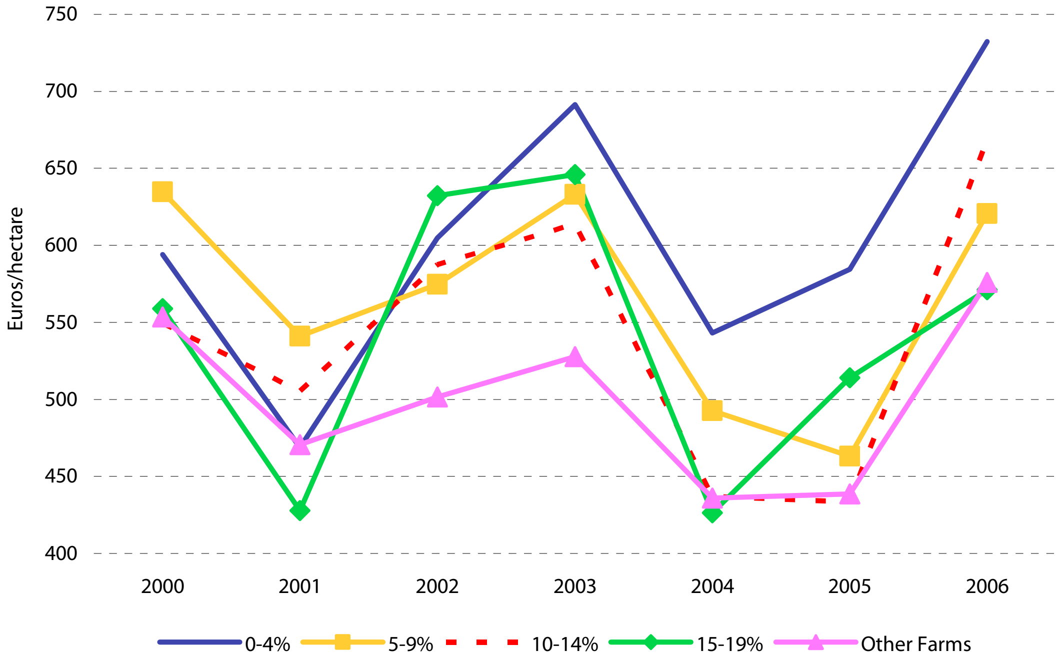
The results of this analysis are shown in Diagrams UK.18 to UK.33. They reveal that

- No clear pattern emerges with respect to the profitability of farms growing protein crops relative to "other" holdings for the different measures of income covered in our assessment.
- There are no clear indications that the size of the share of area devoted to protein crops is linked to increasing (decreasing) returns in any consistent fashion.
- For mixed crops and livestock specialists, for three out of four measures of income, the income of farms devoting between 20% and 100% of area to protein crops appear to be more volatile than the income of farms with little or no area planted to protein crops.

5.1 COP Specialists

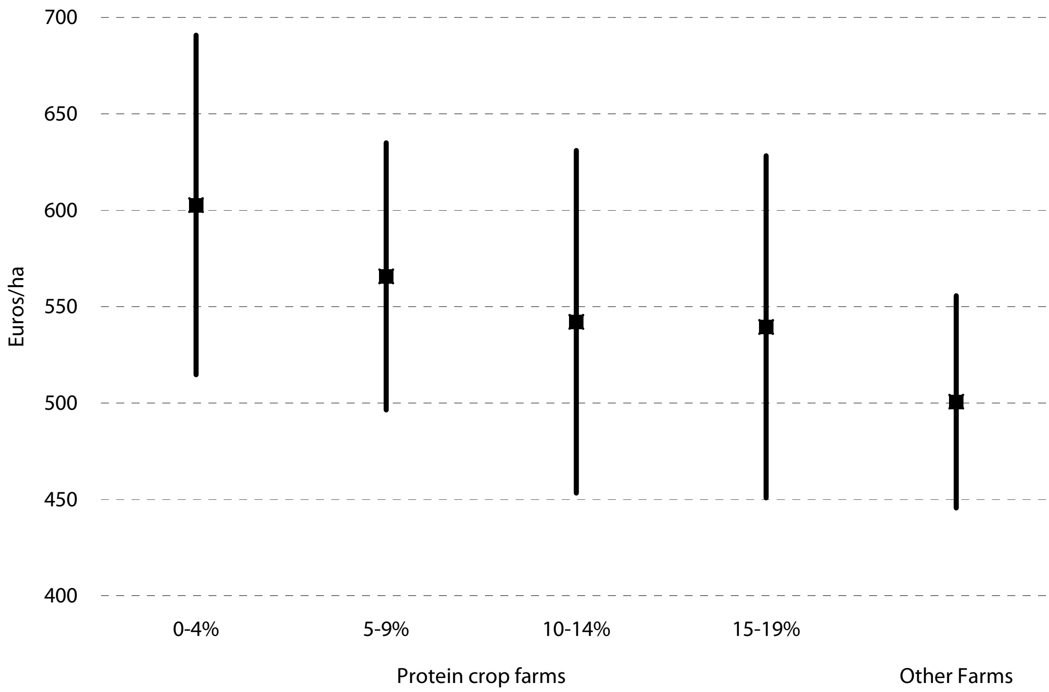
5.1.1 Gross farm income per hectare

Diagram UK.18: Gross farm income per hectare for UK COP specialists, 2000-2006



Source: Analysis of FADN database

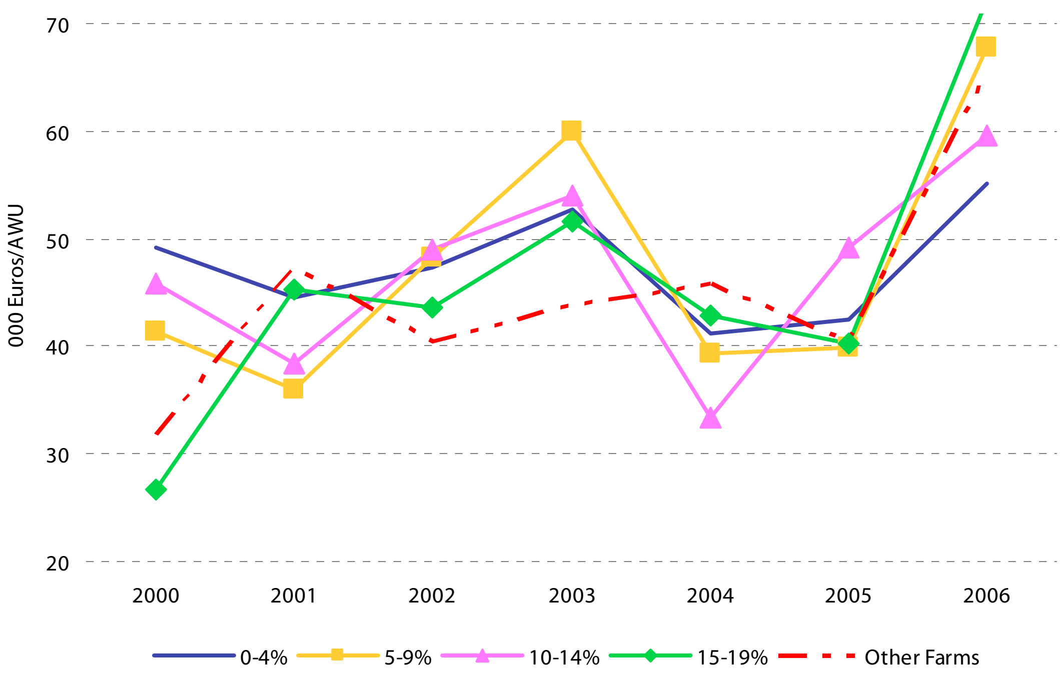
Diagram UK.19: Mean (plus and minus one standard deviation) of gross farm income per hectare for UK COP specialists, 2000-2006



Source: Analysis of FADN database

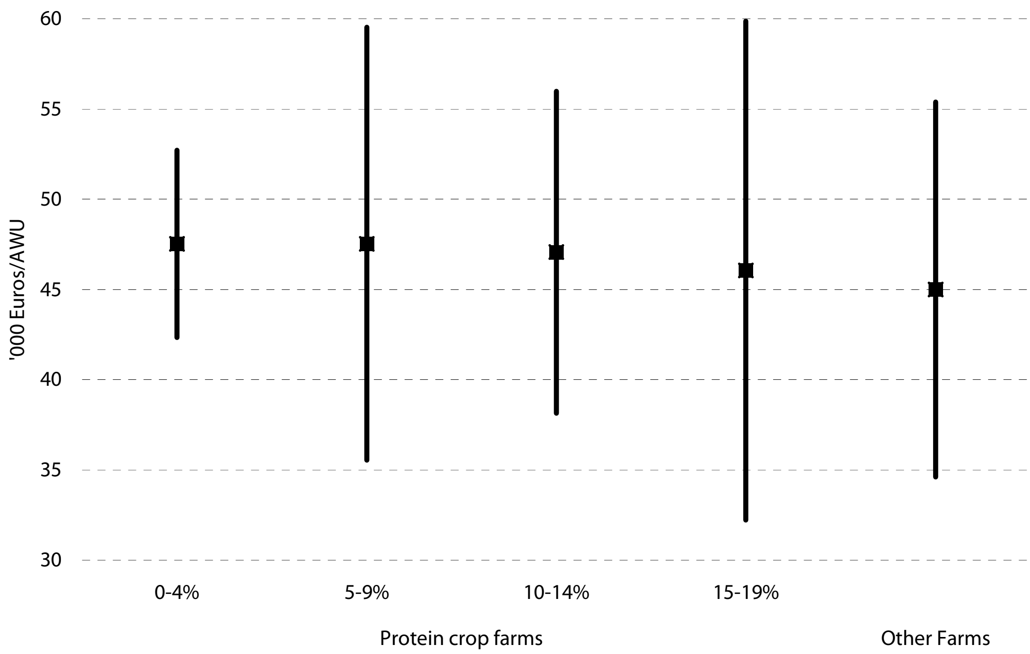
5.1.2 Farm net value added per annual work unit for COP specialists

Diagram UK.20: Farm net value added per annual work unit for UK COP specialists



Source: Analysis of FADN database

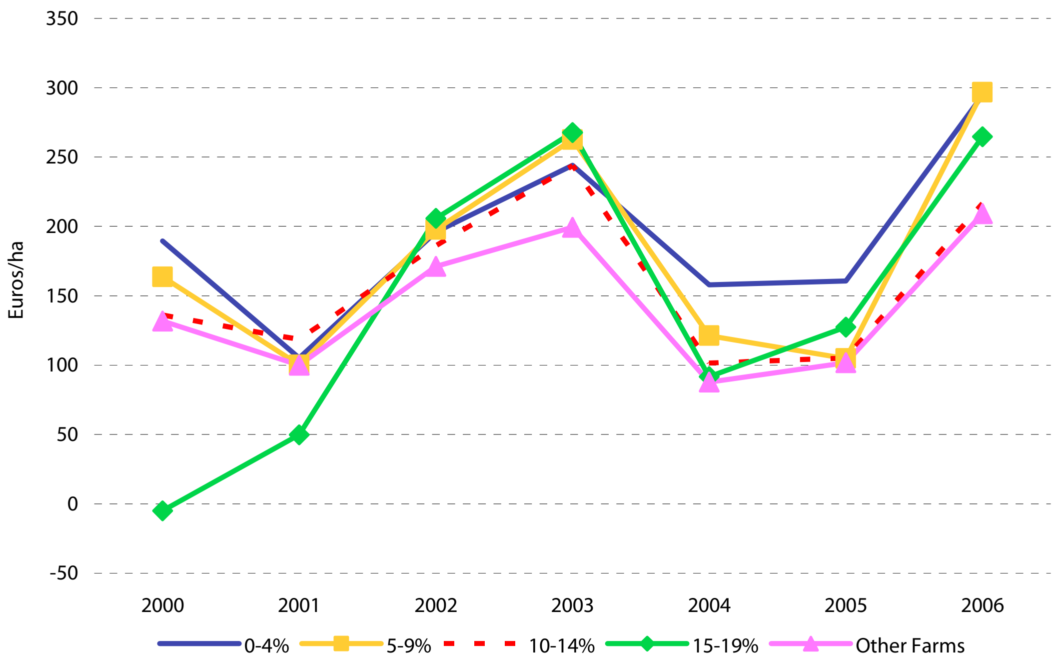
Diagram UK.21: Mean (plus and minus one standard deviation) of farm net value added per annual work unit for UK COP specialists, 2000-2006



Source: Analysis of FADN database

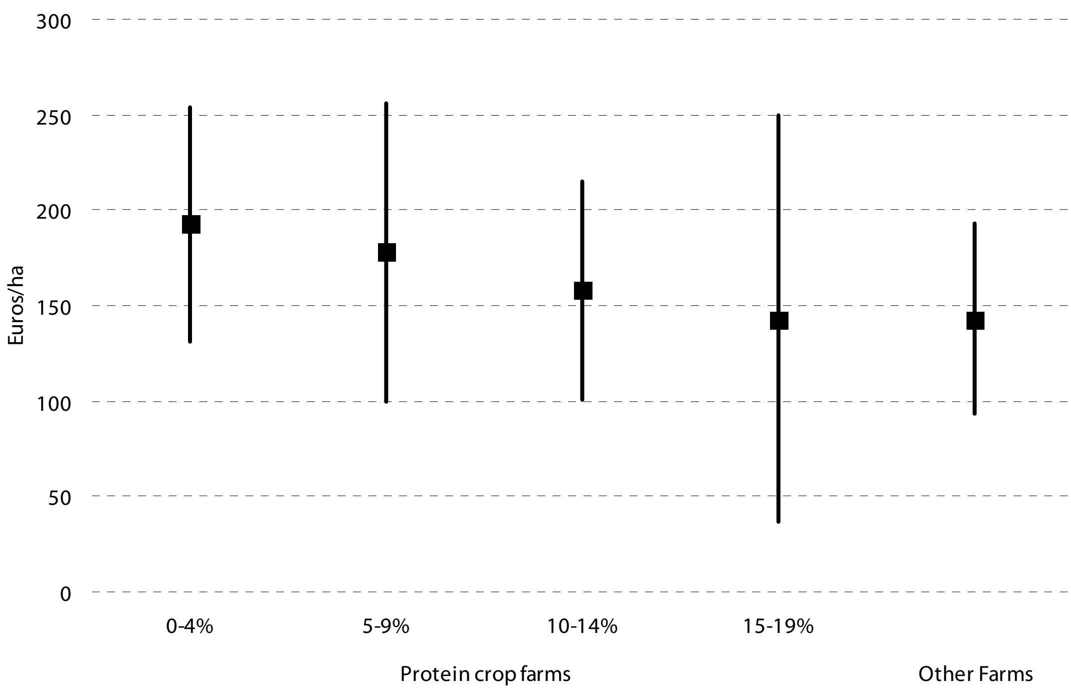
5.1.3 Family farm income per hectare for COP specialists

Diagram UK.22: Family farm income per hectare for UK COP specialists, 2000-2006



Source: Analysis of FADN database

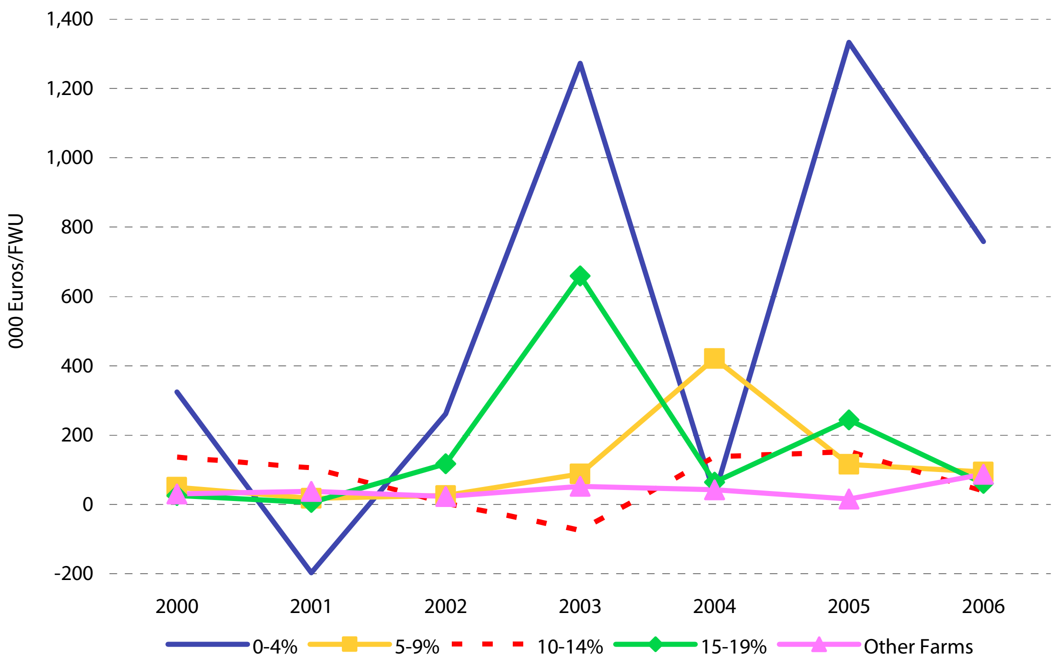
Diagram UK.23: Mean (plus and minus one standard deviation) of family farm income per hectare for UK COP specialists, 2000-2006



Source: Analysis of FADN database

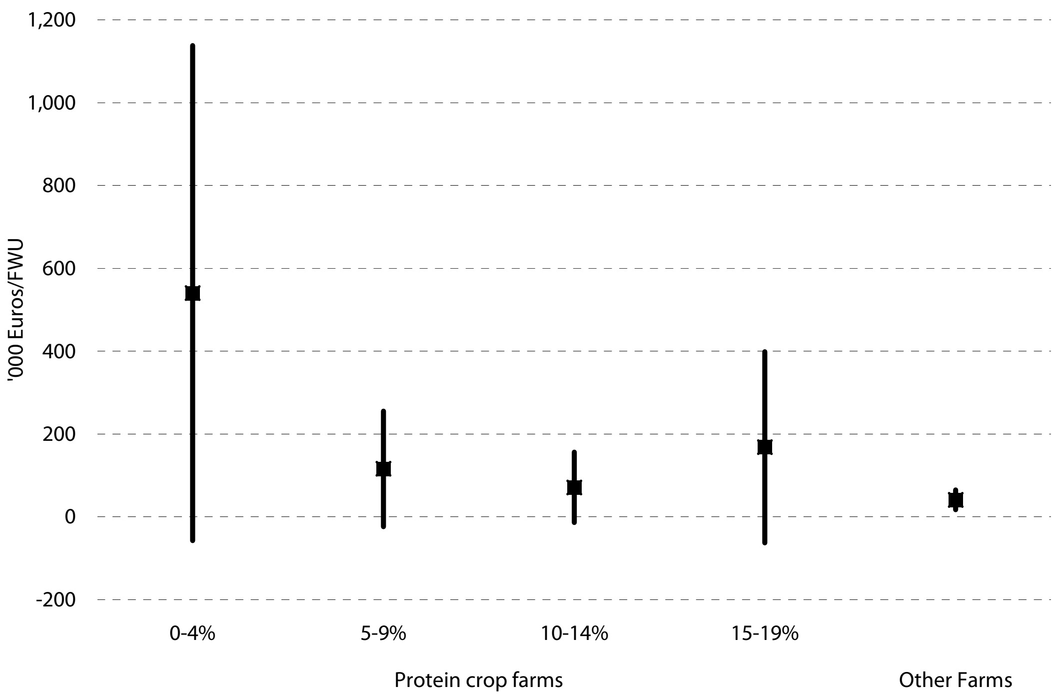
5.1.4 Family farm income per family work unit

Diagram UK.24: Family farm income per family work unit for UK COP specialists, 2000-2006



Source: Analysis of FADN database

Diagram UK.25: Mean (plus and minus one standard deviation) of family farm income per family work unit for UK COP specialists, 2000-2006

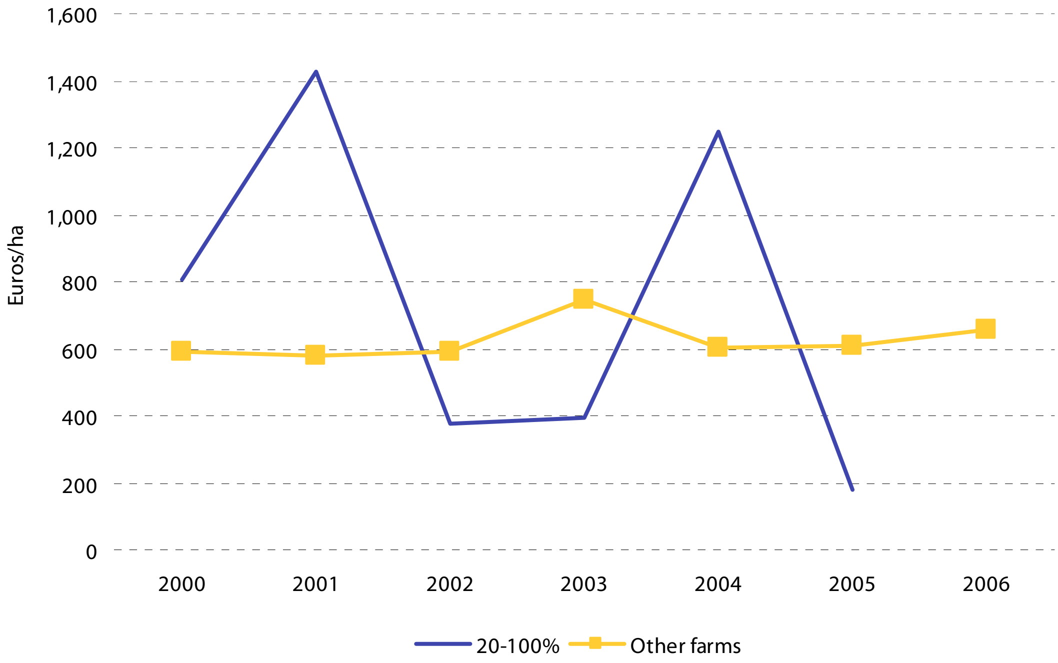


Source: Analysis of FADN database

5.2 Mixed crops and livestock specialists

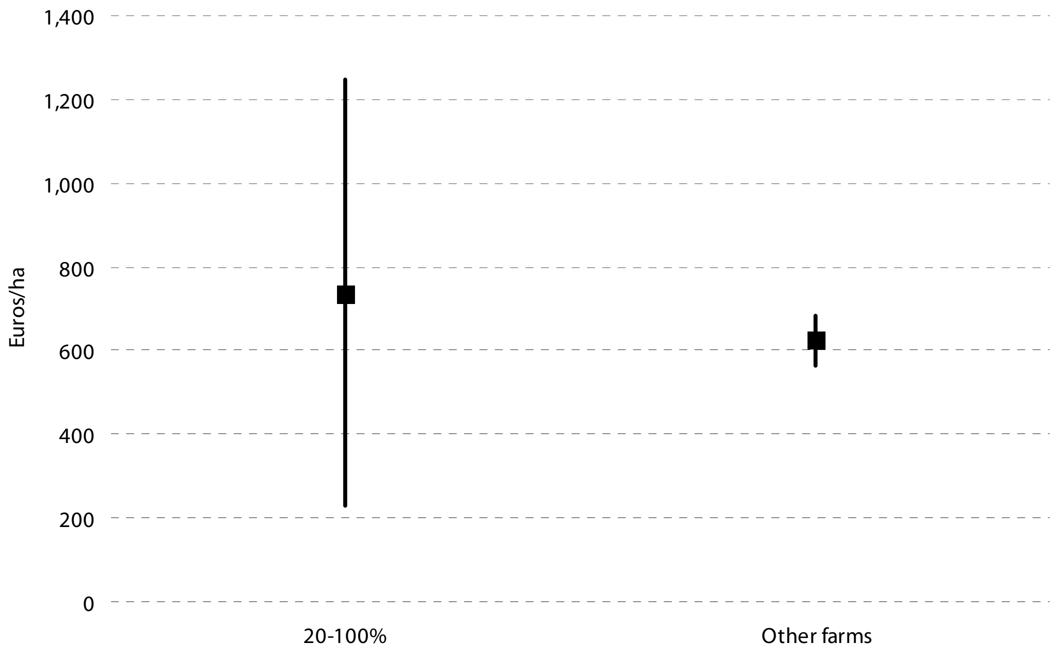
5.2.1 Gross farm income per hectare

Diagram UK.26: Gross farm income per hectare for UK mixed crops and livestock specialists, 2000-2006



Source: Analysis of FADN database

Diagram UK.27: Mean (plus and minus one standard deviation) of gross farm income per hectare for UK mixed crops and livestock specialists, 2000-2006



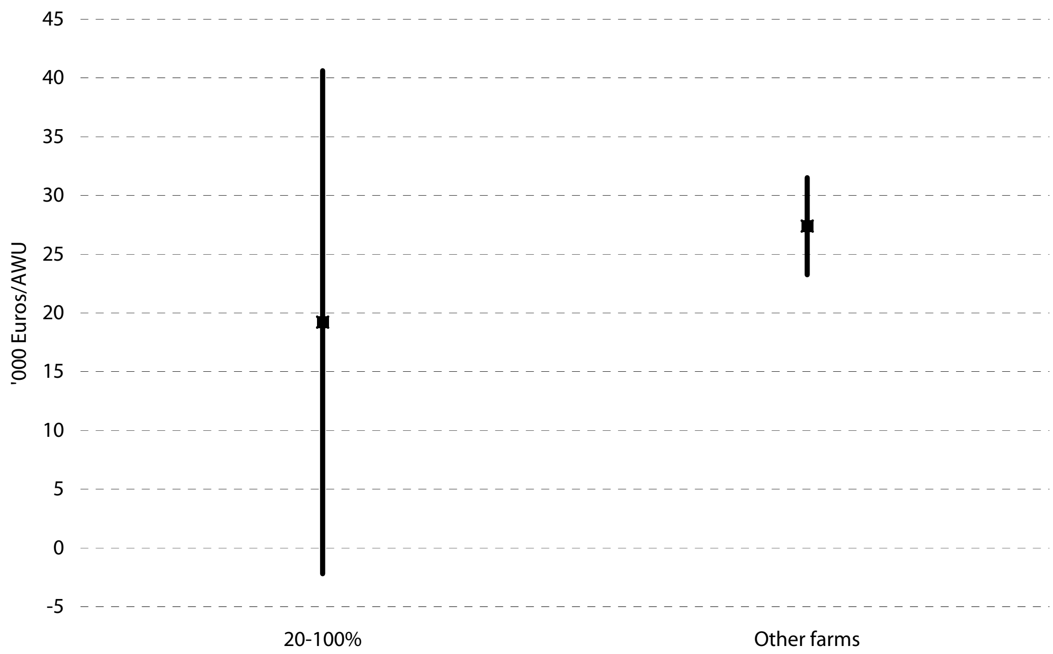
Source: Analysis of FADN database

5.2.2 Farm net value added per annual work unit

Diagram UK.28: Farm net value added per annual work unit for UK mixed crops and livestock specialists

Source: Analysis of FADN database

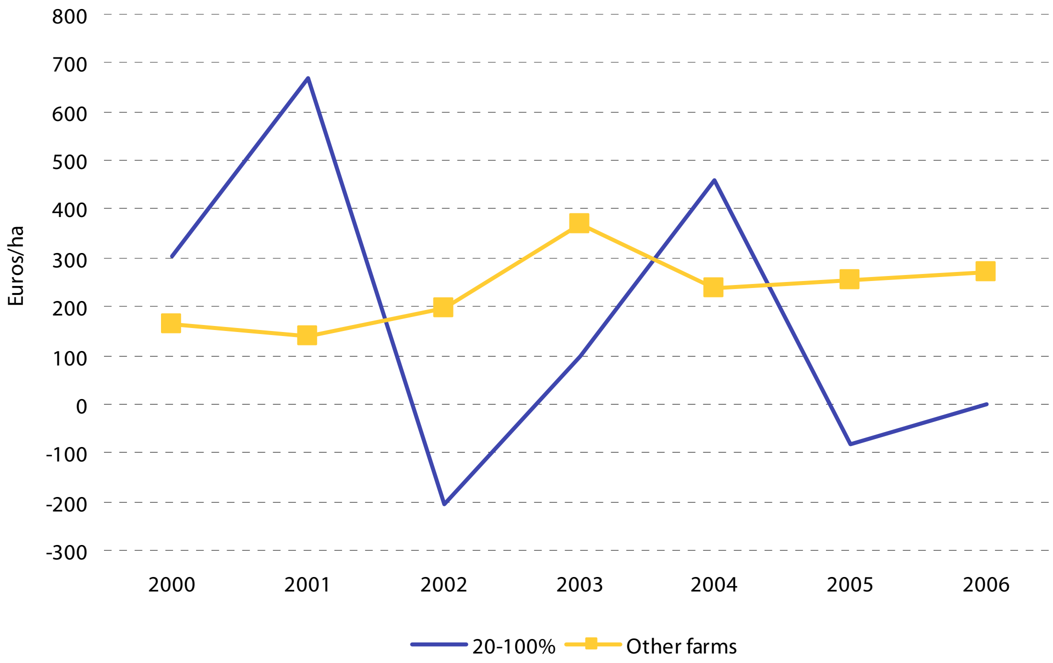
Diagram UK.29: Mean (plus and minus one standard deviation) of farm net value added per annual work unit for UK mixed crops and livestock specialists, 2000-2006



Source: Analysis of FADN database

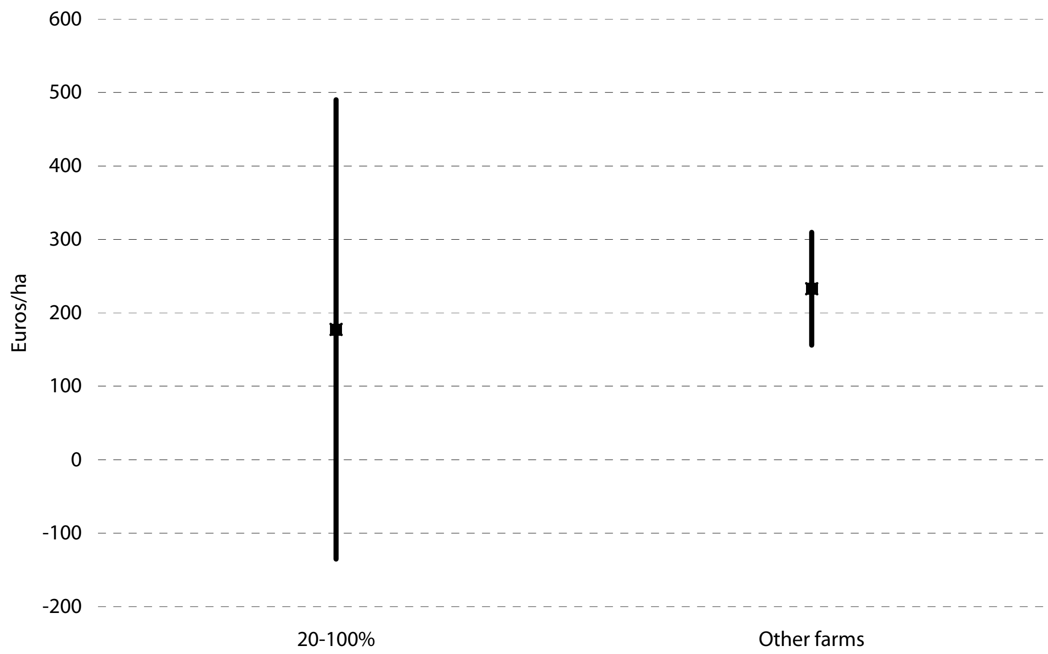
5.2.3 Family farm income per hectare

Diagram UK.30: Family farm income per hectare for UK mixed crops and livestock specialists, 2000-2006



Source: Analysis of FADN database

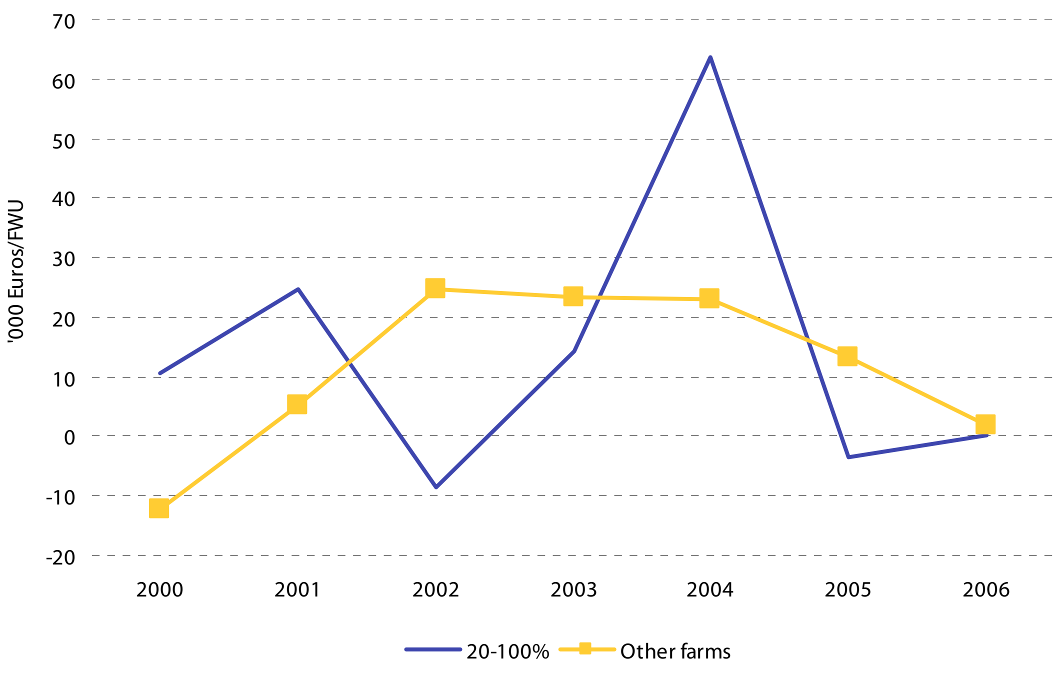
Diagram UK.31: Mean (plus and minus one standard deviation) of family farm income per hectare for UK mixed crops and livestock specialists, 2000-2006



Source: Analysis of FADN database

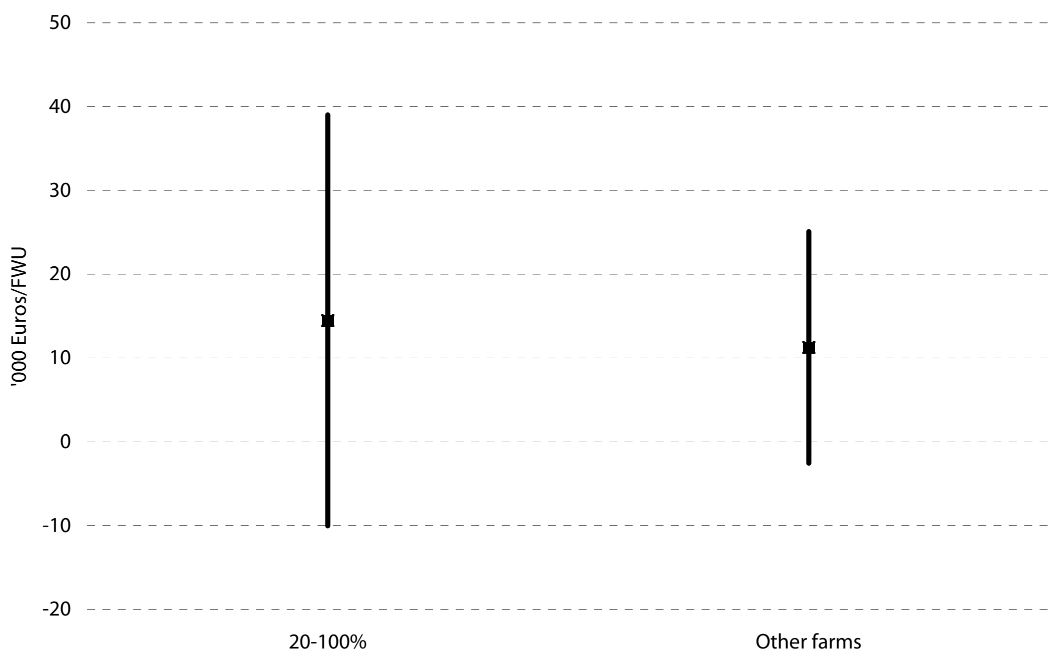
5.2.4 Family farm income per family work unit

Diagram UK.32: Family farm income per family work unit for UK mixed crops and livestock specialists, 2000-2006



Source: Analysis of FADN database

Diagram UK.33: Mean (plus and minus one standard deviation) of family farm income per family work unit for UK mixed crops and livestock specialists, 2000-2006



Source: Analysis of FADN database

6. The development of the local feed compounding industry

Table UK.8 describes the steady progress towards greater concentration and larger scale within the UK feed compounding sector since 1997.

The table includes separate data for the years immediately before and after the 2003 reform. We observe that:

- The number of compounders has fallen by 28.5% between 1997 and 2007, and the decline has continued since the reform.
- National compound feed production has barely altered between 1997 and 2007.
- The average output per plant rose by over 38%, to 32,600 tonnes per plant, from 1997 to 2007.

Table UK.8: The number and annual output of UK feed compounders, 1997-2007 ('000 tonnes)

	Number of compounders	Compound feed output ('000 tonnes)	Annual output per plant ('000 tonnes)
1997	615	14,466	23.5
2003	475	13,718	28.9
2004	460	14,085	30.6
2007	440	14,341	32.6
% change 1997-2007	-28.5%	-0.9%	38.6%

Source: FEFAC Feed and Food Statistical Yearbook, 2007

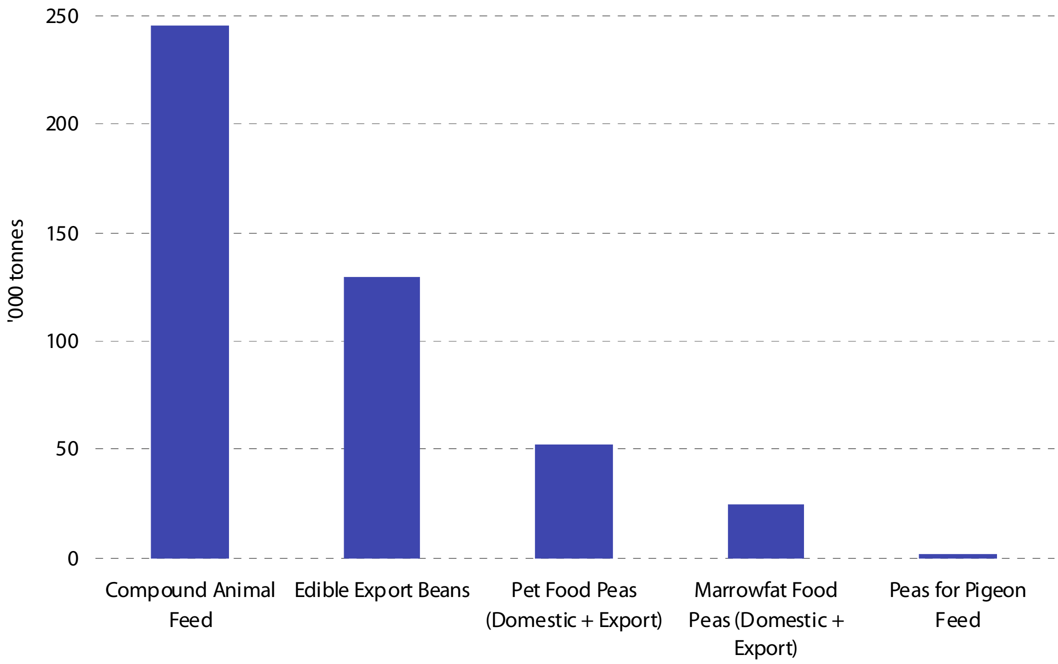
6.1 Patterns of end-use for protein crops

Diagram UK.34 identifies the sectors consuming UK field peas and beans from the combined crop of 455,000 tonnes in 2007. It is important to point out that these data only refer to traded volumes. As a result, on farm feed use do not appear in this analysis. Diagram UK.35 analyses the data by percentage share. The diagrams reveal that:

- Over 50% of the field pea plus bean crops are used by animal feed compounders. This volume is almost entirely accounted for by field beans. Two thirds of the field bean crop is consumed in this way. The UK compound feed industry uses approximately ten million tonnes a year, of which field peas and beans account for only 2.5%.
- The remaining third of the bean crop was consumed by the growing edible export food market, predominantly sales into North Africa and parts of the Middle East.
- Two thirds of the pea crop is destined for the pet food trade, both at home and overseas. This market has expanded with the development of the micronising process for peas, which favours blue peas. The micronising process involves flash cooking to improve palatability.
- Edible pea markets for marrowfat peas, both in the UK and overseas, consumed just over 30% of the pea crop in 2008. This usage includes the "mushy pea" takeaway market, peculiar to the UK, and low priced canned peas for human consumption.

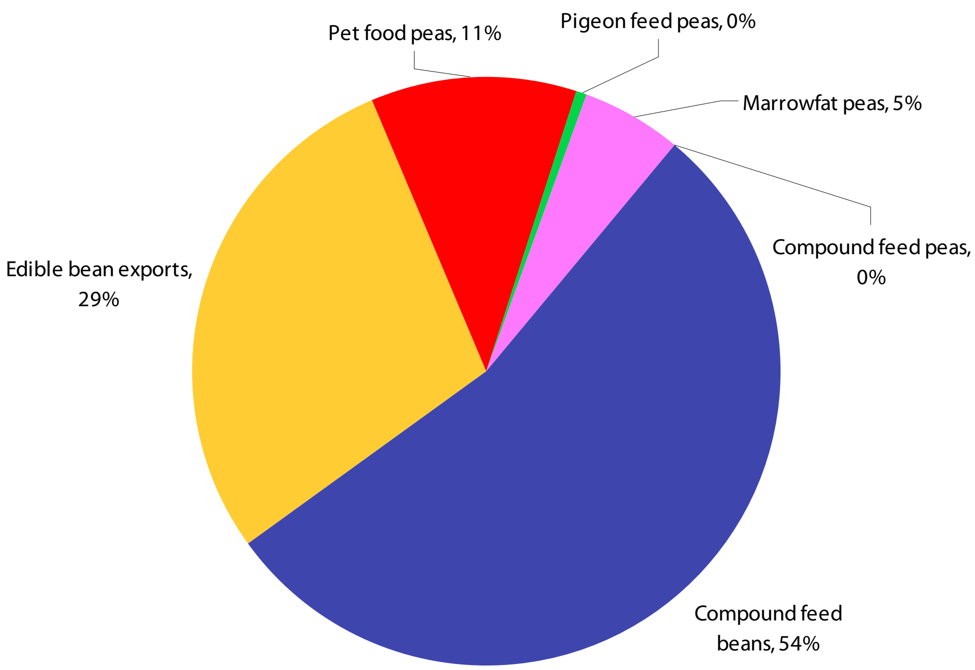
- Very minor volumes of field peas are taken by the pigeon food market.
- The supply of sweet lupins is said to be entirely used in animal feed, mainly on-farm. This is estimated to account for 15-20,000 tonnes of annual protein crop feed demand.

Diagram UK.34: End-use consumption of field peas and beans in the UK, 2007



Source: PGRO

Diagram UK.35: Distribution of demand for field peas and beans in the UK, 2007



Source: PGRO

7. Evidence from interviews and questionnaires with stakeholders in the UK protein crop sector

There are two main sources from which we drew evidence: one was through direct interviews with stakeholders and the other, analysis of individual questionnaires completed by 13 farmers. This is described in the following two sections. The questionnaires were lengthy and many respondents did not complete them in full. Given the relatively small sample of completed questionnaires, prudence should be exercised when interpreting the results.

Questionnaires for processors were fewer in number since many of them are transnational companies active in several Member States. The analysis for this is not presented in the individual case studies but can be found in the Main Report.

7.1 Interview evidence

7.1.1 Interviews were conducted with national associations and farming bodies, and with farmers and processors from the East Anglia region of England

The interviews revealed the following insights into the production systems applied to field peas and beans and producers' decisions for selecting these crops:

- *Proteins provide agronomic benefits in cereal rotations as a break crop with nitrogen-fixing properties. The following cereal crop benefits from the protein planting, and this is not captured by conventional gross margins. Beans are better in terms of nitrogen fixing than peas. Beans fix approximately 300 kilograms of nitrogen per hectare per annum, with about 75 kilograms of this available for the next crop (the rest is lost through leaching and natural decomposition as the harvest and other tasks are undertaken). Peas fix around half this amount of nitrogen.*

- *When fertiliser prices are high, as they have been for the past year (to March 2009) or so, nitrogen-fixing crops such peas and beans become a cheap way of offsetting fertiliser costs. With nitrogen costing around £1 per kilogram, and beans fixing 75 kilograms per hectare for the next crop, the farmer saves £75 per hectare, which is a greater incentive at present than the €55 per hectare protein supplement. This effect should favour field beans more than peas. However, as the benefit is captured by lowering fertiliser costs for the following cereal crops, this is not reflected in conventional gross margin analysis*

- *Many farmers, especially on larger and more diverse holdings, do not chase high prices, but rather look to balance rotations in a sustainable and viable long term manner.*

- *Beans have a particular application in rotations where black grass is a problem, as they provide a natural means of controlling black grass without sprays.*

- *Most alternative spring break crops, such as lupins, potatoes, sugarbeet and vegetables, require contracts with traders, processors or retailers.*

- *Peas and beans provide an on-farm feed source for mixed arable/livestock farmers. There are few protein alternatives available directly as on-farm feeds, since oilseed crops require crushing before the protein is extracted. (Data are not available for total on-farm protein feed use in the UK.)*

- *Peas and beans can use the same farm equipment and machinery as other major combinable crops (i.e., using combined harvesters); therefore, no specialist investment is needed.*

- *Late and wet harvests, such as that experienced in 2008, can mean that winter crops are unable to be planted in time. Winter cereal plantings in England are down 14% in 2008/09* *from 2007/08 and the winter rapeseed area is down up to 10%. This vacant land provides larger opportunities for spring crops, proteins among them. A similar effect was witnessed in 2001, when protein areas peaked for weather reasons. There are relatively few alternatives as spring break crops, and one of them —sugarbeet — is declining in attractiveness.*

- *Some of the more effective spray compounds are likely to come under pressure as a result of new regulations governing water quality in the EU, due to the chemicals' propensity to enter water courses. As sprays are more important for rapeseed than cereals, this will reduce rapeseed's relative competitiveness, and protein crops may benefit a little from this.*
- *Field beans have more potential outlets than field peas, notably in edible product exports to North Africa. Also, beans can be a spring or winter crop, whereas peas are effectively only a spring crop.*
- *Field beans have a good niche as an organic crop for ruminant feeds. Winter wheat and winter beans are the main organic feed crops, for dairy, sheep and beef cattle. About 1/8th of this organic volume is used for on-farm feed on mixed organic farms.*

However, the reasons provided for <u>not</u> planting field peas and beans were expressed much more frequently and included:

- *The protein supplement introduced after 2003 is far too small to have any bearing on planting decisions. Very small changes in yields and prices can have just as much impact on protein margins. Removing the coupled aid completely would, therefore, have little impact on plantings.*
- *Moreover, some farmers believe that any special aids are lost in the value chain as buyers of protein crops simply discount prices to reflect the additional supplement.*
- *For both peas and beans, achieving good quality for premium markets other than for use in compound feed is a difficult task for farmers. The compound feed market is viewed as a default market by most protein farmers. Farming peas needs more care, time and inputs than beans, and this has discouraged many farmers looking to simplify their farming approach. It is also harder to achieve the required quality with peas, but margins can be excellent as prices are high on occasion.*
- *Farm systems and crop rotations on many farms, particularly smaller holdings, have been simplified in recent years toward shortened rotations, often of regular three year cycles of wheat-wheat-rapeseed. Peas and beans have often lost out as a consequence, typically to more frequent rapeseed plantings. Nonetheless, several farmers expressed the opinion that they had tried shorter rapeseed rotations for several years, and problems were beginning to arise with poorer rapeseed yields and increasing requirements for sprays. In these circumstances, several growers suggested they may be looking again at protein crops in the near future as a natural rotational management tool. A pulse crop should be included no more than one year in five, and can be grown in rotations with vegetables or sugarbeet.*
- *Harvesting peas is an especially difficult task, as they pick up a lot of soil, which clogs augers.*
- *On–farm drying is harder for peas and beans than for other major crops, and this has prevented large areas being grown, since the drying requirement becomes a constraint.*
- *With wet summers, the whole pea crop can be severely damaged, as rain breaks the weak stalks (bean stalks are a hardier, due to recent varietal improvements). Stronger pea stalk varieties are being developed, but the lack of critical mass in breeding efforts is a problem.*
- *Wetter summers recently have contributed to increasingly prevalent field pea and bean diseases. Wetter summers also make the harvesting problems of soil clogging even worse.*

- *Diseases are increasing for protein crops, again without really being addressed by agricultural chemical companies, since the potential returns are relatively meagre.*
- *Peas need drier, good quality soils, and struggle in moisture-retaining soils. This limits their potential area, and wetter UK summers have militated against expansion of pea areas, with the pea crop retreating towards a core of farmers with suitable soils and with experience of achieving the required product quality. The problem with the requirement for good quality soils is that peas often compete with high value intensively farmed crops, such as fruits and vegetables, on these soils.*
- *The protein special aid is not only too small to affect plantings, but it also introduces an element of risk into farm management. This is because, if farmers measure incorrectly the area they have claimed the coupled aid, then they are liable to fines levied on their entire single farm payment. The modest protein crop aid means that this is not worth the risk for many farmers with small protein crop acreages.*
- *Field peas and beans are viewed as relatively high risk by farmers, especially peas. Winter wheat is seen as the lowest risk, then rapeseed, followed by barley, with peas and beans perceived as very high risk as it is hard to achieve the desired quality; wet weather also causes large problems when harvesting. Quality in the bean market is very important, as farmers aim for the North African food grade export market. The compound feed sector is viewed as a fallback outlet for production.*
- *Spring beans are seen as more of an opportunist crop than winter beans. Generally, winter beans form a plant of planned rotations. Spring bean plantings are not planned, but are opportunistic, taking advantage of vacant land after all cereal and oilseed decisions have been made, or if need a spring crop is desired after a wet winter. They also benefit from decisions to spreading the workload and timings on the farm.*
- *Winter beans have suffered a particular problem recently, as a good herbicide for them, Simazine, has been banned.*
- *Storage is an increasing issue for farmers, as more try to store crops on-farm to avoid using expensive silos. Having to use separate storage facilities for small volume crops such as peas and beans makes their storage less efficient and hence less cost-efficient..*
- *A problem with peas is that they clash with milling wheat harvest times. Beans are less temperamental about their harvesting times than peas.*
- *Bean harvests are a problem in hot weather because the bean splits. This means that farmers avoid areas as they cannot harvest the crop quickly enough.*
- *Farmers are becoming increasingly sophisticated in their use of futures and options for marketing crops, but peas and beans suffer in this respect because they cannot be hedged since there is no futures market, unlike many major crops.*

7.1.2. Interviews with feed compounders

In interviews, UK feed compounders were ambivalent towards the use of field peas and beans. They stated that these protein crops have no specific functional properties that cannot be found in alternative ingredients. In terms of crude protein content, peas and beans are relatively poor compared with alternative meal products.

As rapeseed areas have grown in the UK, there has been less need for traditional protein crops in the feed mix. Moreover, as the UK bio-ethanol industry expands in the future, growing volumes of domestic DDGS will become available (up to half a million tonnes per annum by some estimates) in direct competition with protein crops in the UK compound feed sector. From a feed compounder's point of view, there is little reason to be concerned about protein crop production, as alternative local protein ingredients are increasingly abundant.

UK compound feed manufacturers stated that they include field peas and field beans in their animal feed rations for the following reasons:

- *Although field peas and beans cannot compete with soybean meal on price, their non-GM status is an advantage. For those retailers who do not want to stock GM-fed meat products, the segregation of non-GM soybean meal and the associated premium charged for such products makes it easier for peas and beans to compete in this sector. If EU acceptance of GM products were to increase, it would be another nail in the EU pea and bean coffin.*
- *As a home-grown protein source, peas and beans would have more value if there were incentives to encourage lower "feed miles" and reduced carbon footprints. However, though people claim these are important, there is no market premium for them, as farmers and hence compounders only buy on feed efficiency and price.*
- *There are field pea and bean price gradients nationally, with the pulses cheapest and most abundant in the south of the UK. Thus, they are more likely to enter feed rations in the south of the country.*
- *Some mills produce specialised feeds, such as for the pet food trade, where margins are far higher than in bulk livestock feeds. Field peas are favoured in this market, with purchases based on colour ("blue" peas), rather than simply on price. However, the size of the market is small, though expanding.*

However, despite these explanations, feed manufacturers were overwhelmingly indifferent toward incorporating peas and beans in protein feeds. The reasons given for this were:

- *Pea/bean protein is essentially viewed as a substitute for soybean meal protein, but as crude protein content is far less dense in field peas and beans, this dilutes the amount of protein incorporated in any given volume of ingredient.*
- *In price terms, peas and beans do not compete effectively with soybean meal (other than in the small non-GM soybean meal market segment).*
- *Peas and beans are more suited to older pigs and cattle/dairy. They are not very well suited to young and suckling pigs or poultry, which need more "potent" feeds, such as soybean meal, to get them to commercially attractive weights more quickly.*
- *Compounders tend only to source peas and beans where relatively abundant local supplies are available. Any national purchasing plan by larger multi-plant compounders requires secure availability, but in the UK there are simply not enough guaranteed supplies for this to be undertaken readily with protein crops.*
- *An important constraint identified by several UK feed compounders is the number and size of storage bins at each mill. Storage bins keep ingredients separate, and so if a mill were to use protein crops regularly, this would push an alternative feed out of one or more bins. Therefore, peas and beans must demonstrate that they are saving enough money to the user in the feed ration to warrant this. However, protein crop supplies have to be of sufficient volume to make it economic to occupy a bin for a few months each year, since the availability of these products is very seasonal. This critical minimum level of the monthly volumes required by a reasonable sized plant precludes the use of peas or beans at many locations.*
- *Small, local mills are even less flexible with their feed ingredients, as they have fewer storage bins. This makes smaller mills even less likely to use pulses, unless they have a specialised product, such as micronised peas for the pet food market.*
- *It is unlikely that field bean prices will move independently of other protein ingredients.*

Typically, at the start of the harvest, beans are priced as a food for North African markets, but once that demand is filled, they have no choice but to price themselves into domestic feed markets as there is no other source of demand. The major feed compounders only purchase beans when they see prices dropping after the edible food markets are exhausted. This purchasing strategy demonstrates that feed compounders are essentially ambivalent about pulses, and will only include them if there price and volumes merit it; they have no technical or functional compulsion to include pulses in feed rations. For commodity feed (unlike pet food or pigeons for example), there is no special premium value attached to protein crops.

- *Some of the largest UK feed compounders expressed the view that they would not mind at all if there were no peas or beans available in the UK, as these crops make little difference to their overall protein feed requirement. In contrast, they stated that they cannot do without soybean meal, and now have increasing volumes of rapeseed meal available to replace the protein crops they might have used in the past. Rapeseed meal is also getting relatively cheaper as it has become more abundant over the last decade, with prices typically trading at half of soybean meal levels, where previously it was up to 70% of soybean meal prices.*
- *There have been some anti-nutritional problems with protein crops in feed, such as the tannin content in many varieties of beans. Peas do not have tannin and new bean varieties appear to have solved the tannin problem. Also, a poor combination of amino acids was mentioned as a problem in the use of field beans and peas in relation to other protein crops.*

7.2 Summary of analysis of farmers' questionnaires

The following section summarises the key points that emerged from the analysis of questionnaires administered to protein crop farmers during the fieldwork carried out for this evaluation. Looking ahead, simulations of full decoupling, based on the results of the farmers' survey, are indicative of a fall in protein crop area of around 15% from 2008 levels.

7.2.1 Protein crop areas

- There are strong indications that the area under protein crops declined over the period 2003/04 – 2008/09.
- Plantings take place in March and the crop is harvested in July.

7.2.2 Crop rotations

- Amongst respondents, 62% said that they have a rotation cycle for protein crops.
- Wheat is the crop mostly used in rotation with protein crops. Other crops commonly used are barley, oats and rye.
- Over 60% of farmers use protein crops in their rotation cycle for filling in the spring, while a half said that it was for their rotational benefits.
- Among respondents, rapeseed was reported as the crop famers would use in place of protein crops in rotation cycles.

7.2.3 Production of alternative (non-protein) crops

- The majority of respondents reported no or small increases in area since 2003.
- Just below 50% said that their protein crops had been replaced by other crops, more notably rye and rapeseed.

7.2.4 Protein crop quality

- Over a third reported that the variety of protein crops they cultivated had changed over the last five years. The main reasons for changing were improved yield and quality.

- Protein crops seeds tend to be obtained from sources other than cooperatives and processors.

7.2.5 Outlets for your protein crops

- Only 8% said that they used their protein crop output directly on their farm for feed, of which between 40 and 60% of their output was used in this way.
- Around 40% reported traders as the main buyers of their protein crops, while 15% quoted feed compounders.
- Just under a third said that their protein crop was used mainly in feed. Of these, 50% said this was destined nationally.
- Of those who said that their protein crop was used mainly in food, this was destined both nationally and for non EU markets.

7.2.6 Protein crop marketing

- Just under a third said that they had a contract with a processor. A similar number said they had a contract with a trader. 57% of those who have a contract said that these were private companies.
- 57% of respondents indicated that quality and quantity are set in the contract. Price was part of the contract for 14% of respondents.
- 57% of those who have a contract are permitted to sell their protein crops to other processors.
- In 2008 the average price received per tonne of field peas was 255 (s.d. 49.5) and for field beans was 265 (s.d. 21.2),

7.2.7 Use of inputs

- 62% of farmers said that none of their protein crops were grown on irrigated land.
- There are no indications of investment linked to protein crop farming in the last five years.

7.2.8 On-farm employment and labour used

- Less than 20% of household employment is derived from protein crop production.
- Less than 20% of employed (i.e. non family) labour time is spent on protein crop production.
- Less than 20% of farm revenue is derived from protein crop production, including the special area payment) in 2008.
- Profit is commonly calculated as gross revenue minus cash costs, profitability is mainly judged per hectare.
- Soft wheat was regarded as the most profitable crop in 2008 and 2003.

7.2.9 The impact of reforms in the Common Agricultural Policy

- Just below 40% of farmers indicated that the introduction of a decoupled payment had an impact on the area they plant to protein crops. A similar proportion said that the change in payment system for protein crops since 2003 had affected the area they planted to protein crops.

- Our responses indicate that as the level of payment tied to protein crops decreases, area planted to protein crops decreases. If coupled payments rose to €100, area under protein crops would rise by up to 17%.
- The main elements affecting farmers' decisions of planting protein crops are the benefits for following crops and the price of competing crops.

8. Impact of the CAP measures upon the local protein crop sector

As a whole, the UK protein crop sector has contracted in its overall area since 2000. Area fell by 15% between the period 2000-01 to 2003-04, when it averaged 241,000 hectares per year, to the period 2004-05 to 2008-09, when area stood at around 204,000 hectares per year. Within the sector, the individual protein crops witnessed different fortunes. Field peas were the only protein crop to have experienced a decline in area (of 49%) comparing pre-and post-reform periods. Field bean area increased marginally after the reform by 2%. Sweet lupin areas rose by 41% between the two periods, albeit from a very small starting point. The combined effect of very volatile yields and shrinking area meant that production also fell after the reform.

Based on the findings of this report, there is no clear indication that this decline is a direct result of the changes introduced with the 2003 reform[16] . Rather, there is strong evidence that a number of exogenous market factors have acted to harm demand for protein crops.

- Trends in area reveal that total area under field peas and field beans been rather stable in the UK since the late 1980s at around 210,000 hectares per year over the period 1987 to 2006. At the same time, output peaked in the early 2000s but it since then declined sharply due to the simultaneous decline in area and yields.
- Interview findings suggest that field peas and field beans tend to be mainly grown for rotational and opportunistic reasons. Rotational reasons include the benefits of natural control of pests and grasses, plus the value of nitrogen-fixing and yield boost. Opportunistic reasons include plantings after wet summers, when winter crops have not been sown in time, and when fertiliser prices are high. At the same time, however, a trend toward a simplification of farming approach (including shorter rotations) and the high risks associate with growing protein crops (relative to alternative COP crops) means that these favourable factors are not sufficient to encourage protein crop production on a larger scale.
- Comparison of gross margins of field peas and field beans vis-à-vis alternative COP crops for the region of East Anglia for the years 2000 to 2006 paints a mixed picture of the competitive position of the two protein crops. Field peas and field beans were at a disadvantage to rapeseed and wheat in most years. In contrast, gross margins of the two protein crops were broadly comparable with barley gross margins over the same period. No clear pattern emerges with respect to the profitability of field peas and field beans relative to competing crops pre and post-reform.
- The feed compounding sector has been undergoing a process of consolidation which started prior to 2003 reform. At the same time, the greater availability of feed ingredients rich in protein and competitively priced, such as soybean and rapeseed, has meant that feed compounders have reduced their use of protein crops in favour of these feed ingredients.

At the same time, there are bright spots, too. Our assessment reveals that there are two markets were the competitiveness of these crops has been enhanced (relative to the rest of the sector). The non-GM status of field peas and field beans means that it is easier for them to compete in feed outlets where non GM-products are required (due to the high premium associated with non-GM soybeans). The growing markets for proteins (edible bean export and pet food for peas) are able to pay a price premium for crops under contract as margins in these sectors are higher. This evidence indicates that protein crop production should be preserved where viable markets exist.

[16] These are the partial integration of the previous aid for protein crop production into the Single Payment Scheme and the special aid for protein crops set at €55.57 per hectare.

Canadian Protein Crop Sector

1 Field peas

Canada is the world's leading largest producer and exporter of field peas, accounting for an average of about 25% of world production and 50% of world exports. Canadian field pea exports have reached a value of C$500 million in each of the last two years. Production of field peas has been steadily increasing since the early 1990s because of its strong competitiveness and the complementary nature of growing a pulse in rotation with cereals and oilseeds. Saskatchewan is the leading province for field pea production with roughly 80% of Canadian production. Major export markets include India for edible peas and the EU for feed peas.

1.1 Agronomics

Dry peas are a cool season crop, which means they can be seeded early and tolerate light frosts between above -6ºC. Best yields are achieved if planting takes place in early May. Peas have a relatively shallow root system and are generally as drought tolerant as grains, but cannot tolerate drought stress during flowering. Peas take approximately 90-105 days to reach maturity

If peas are planted on land which had nodulated field peas or lentil grown on it in the previous two years, inoculation is generally not necessary. Nitrogen fertiliser is not required for optimal field pea production, unless the soil has less than 50 kgs of available nitrogen per hectare. In this case, an application of nitrogen to get the young plants off to a good start is recommended. Over-application of nitrogen will increase costs without increasing yields. Relatively large amounts of potassium and phosphorus are required by the crop, and the required fertiliser is usually applied before spring planting.

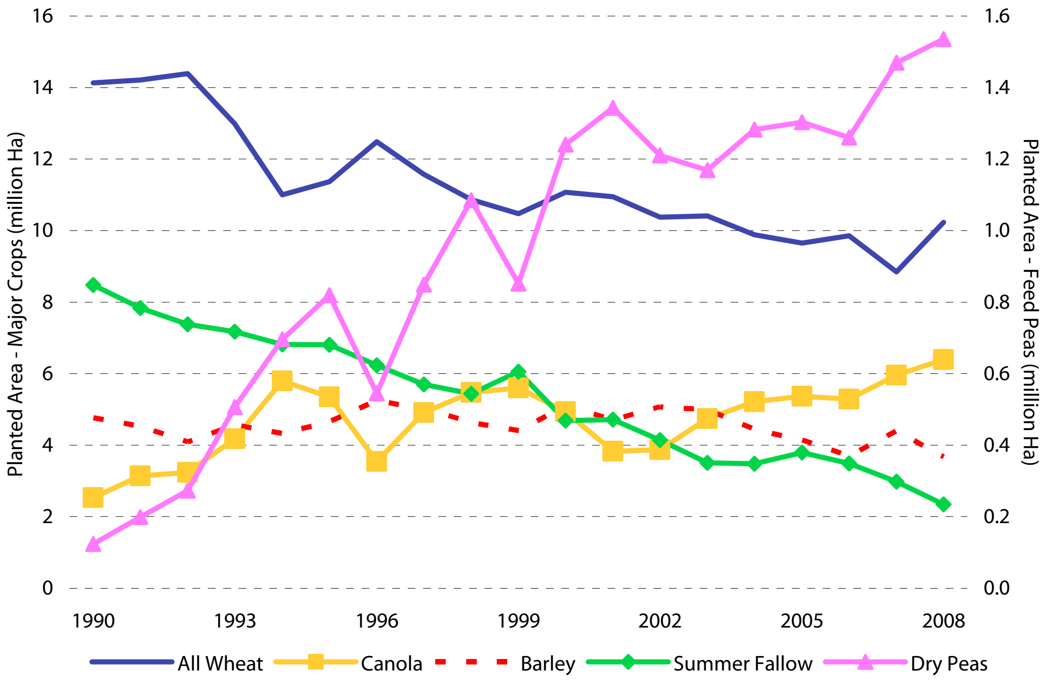
Peas, as with many other pulses, have an indeterminate growth habit, which means they continue to flower and produce pods until they are stopped by some stress. Plants may be actively growing and flowering when the first pods are ripe and ready to shatter. Harvest timing is therefore a compromise between increased yield from the younger pods and increased losses from the shattering of the older pods. The optimal time for harvest is generally before shattering losses occur because young pods face greater risk from weather disease and insect damage. Harvest takes place between mid-July and mid-August depending on planting times and weather. Hot, dry and windy conditions can move up the harvest date.

1.2 Production

Canadian dry pea production has been increasing steadily over the last 20 years and took off in earnest in the early 1990s, coinciding with the collapse of the Soviet Union and the low world cereal prices that followed. Other factors that have opened the door for the expansion of field peas, and pulses more generally, have been the steady erosion of fallow acreage in the Canadian Prairies.

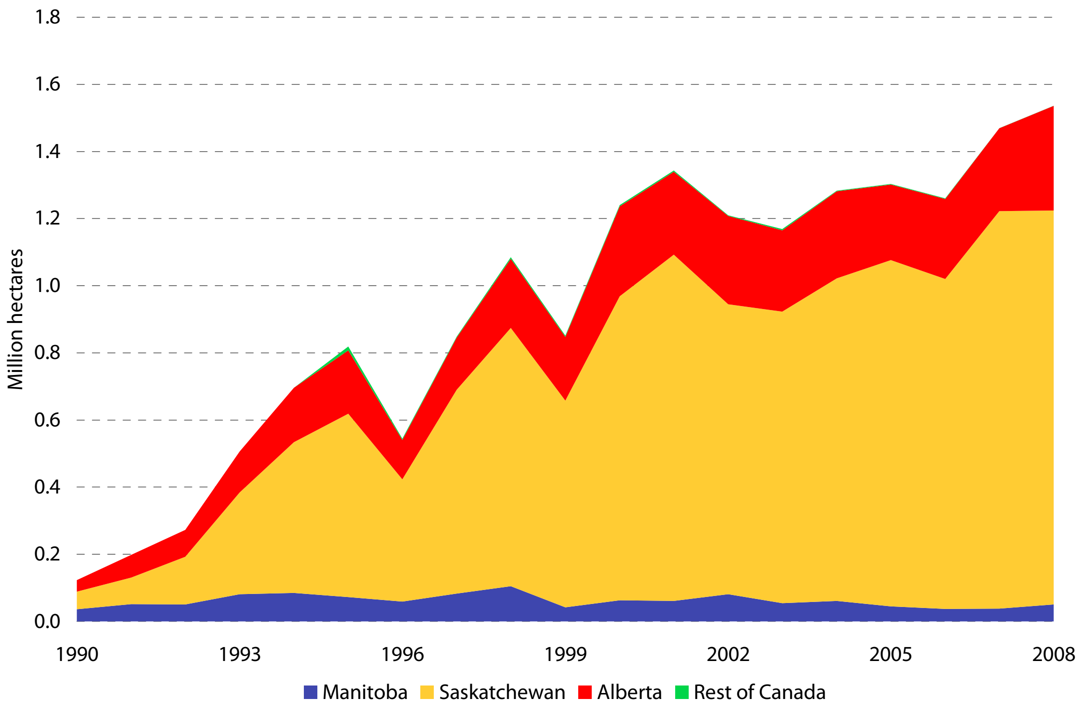
In 1990, there were 125,000 ha planted to field peas in Canada. In 2007/08 there were nearly 1.5 million ha. planted (Diagram CA.**1**), with this acreage located almost exclusively in the Prairie provinces (Diagram CA.2), with a very small area planted in the Peace River Valley of British Columbia. Saskatchewan dominates the area planted to peas with over 80% of the total. Alberta has the second largest planted area with roughly 18%. Manitoba's planted acreage peaked in the late 1990s, and has declined since then, now accounting for about 50,000 ha. Production (Diagram CA.3) has followed a similar upward trend with planted acreage, albeit with actual outcomes reflective of annual growing conditions. 2002/03 was a particularly bad year for pea production, as it was for all agriculture in Western Canada because of a drought that summer. Production for 2007/08 was just under three million tonnes and is forecast at 3.3 million tonnes for 2008/09.

Diagram CA.1: Evolution of area planted to field peas vs. other crops and summer fallow



Source: Stat Canada

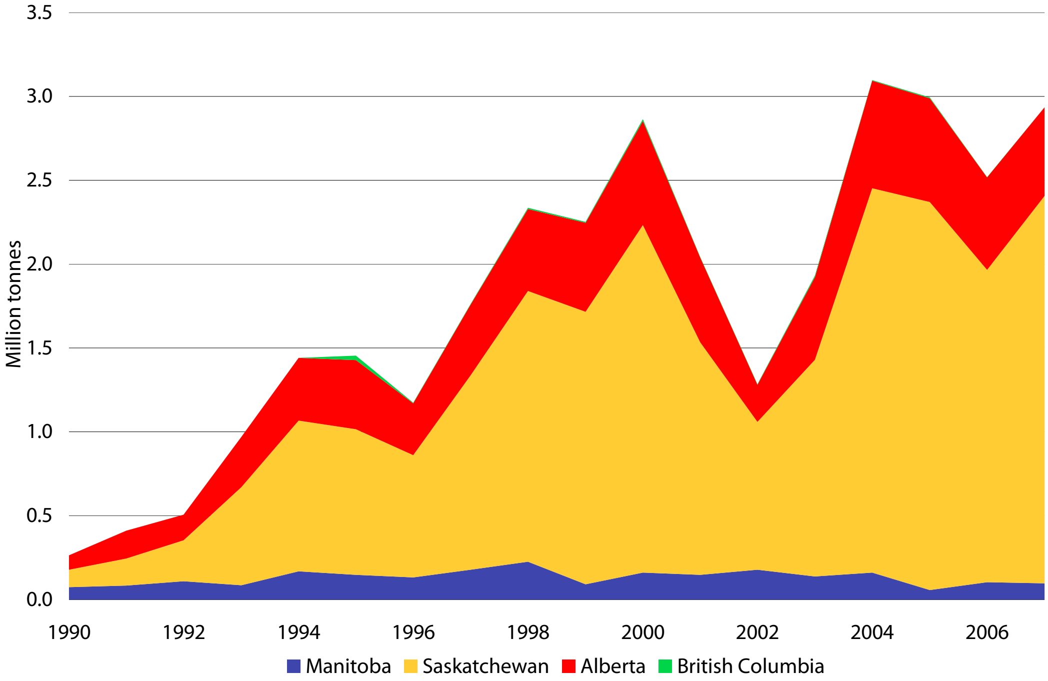
Diagram CA.2: Canadian field pea planted areas by province



Source: Stat Canada

Field pea varieties are typically grouped along the colour classification of green and yellow. Peas not classified as green or yellow are categorised as "other" and include the small yellow, maple, green marrowfat and Austrian winter varieties. Yellow peas are by far the most widely produced, averaging 75% of total production over the last five years, with green peas making up the bulk of the remainder. Green and "other" pea varieties are marketed mostly for human consumption, while yellow peas are used both for food and animal feed.

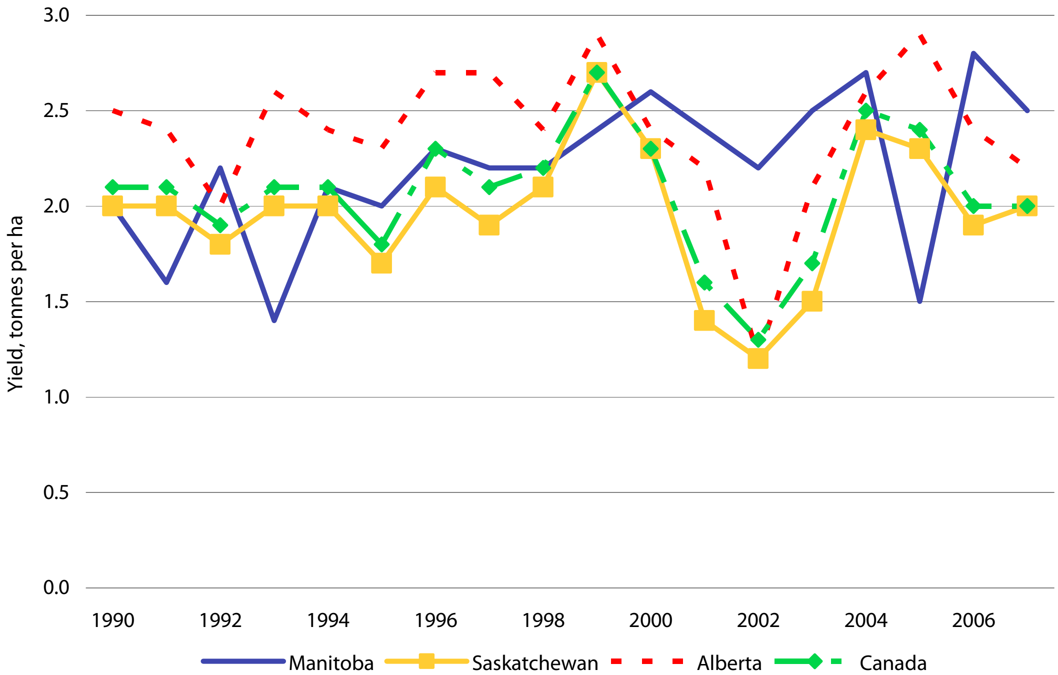
Diagram CA.3: Canadian field pea production by province



Source: Stat Canada

Yield gains in field peas (Diagram CA.4) have been almost nonexistent. The reason is that the industry has made a conscience decision to avoid becoming genetically modified, since a significant share of the export market is in the European Union. Peas are also a relatively segmented market and are subject to significant differences in price based on grade.

Diagram CA.4: Field pea yields by province



Source: Stat Canada

1.3 Consumption in Canada and overseas

There are two uses for dry peas, animal feed and human consumption. The outlets as animal feed are mainly concentrated in Europe and Canada itself, whereas sales for food use are primarily made in Latin America and Asia. Canada exports on average 75-80% of its production, with the remainder for domestic consumption.

When the pea crop is planted, most farmers select inputs and produce the crop with the goal of selling edible peas, for which there is a significant price premium over field peas. In the world market, the demand for edible peas is fairly constant, with most of this demand coming from the Indian subcontinent, Latin America and the Middle East. If there are sufficient edible peas in the world market to meet global demand, the residual, supplied mostly by Canada, is sold as feed peas. Within Canada, most consumption is in the form of animal feed, making Canada part of the broader residual market for peas. Canadian consumption shows a degree of variability, ranging between 650,000 and 912,000 tonnes over the last five years, reflecting the high degree of substitutability between peas and other protein crops in feed rations.

The pig industry is the most important user of feed peas, although they are also used for poultry, cattle and other livestock. The biggest challenge in developing feed markets for peas, both within Canada and abroad, has been the unreliability of supply which can be limited by weather or by high premiums in the edible pea market, which makes peas less competitive as a feed ingredient.

Peas are a good source of energy and protein for pigs. Usually dry peas displace soybean meal and grains, such as wheat or maize, in a one-third to two-thirds ratio. Therefore a formula of 1/3 soybean meal + 2/3 wheat or maize (whichever is cheaper) provides an estimate for the opportunity cost of dry peas. North American pig rations are usually formulated on the basis of metabolisable energy. In Europe, by contrast, they are typically formulated on the basis of net energy. Using net energy as a basis increases the value of feed peas by about 12%, because the net energy content of peas is about 37% higher than that of soybean meal (and 12% is 1/3 of 37%). A common feed product produced in Canada is a blend of ground peas and rapeseed meal, two products which have a complementary profile of amino acids.

1.4 Trade

Because of its high demand for edible peas, which cannot always be met with domestic production, the Indian subcontinent, and India in particular, is the most important export market for Canada (Table CA.1). Together, India, Pakistan and Bangladesh have accounted for 43% of Canadian exports over the last ten years. Exports to this region have been trending upwards, and were 60% of exports in 2007/08. More broadly, Asia as a whole has averaged over 60% of export outlets for Canadian field peas since 1997-98.

The destination of imports is well correlated with the premium of edible yellow peas to feed peas. In years, where the premium is high, the percentage of Canadian exports to countries whose primary use for peas is animal feed goes down. Conversely, in years of high prices, driven in theory by low stocks elsewhere in the world, exports to countries whose primary use is food go up.

Diagram CA.5 illustrates this analysis of the premium for edible peas by plotting the percentage of total Canadian exports to the EU against exports to the Indian sub-continent. In years when the subcontinent imports a high proportion of Canada's pea exports, there are high premia for edible peas. When sub-continental imports are low, the share of imports to the EU increases and the premium for edible peas is low, allowing field peas to be a competitive component in feed rations. Within the EU, the largest importer of peas is Spain, followed by Belgium and the Netherlands.

Canada itself imports around 50,000 tonnes of peas annually, almost exclusively from farmers along the northern border of the United States selling to Canadian elevators.

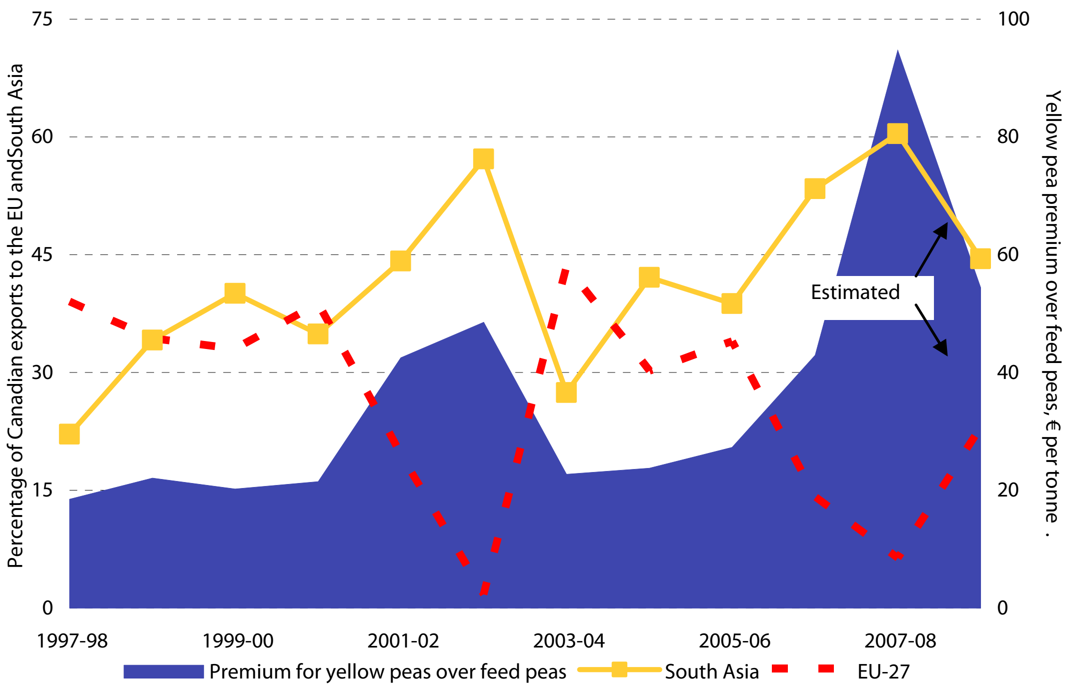
Table CA.1: Leading Export Destinations for Canadian Field Peas

	India	China	EU-27	Bangladesh	Pakistan	US	Cuba	Other	**Total Exports**
1997-98	175	66	436	70	2	31	141	195	**1,116**
1998-99	382	30	586	181	19	23	201	283	**1,705**
1999-00	210	47	468	312	46	24	38	272	**1,417**
2000-01	529	124	851	186	51	22	74	359	**2,196**
2001-02	454	101	271	122	34	26	76	297	**1,381**
2002-03	284	26	11	71	3	26	40	165	**626**
2003-04	300	27	572	22	39	36	65	255	**1,316**
2004-05	599	146	560	130	51	39	47	281	**1,853**
2005-06	631	301	872	230	134	43	55	301	**2,567**
2006-07	896	251	279	110	45	34	27	327	**1,969**
2007-08	1,122	215	143	209	28	29	107	397	**2,250**
2008-09 ytd	529	64	38	0	3	11	81	98	**824**

Source: Stat Canada

Although the Canadian prairies in general, and Saskatchewan in particular, are competitive producers of pulses, they are disadvantaged in terms of logistics. Exporting peas is made difficult by the interior location of the Canadian prairies, from which exporters must ship by rail either to Vancouver on the West Coast or out of Thunder Bay and through the St. Lawrence Seaway. Rail freights to these destinations from Saskatoon in South-Central Saskatchewan are C$42 to Vancouver and C$36 per tonne to Thunder Bay. A special problem for elevators is securing rail wagons, because the railway companies tend to give precedence to higher value cargoes.

Diagram CA.5: Canada's export shares to the EU and Indian Subcontinent vs. the premium for edible peas

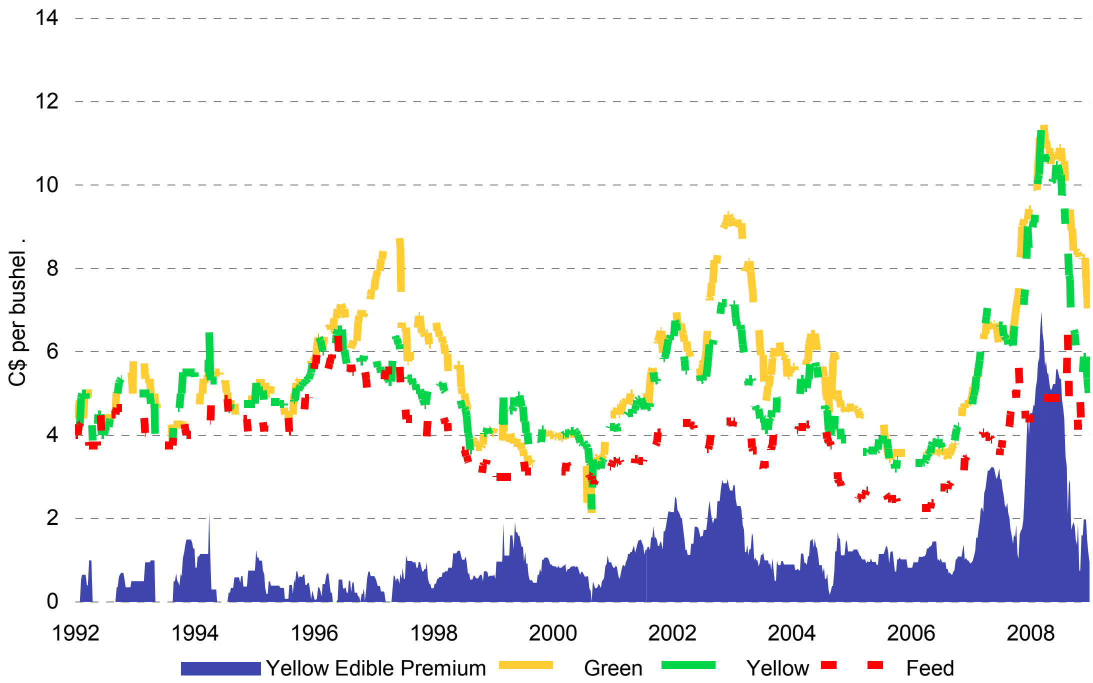


Source: Stat Canada

1.5 Disposition and pricing

Diagram CA.6 plots the price of field peas by type since 1992. Prices for field peas peaked in early spring of 2008, but began to fall rapidly in late summer. This was due to strong production from Canada, as well as from its competitors in the export market, namely the Ukraine, other former Soviet Union republics and France. With prices falling from historically high levels, many contracts were repudiated with buyers refusing to accept delivery upon arrival in port, leaving shippers facing heavy losses. Because of declining prices, many importers, particularly in China, India and Turkey, wanted to renegotiate contracts to get a lower price, while some used the recent credit crisis as an excuse to renege on their contracts entirely.

Diagram CA.6: Canadian wholesale pea prices by class



Source: Stat Canada

Table CA.2 provides a detailed disposition of Canadian field pea production, supply, exports and use. For the 2007/08 crop year, which ended in July, high export and, low carry-in stocks created an environment of tight stocks and high prices. For 2008/09 high global production creates a bleak outlook for pea prices. Low prices suggest that a relatively large share of production will go towards Europe's animal feed market.

Table CA.2: Canadian field pea disposition ('000 tonnes)

	2004/05	2005/06	2006/07	2007/08	2008/09
Carry-in Stocks	205	595	440	205	150
Production:					
Yellow	2,190	2,050	1,940	2,355	2,590
Green	825	890	535	535	660
Other*	83	54	45	45	50
Total Production	**3,098**	**2,994**	**2,520**	**2,935**	**3,300**
Imports	**57**	**76**	**60**	**50**	**50**
Total Supply	**3,360**	**3,665**	**3,020**	**3,190**	**3,500**
Exports					
Asia	974	1,349	1,373	1,580	1,406
Europe	567	887	289	270	554
South America	110	71	86	110	120
Middle East	59	84	82	100	110
Central America and Antilles	59	72	46	80	90
Africa	41	60	57	70	80
United States	39	42	34	38	38
Oceania	4	2	2	2	2
Total Exports	**1,853**	**2,567**	**1,969**	**2,250**	**2,400**
Total Domestic Use	**912**	**658**	**846**	**790**	**800**
Total Use	**2,765**	**3,225**	**2,815**	**3,040**	**3,200**
Carry-out Stocks	**595**	**440**	**205**	**150**	**300**
Stocks-to-Use Ratio (%)	**21.5%**	**13.6%**	**7.3%**	**4.9%**	**9.4%**
Average Producer Price	**C$ per bushel**				
Food - Yellow	3.90	3.50	5.40	8.25	
Food - Green	4.65	3.55	5.30	8.75	
Feed	3.10	4.00	3.80	5.25	
Average Producer Price	**Euros per tonne**				
Food - Yellow	91.0	91.1	134.3	202.9	
Food - Green	108.5	92.4	131.8	215.2	
Feed	72.3	104.2	94.5	129.1	

Sources: Stat Canada and the Saskatchewan Pulse Board

1.6 Canadian field pea cost competitiveness and the medium term outlook

The short term outlook for crop prices has come to resemble somewhat of a downward spiral. Yet, despite low prices, peas are not likely to lose large amounts of acreage in the coming year both because of their nice fit in the production rotation and relatively higher gross margins when compared with other broad acre crops grown in Saskatchewan.

In Table CA.3, we contrast the gross margins, revenues and production costs for peas, lentils (as a basis for comparison with another protein crop), barley, spring wheat and canola. Gross margin figures include a residual Nitrogen credit of 25 kg per hectare for peas and 10 kg per hectare for lentils. In all cases, Saskatchewan agriculture employs an extensive form of cultivation, with large farms, a comparatively low intensity of input use and hence significantly low yields per hectare than those achieved in most of the EU.

For farmers who can produce and sell their field peas at edible pea prices, gross margins are clearly higher than those for barley, wheat or canola. However, because world pea production could exceed demand, pea producers run the risk of their output being priced at a feed market value, for which gross margins have, on average, been lower than for barley or canola.

It is evident that lentils have been a clear winner over the period in the table, and there are some indications that pea growers are responding to this by switching acreage to lentils. However, lentils are more limited in their geographical range of production, in that they do not do well in the wet and heavy "black" soil type that dominates the northern and eastern parts of Saskatchewan and comprises more than half of the arable area in the province.

Table CA.3: Saskatchewan arable crop revenues, production costs and gross margins (Canadian $ per hectare)

Gross Margins II	2007	2008	2009	3 year average
Green Pea	176	364	73	***204***
Yellow Pea	199	321	69	***196***
Feed Pea	49	72	25	***49***
Lentil	251	721	572	***515***
Barley	93	51	25	***56***
Spring Wheat	37	6	-7	***12***
Canola	165	118	7	***97***
Revenues, including Nitrogen Credit				
Green Pea	493	751	441	***562***
Yellow Pea	508	699	423	***543***
Feed Pea	348	417	358	***374***
Lentil	566	1,101	957	***875***
Barley	318	353	253	***308***
Spring Wheat	314	339	271	***308***
Canola	441	415	304	***387***
Cost of Production				
Green Pea	318	387	368	***357***
Yellow Pea	308	378	354	***347***
Feed Pea	298	345	333	***325***
Lentil	315	380	385	***360***
Barley	241	320	241	***267***
Spring Wheat	283	340	283	***302***
Canola	276	297	297	***290***

Source: Saskatchewan Ministry of Agriculture

2 Field beans

Field beans (faba beans) are a minor crop in terms of planted areas and production in Canada. Canada is also a small exporter of the crop, accounting for less than 1% of global exports on average. Production of faba beans has been relatively volatile, reflecting its stature as a crop of secondary importance in most farming operations. However, in some parts of the Canadian prairies, most notably where soils have the highest moisture content, faba beans can outperform other pulses. Faba beans have the disadvantage of being costlier to produce than field peas, while not receiving a price premium for their higher protein and energy content. Distinctions in the requirements for the human food market and the animal feed market make it difficult, if not impossible to sell one variety of beans in both markets. In general, higher gross margins in other crops make faba beans an unlikely front runner for expanded acreage.

2.1 Agronomics

Faba beans are better at fixing Nitrogen than any other pulse crop and therefore Nitrogen use is not recommended, provided the seed is inoculated with the right type of rhizobia. Although faba beans are the best nitrogen-fixing pulses, they do not necessarily leave as much residual Nitrogen in the soil as field peas, with studies showing that cereals and oilseeds perform better being planted after peas than faba beans. Faba beans, like field peas, are a cool weather crop and should be seeded early, not after the second week of May, to maximise yields. Faba beans are the least drought-tolerant of the pulses and are most suitable in Canada's clayey black soil zone.

The faba bean harvest takes place in late August or early September. The crop should be desiccated prior to harvest to decrease moisture and ease combining. The upright growth habit for Faba beans means that it can generally be combined directly without swathing, which is the prevalent cultural practice with field peas which often lie flat on the ground when mature, making faba bean harvest generally quicker and cheaper.

2.2 Production and domestic consumption

As noted, Canada is a small producer of faba beans, producing approximately 17,000 tonnes from just over 8,000 hectares in 2007/08, accounting for less that 0.5% of total world production. Domestically, the largest producing province is Manitoba, although production in Alberta took off following the expansion of the pig sector in that province in the late 1990s.

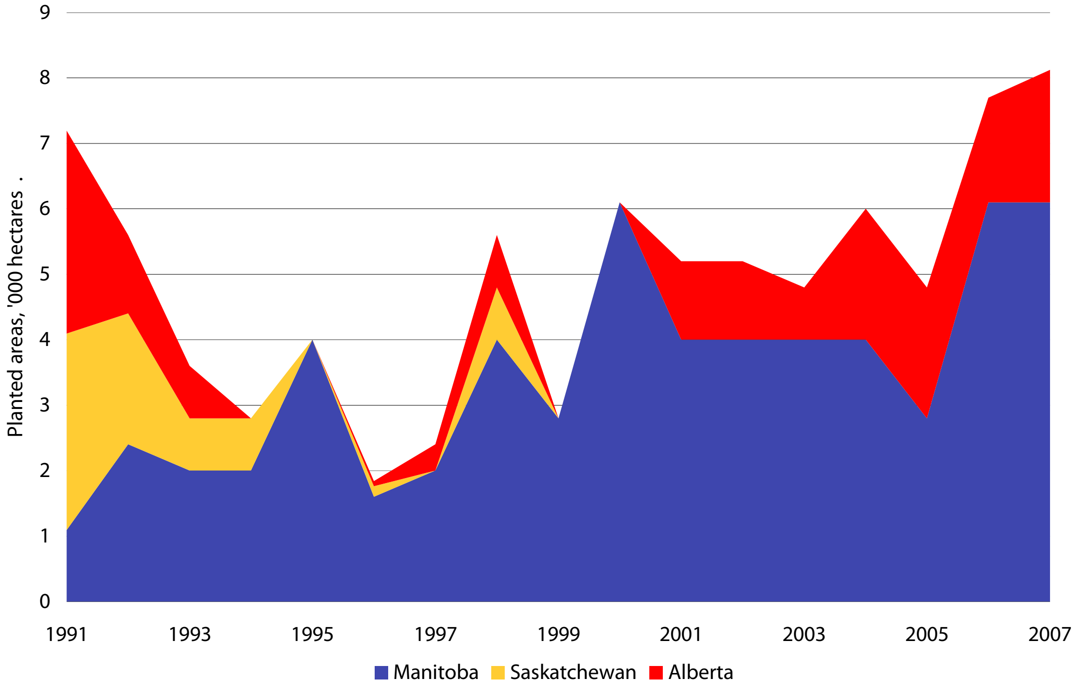
Faba bean production is of two types, a low tannin variety that is produced for animal feed and varieties that contain tannins (which provide flavour) for human consumption. Low tannin varieties are used for livestock because tannins decrease protein digestibility and palatability for animals.

In Alberta it has been estimated that over 90% of faba beans are the low tannin variety. Conventional wisdom says that in Alberta a high degree of insect pressure yields faba beans that are discoloured and not suitable for human consumption. In Manitoba a larger share of production of faba beans is produced for the food market.

As a feed, the high fixation and uptake of Nitrogen in faba beans makes the bean itself high in Nitrogen, which corresponds to high levels of amino acids. Among pulses, faba beans have the highest energy and protein content; however Canadian producers have not been able to command higher prices for faba beans than they do for feed peas, due to the availability of cheaper protein feeds in the form of DDGS and soybean meal.

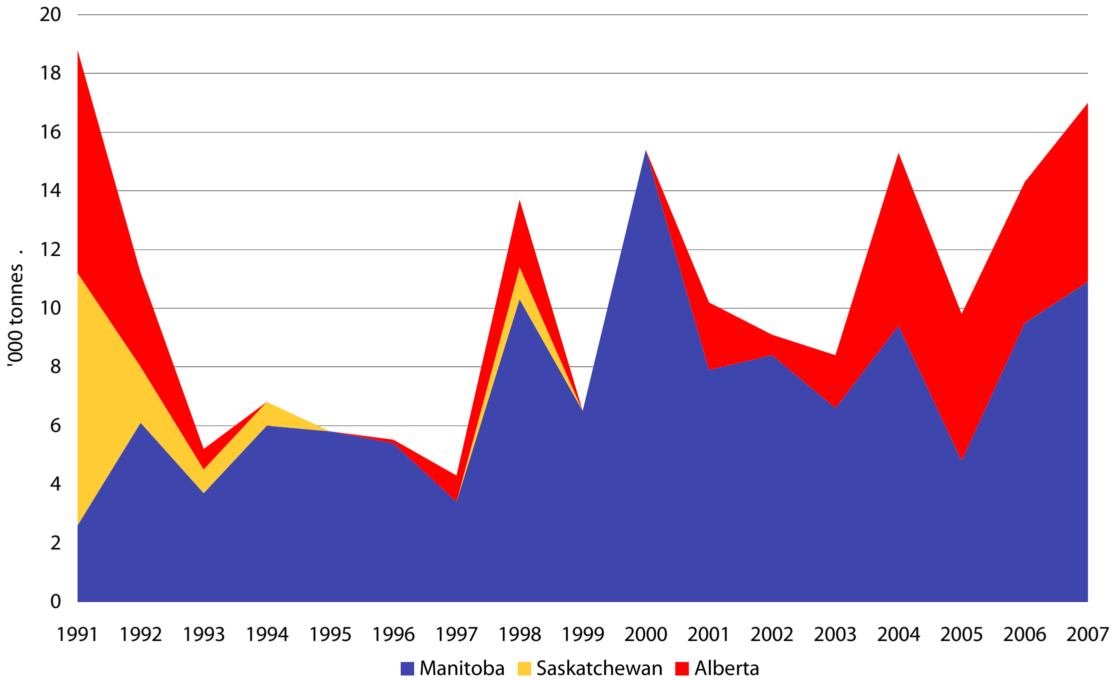
Canadian faba bean yields have not seen any substantial improvements over the last 20 years. However, there are signs of improving yields in Alberta, where there has been an emphasis on developing lines suitable for the more arid conditions of that province.

Diagram CA.7: Canadian faba bean planted areas, by province



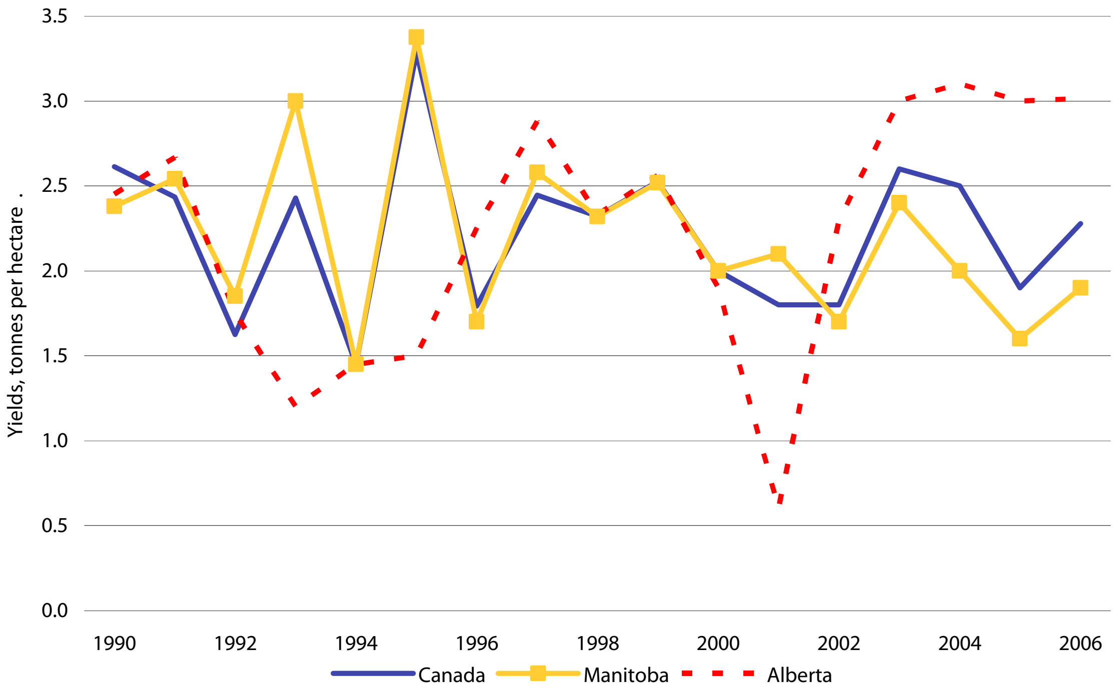
Source: Stat Canada

Diagram CA.8: Canadian faba bean production, by province



Source: Stat Canada

Diagram CA.9: Canadian faba bean yields, by province



2.3 Trade, disposition and pricing

Typically, between 400-600,000 tonnes of Canadian faba beans are exported onto the world market in a given year. Exports are dominated by France, Australia and the UK, with Canada averaging only 0.77% of global faba bean exports over between 2002/03 and 2006/07.

Only in the last two years have Canadian faba bean exports exceeded 1% of the world total. Exports are projected to continue to grow as the Canadian pig sector contracts and breeding programmes increase the yields achieved on existing acreage.

The vast majority of Canadian faba bean exports are for human food. Historically the Middle East, in the form of Egypt, Saudi Arabia, Lebanon, Jordan and Israel, were the top markets for Canadian faba beans. In 2006/07 and 2007/08 faba bean exports to the EU expanded markedly on the back of decreased production in Europe, as well as in Australia. The leading importers in the EU have been the Netherlands and Italy.

Table CA.4: Canadian faba bean disposition ('000 tonnes)

	2003/04	2004/05	2005/06	2006/07	2007/08
Carry-in stocks	**0**	**2**	**6**	**5**	**1**
Production	**8**	**15**	**10**	**16**	**17**
Imports	**5**	**2**	**2**	**2**	**2**
Total Supply	**13**	**19**	**18**	**23**	**20**
Exports:					
Europe	0	0.2	0.1	10	5
Middle East	1.1	0.3	0.9	1	1
United States	0.9	1.5	1	1	1
Total Exports	**2**	**2**	**2**	**12**	**7**
Total Domestic Use	**9**	**11**	**11**	**10**	**11**
Total Use	**11**	**13**	**13**	**22**	**18**
Carry-out Stocks	**2.34**	**6.84**	**5.58**	**1.15**	**2.2**
Stocks-to-use Ratio (%)	**18%**	**36%**	**31%**	**5%**	**11%**
Average Producer Price - Feed, C$/bushel	**5.40**	**5.40**	**4.50**	**4.20**	**5.50**
Average Producer Price - Euros/tonne	**126**	**126**	**117**	**104**	**135**

Source: Stat Canada

2.4 Bean competitiveness and the medium term outlook

The outlook for faba beans is mixed. Work is under way in Saskatchewan and Alberta to develop varieties which are more suitable for both food and feed. For the food market, the goal is to develop beans of the appropriate appearance to meet market demands. For the feed market, research is focused on developing smaller feed grade, low tannin varieties that will be suitable for both poultry and pigs.

An important focus of research for faba beans in Canada is to develop early maturing varieties so that faba beans will be better adapted to the short growing season of the black soil zones found in the northern parts of the province.

However, there is a widespread view in Canada, and in Alberta in particular, that faba beans may not see further increases in their planted areas. Lentils have had a phenomenal run the last three years due to high prices.

Peas have the advantage of giving the producer the opportunity to sell at least a portion of his/her peas at the higher prices associated with human food, with a safety net in the form of the residual feed market. When growing faba beans, however, a producer must decide from the very start whether to grow the low tannin or food bean variety, locking the producer into the feed or food markets.

While faba beans are able to achieve higher overall revenues per hectare than feed peas, higher production costs, because of costlier seed, have made the gross margins for faba beans lower than those for field peas. Also, residual nitrogen from faba beans is less than for feed peas.

Table CA.5: Average gross margins per hectare for faba beans and field peas, 2007-2009 (C$ per hectare)

	Faba Bean	Feed Pea	Edible Yellow Pea
Gross Margin II	**-32**	**49**	**196**
(of which N Credit)	13	31	31
Total Costs	**421**	**325**	**347**
Revenue from Sales	**376**	**343**	**512**

Source: Saskatchewan Ministry of Agriculture

The window remains open for faba beans where agronomic constraints make other pulses difficult to grow. They are superior to feed peas and lentils in conditions of high soil moisture. Because they are the best pulse in terms of nitrogen fixation, albeit not for residual nitrogen, faba beans may prove to be attractive in years of very high fertiliser costs in that N use in faba beans is never recommended.

The fortunes of faba beans, the pulse with the highest protein content, could also improve if its main competitors among low cost protein rations, such as DDGS and soybean meal, increase in cost.

Finally, faba beans may also prove to be a good choice for high protein silage, because of high amounts of biomass and because it is possible to leave standing stubble for improved moisture retention under an environmentally attractive reduced tillage system.