Directorate-General for Agriculture
and Rural Development

Expert Group for Technical Advice on Organic Production

EGTOP

# FINAL REPORT

on

# Plant Protection (VIII)

# and

# Fertilisers (VI)

The EGTOP adopted this technical advice at the plenary meeting
of 6 – 8 June 2023

About the setting up of an independent expert panel for technical advice

Regulation (EU) 2018/848[1] requires that authorisation of products and substances used in organic production may only be authorised if they comply with the principles, criteria and objectives of organic production described in that Regulation. The Commission has decided that when taking decisions on these authorisations it will take account of scientific advice by a group of independent experts. For that purpose the Commission has set up the Expert Group for Technical Advice on Organic Production by Commission Decision 2021/C343/03 of 4 August 2021.

EGTOP

The Group's tasks are:

(a) to assist the Commission in evaluating technical matters of organic production, including products, substances, methods and techniques that may be used in organic production, taking into account the objectives and principles laid down in Regulation (EU) 2018/848 and additional policy objectives with regard to organic production;

(b) to assist the Commission in improving existing rules and developing new rules related to Regulation (EU) 2018/848;

(c) to stimulate an exchange of experience and good practices in the field of technical issues related to organic production.

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http://ec.europa.eu/agriculture/organic/home_en

[1] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0848&from=EN

## ACKNOWLEDGMENTS

Members of the Group are acknowledged for their valuable contribution to this technical advice. The members are:

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http://ec.europa.eu/agriculture/organic/home_en

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## EXECUTIVE SUMMARY

The Expert Group for Technical Advice on Organic Production (EGTOP) was requested to advise on the use of several substances with plant protection or fertilising effects in organic production, and to advise on aspects of organic production of yams. The Group discussed whether the use of these substances and methods is in line with the objectives and principles of organic production, and whether they should be included in Reg. (EU) 2021/1165.

With respect to Annex I to Reg. (EU) 2021/1165, the Group recommends the following:

- For spinosad, the conditions for use in organic production do not need to be changed for the moment.
- Sodium hydrogen carbonate should be maintained as an allowed substance. The Group recommends that the Commission Services place sodium hydrogen carbonate in the chapter of Annex I, which is legally correct.
- For authorized substances, the Group recommends that the Commission Services select the most appropriate category, and sees no need to consult EGTOP before doing so.

With respect to Annex II to Reg. (EU) 2021/1165, the Group recommends the following:

- The Group considers carbon dioxide enrichment to be implicitly authorized. The Group leaves it to the Commission to decide whether carbon dioxide needs to be listed explicitly as authorized for this purpose, and in this case, in which article or annex this should be placed.
- Plant-based fibres (for example, hemp fibre, flax fibre, cellulose or coir/coconut fibre) should be authorized as carriers for organic production of sprouted seeds. The Group does not make a precise recommendation in which form the authorisation should be made.
- Frits specifically produced for fertilisers should be included in Annex II.

With respect to Annex VI to Reg. (EU) 2021/1165, the Group recommends the following:

- The use of ethylene for flower induction in pineapples should be included in Annex VI.

With respect to yams production, the Group clarified the terms ‘living soil’, ‘in connection with subsoil and bedrock’ and 'plant production is based on nourishing the plants primarily through the soil ecosystem'. With respect to yams production in elevated beds or trenches, the Group concluded that:

- There are no restrictions on materials used for such methods of cultivation.
- As a general rule, organic crops, except those which are naturally grown in water, shall be produced in living soil. There are no dedicated rules for yams production.
- There are no restrictions on the height of the container nor the height of the mixture filling the container. As a guiding principle, the container height must ensure that soil contact is possible during normal root development (yams can root over one meter).
- There are no restrictions on the depth of the trench and the filling with river sand and humus.
- The open mesh must ensure soil contact during normal root development and must not hinder root penetration into the soil underneath the container.

## 1. BACKGROUND

Several Member States and a certifying body have submitted dossiers under Article 16(3)(b) of Regulation (EU) 2018/848 concerning the possible amendment of Annex I, II and VI to Commission Implementing Regulation (EU) 1165/2021[2] and in general, on their compliance with the above mentioned legislation.

- The Commission asked whether the amendment of the MRLs for spinosad on certain commodities has implications for its authorisation in organic production.
- Germany asked whether sodium hydrogen carbonate should be re-located within Annex I, as a consequence of its approval as a low-risk active substance.
- Italy requested the authorisation of carbon dioxide enrichment for the cultivation of microalgae in land-based systems.
- Italy requested the authorization of frits as micronutrient fertilisers.
- Ecocert[3] requested the authorization of ethylene for flower induction in pineapples.
- Germany and Austria requested clarification of terminology and guidance concerning the organic cultivation of yams in elevated beds and trenches filled with river sand.

## 2. TERMS OF REFERENCE

The Expert Group for Technical Advice on Organic Production (EGTOP) is mandated to examine the questions and dossiers mentioned above, in the light of the most recent technical and scientific information available. It shall conclude whether the substances and production methods are in line with the objectives, criteria and principles as well as the general rules laid down in Regulation (EU) 2018/848 and, hence, can be authorised for use in organic production under the EU organic legislation. The Group is invited to suggest amendments to the current lists in Annexes I, II and VI to the Regulation (EU) 2021/1165.

2 EUR-Lex - 32021R1165 - EN - EUR-Lex (europa.eu)

3 https://www.ecocert.com

# 3. CONSIDERATIONS, CONCLUSIONS AND RECOMMENDATIONS

## 3.1 Plant protection (Annex I of Reg. 2021/1165)

### 3.1.1 Comments on spinosad

*Introduction and focus*

The use of spinosad in EU organic production was first recommended in 2008 by an ad-hoc expert group. In the plenary meeting of 9 – 10 June 2016, The Group prepared an overview of all plant protection products that were never evaluated by EGTOP before (see EGTOP report on Plant Protection III, chapter 4.7.2). In the case of spinosad, the Group did not see the need for a dossier and/or re-evaluation and recommended that the substance should remain on Annex II.

Spinosad was evaluated for renewal of approval in the framework of Commission Regulation (EC) No 1107/2009. On 03 May 2018, EFSA published its conclusion on the peer review of the pesticide risk assessment of the active substance spinosad (EFSA, 2018). In conclusion, the current acceptable daily intake (ADI) was confirmed, and an acute reference dose (ARfD) of 0.1 mg/kg body weight was proposed. This was the first time the ARfD for spinosad was defined. A decision by the EU Commission regarding renewal is expected soon

Based on the newly defined ARfD, the Maximum Residue Level (MRL) of the substance remained the same for most commodities but was modified for five leafy vegetables, i.e. lettuces; escaroles / broad leaved endives; spinaches; chards/beet leaves; witloofs / Belgian endives, and also for sweet peppers/bell peppers (EFSA, 2021).

After these revisions, the European Commission requested EGTOP to evaluate if it is necessary to adjust spinosad's current approval for organic agriculture.

*Authorization in general production*

Plant protection products based on spinosad are registered for use on a wide range of crops and against many different insect pests.

*Authorization in organic production*

Spinosad is authorized for EU organic production.

*Agronomic use, technological or physiological functionality for the intended use*

Spinosad is a widely used insecticide in organic agriculture against a range of pests.

*Necessity for intended use, known alternatives*

- Whether a use is essential depends on (i) the economic damage caused by a certain pest on a specific crop, (ii) the effectivity of a pesticide in preventing/reducing that damage, (iii) the availability and effectivity of alternatives (management practices and/or other insecticides).
- Whether spinosad is authorised against a certain pest on a certain crop, and whether alternative insecticides, as well as biological alternatives are authorised against the same pest / crop, may differ from one country to another, and over time. Whether a given pest is expected to cause severe economic damage and whether management practices might prevent/reduce the damage may depend on site-specific conditions. The Group sees no way to handle this appropriately at the EU level, as it should be dealt with by national authorities. The Group underlines that every organic farmer should reflect on the necessity of applying spinosad as well as any other pesticide.
- The difficulties in establishing whether a use is essential are illustrated here with a few examples: Spinosad has a regular authorisation in the EU for several different crops or crop groups (berries, fruit, grapes, vegetables - both in open field and protected, field crops and ornamentals). For example, in Italy and Switzerland it is authorised on more than 60 crops, and on more than 40 in Poland (data from national databases or approved labels). As the situation is constantly evolving, this reflects the situation in early

June 2023. Authorised uses may include up to 7 different pest species or groups of pest species (e.g. 'leaf-feeding caterpillars') overall adding up to more than 100 possible crop/pest combinations of uses. Such a situation makes it difficult to fully assess the 'essential' condition, which can be also exemplified with the decisions made by a private label active in Switzerland[4]. Spinosad is considered essential in culinary herbs for use against leaf beetles, *Psylliodes*, and various caterpillars in Switzerland, as the trade tolerates hardly any feeding damage on them. On the other hand, spinosad is registered for use against potato beetles. However, *Bacillus thuringiensis* var. *tenebrionis* (Btt) is also registered against this pest in Switzerland and several EU countries and has a sufficient effectivity making spinosad not essential. However, Btt is currently not available in all countries. Thus, where Btt is available, spinosad is not essential for potatoes, and where Bt is not available, spinosad is essential for potatoes.

As an overall conclusion, spinosad is essential in some cases, where there are no viable alternatives available (plant protection products or alternative control methods).

*Origin of raw materials, methods of manufacture*

Spinosad is produced by a fermentation process using a strain of *Saccharopolyspora spinosa*. After the fermentation process is completed, spinosad is recovered from the fermentation broth by solvent extraction. As a natural substance, it complies with the principles of organic production. The evaluation for renewal has not revealed changes in the substance's origin or production method, and the Group confirms its evaluation from 2016.

*Environmental issues, use of resources, recycling*

Although many data gaps were identified by EFSA (2018), spinosad and its metabolites spinosyn A, D, B and N-dimethyl spinosyn D, are identified to pose:

- A low risk to soil macro- and micro-organisms. The substance and its metabolites have low mobility in soil, so there is little risk for leaching;
- A high risk for aquatic organisms;
- A high risk for non-target arthropods, but no systemic action;
- A low acute and long-term risk to birds;
- A low acute and long-term risk to wild mammals.

*Animal welfare issues*

The Group confirms its evaluation from 2016.

*Human health issues*

The Group confirms its evaluation from 2016. As stated in the introduction, the Maximum Residue Level (MRL) for spinosad has been modified for five leafy vegetables and sweet pepper. If these MRLs are respected, the Group has no concerns regarding human health.

*Food quality and authenticity*

No issues.

*Traditional use and precedents in organic production*

No issues.

[4] private label 'Bio Suisse'; authorised uses for spinosad shown in the 'Swiss Input List', see https://www.betriebsmittelliste.ch.

*Authorised use in organic farming outside the EU / international harmonization of organic farming standards*

No issues.

*Other relevant issues*

No issues.

*Reflections and conclusions*

- The mandate to EGTOP was to assess whether the modification of MRLs for five leafy vegetables and sweet pepper established by EFSA brings forward elements that make it necessary to adjust spinosad's current approval for organic agriculture. Considering all the aspects mentioned above, the answer to the present mandate is that the new MRLs are not requiring modifications to the use in organic.
- However, the Group is concerned about the possible negative impact on non-target insects. For example, the use of spinosad is not compatible with biocontrol strategies utilizing the pest control services of naturally occurring or mass-released beneficial arthropods like *Orius laevigatus* or parasitoid hymenoptera (Biondi et al., 2012; Cruz Esteban et al. 2022; Martelli et al. 2022). However, the Group has similar concerns regarding other non-specific insecticides allowed in organic agriculture (e.g. plant-based pyrethrin). Biological control through arthropod Biological Control Agents (BCA's) is the only sustainable basis for pest control in many crops, and there is a strong tendency to promote conservational biological control through increasing biodiversity. The Group highlights the importance of appropriate application of spinosad as well as of any other PPPs according to good agricultural practises in order to reduce the risks for beneficial fauna (including pollinators and natural enemies of pests). For this scope, appropriate measures should be defined at the Member State level, also considering the impact of drift towards ecological infrastructures. Such measures are also supported within the CAP 'Ecoschemes'.
- At the same time, spinosad is still needed in the protection of certain crops under certain conditions, because viable alternatives are not available yet; see examples above. The Group would welcome the development of alternatives for organic production.

*Recommendations*

The Group advises maintaining spinosad as an allowed substance for organic agriculture. Therefore, no changes regarding the entry of spinosad in Annex I of Reg. 2017/1165 are recommended.

### 3.1.2 Sodium hydrogen carbonate

*Introduction*

Germany requested a modification of the listing of sodium hydrogen carbonate. Within Annex I of Reg. 2021/1165, it shall be moved from chapter 1 (Basic substances) to chapter 2 (Low risk active substances).

*Authorization in general production*

Sodium hydrogen carbonate was approved as a Basic Substance some years ago (the first review report dates from 2015). More recently, it was also approved as a low risk active substance (review report from 2020). The approval as an active substance should lead to the withdrawal as a Basic substance. Until now, however, no withdrawal has taken place (EU pesticides database checked on 3 June 2023).

*Authorization in organic production*

The Group recommended the authorization of sodium hydrogen carbonate in 2016 (see EGTOP report on Plant Protection III, chapter 4.1). It is currently included in chapter 1 (Basic substances) of Annex I of Reg. 2021/1165.

*Reflections and conclusions*

The Group confirms that the use of sodium hydrogen carbonate aligns with the objectives and principles of organic production. Its use should therefore continue to be allowed.

Within Annex I, sodium hydrogen carbonate should be placed in the chapter which is legally correct.

*Recommendations*

- The Group recommends that the Commission Services place sodium hydrogen carbonate in the chapter of Annex I, which is legally correct.
- The Group recommends that the Commission Services select the most appropriate category for all authorized substances, and sees no need to consult EGTOP before doing so.

## 3.2 Fertilisers, soil conditioners and nutrients (Annex II of Reg. 2021/1165)

### 3.2.1 Use of carbon dioxide in the production of micro-algae for food and feed

*Introduction, scope of this chapter*

This request concerned the enrichment of water with carbon dioxide in land-based, confined systems for producing microalgae (including cyanobacteria) for food and feed. The Group understood these production systems as being pond systems. The original request made by Italy was to include carbon dioxide in Annex I of Reg. EU 2019/1126 as a nutrient for microalgae in land-based, confined systems. Micro-algae are cultured for various purposes in aquatic cultures, often closed systems. This chapter deals with their use for food and feed production.

Microalgae and cyanobacteria, also called blue-green algae, which are frequently considered part of the same group due to their physiological characteristics and 'photo-fermentation' feature, are aquatic unicellular photo-synthetic microorganisms that can be both found in freshwater and marine systems. Microalgae lack a complex structure and organs but are characterised by a high photosynthetic yield (15-25 g d.w.•$m^{-2}$•$day^{-1}$). Moreover, the ability to accumulate many valuable bioactive compounds (e.g. lipids, proteins, carbohydrates, carotenoids, and vitamins), make them a good raw material for several uses as food or feed (de Freitas Coêlho et al. 2019).

Microalgae culturing systems can be classified into two groups: the open pond and the photobioreactor. Microalgae can grow under different modes: mainly they are cultivated as photoautotrophic or heterotrophic, but some algae can grow under mixotrophic and photoheterotrophic modes. In the former case, they generate organic compounds using sunlight to process carbon dioxide ($CO_2$). Carbon dioxide requirements can be met by dispersing atmospheric air using a submerged liquid/gas equipment. The open pond system, which has been used since the late 1950s is the most primitive for their cultivation but still represents about 20% of the production in the EU. The open pond system is the predominant system for producing *Spirulina* and *Chlorella* spp. (Araújo et al. 2021). A technological improvement of this system uses thin-layer culture technology. This system uses layers of well-mixed microalgae and is characterized by very high culture densities, higher production rates and lower operational costs (Doucha et al. 2005).

*Authorization in general production*

Carbon dioxide can be used as a plant nutrient in closed production systems for microalgae as well as in greenhouse production. In the food industry, it can be used as an acidifier in beverage and water treatment applications, as a shielding gas (e.g. for freezing of food products or chilling of meats prior to grinding) and as a supercritical solvent (e.g., in enhanced caffeine extraction from coffee). It can also be used to control pests in storage facilities or packaged food. Among other industrial uses can be mentioned: i) refrigeration and maintenance of ideal atmospheric conditions during storage (e.g. with modified atmosphere systems) and transportation of food products.

Although carbon dioxide can be seen as a plant nutrient, it does not belong to Product Function Category (PFC) 1, fertilisers, as described in the EU fertilizer legislation Reg. 2019/1009.

*Authorization in organic production*

Carbon dioxide is currently authorized by Reg 2021/1165:

a) for plant protection (control of storage pests; Annex I, chapter 4).
b) as a food additive and processing aid for products of plant and animal origins (Annex V, part A, section A1)
c) for processing of ingredients of agricultural origin (Annex V, part A, section A2).
d) for the production of yeast and yeast products, specifically for primary yeasts production / confection / formulation (Annex V, part C).
e) for winemaking (Annex V, part D).
f) the use for the enrichment of greenhouse atmospheres is not explicitly mentioned in Reg. 2021/1165, but the Group understands that this is an accepted and implemented practice in organic greenhouse production (see EGTOP Report on Greenhouse Production).

*Agronomic use, technological or physiological functionality for the intended use*

Carbon dioxide is the basic carbon source necessary for plant and microalgae growth through photosynthetic metabolism.

*Necessity for intended use, known alternatives*

Atmospheric carbon dioxide cannot satisfy the carbon needs of a commercially sustainable autotrophic production system of microalgae due to the limited low solubility of carbon dioxide in water and the poor net mass transfer from the atmosphere (Uggetti et al 2018). There are no alternatives to additional carbon dioxide for an economically sustainable production system of microalgae.

*Origin of raw materials, methods of manufacture*

Carbon dioxide is released as a by-product of several industrial and biological processes. Examples of industrial processes include burning fossil fuels, cement production and hydrogen production by steam reforming natural gas. Examples of biological processes include fermentation processes such as ethanol production, brewing and other processes (e.g. distilleries or wineries).

*Environmental issues, use of resources, recycling*

New technologies improving the open pond microalgae production system, combining biodigestion of agricultural wastes with microalgae production can be applied in small farm-size units where the carbon cycle terminates via recycling of organic carbon to the field as fertilizer and via microalgae production for other uses (e.g. feedstuff), with evident economic and environmental benefits (Doucha et al. 2005).

In case wastewater is released from algae production, it should not contain carbon dioxide levels that could be toxic to fish. However, the Group assumes that microalgae producers will avoid such carbon dioxide losses for economic reasons.

*Animal welfare issues*

No issues identified.

*Human health issues*

Carbon dioxide is naturally present in the earth's atmosphere and is not harmful to humans and animals at these concentrations. At high concentrations, however, it has been recognised as a workplace hazard, as it can cause asphyxiation when it displaces oxygen entering confined spaces (e.g. tanks or cellars) or accumulating in outside trenches or depressions following leaks. The Commission Directive 2006/15/EC has set the following limits for occupational exposure to carbon dioxide: 9000 mg/$m^3$ (of air at 20 °C and 101,3 kPa) or 5000 ppm (by volume in air - ml/$m^3$) measured or calculated concerning a reference period of eight hours as a time-weighted average. No limits are set for short time exposure (related to 15 minutes). However, this hazard issue is related to the application (i.e. to operators) of carbon dioxide and not to the effects on consumers.

*Food quality and authenticity*

Carbon dioxide is the basic compound upon which any food (plant or animal-derived) is based, through its transformation into organic compounds via photosynthesis. Therefore, the Group has no concerns over food quality and authenticity.

*Traditional use and precedents in organic production*

Carbon dioxide can be used as a plant nutrient in organic greenhouses (see EGTOP report on Greenhouse Production from 2013). From a biological point of view, this use serves a similar purpose to the requested use in microalgae production.

Other uses in organic production include plant protection (Annex 2 point 4), food production (Annex V, part A, section A1, section A2, part D), the production of yeast and yeast products (Annex V, part C) and winemaking (Annex V, part D).

*Authorised use in organic farming outside the EU / international harmonization of organic farming standards*

Carbon dioxide is included in the list of allowed PPPs of IFOAM norms for organic production and processing (2019) with the note that it shall not be the result of burning fuel only to produce carbon dioxide and allowed only as a by-product of other processes. The same standard allows its use within additives, processing and post-harvest handling aids.

The NOP standard (NOP Reference 205.105; Guidance 5023, date active: April 4, 2019) allows using carbon dioxide from non-synthetic origin as a crop management tool and production aid. However, for other uses (e.g. processing, pest control) it also allows the use of carbon dioxide from synthetic origin.

The Canadian standard allows the use of carbon dioxide from non-synthetic and synthetic origin for several applications, including crop production aids and materials.

Codex Alimentarius approved the inclusion of carbon dioxide among those subject to GMPs as an additive in wine and other food processing.

*Other relevant issues*

None

*Reflections and conclusions*

The dossier requests:

- to authorize carbon dioxide enrichment in confined production systems for microalgae (including cyano-bacteria);
- to limit the authorization to microalgae intended for food and feed production;
- to limit the authorization to carbon dioxide of food grade;
- to limit the authorization to carbon dioxide from sustainable sources, i.e. from fermentative processes of food and non-food materials, anaerobic digestion, and thermoconversion of biobased products (e.g. bio-masses, biofuels).

The Group’s reflection are:

- Carbon dioxide enrichment is necessary to allow economically sustainable productivity of microalgae.
- To avoid possible contaminations, the Group agrees to limit the authorization to carbon dioxide of food grade.
- The Group sees problems in limiting carbon dioxide to sustainable sources. For example, it might not always be clear whether a source is natural (e.g. industrial fermentation processes, natural wells/fuma-roles). In addition, carbon dioxide from natural sources may require high amounts of energy for recovery

(e.g. fumaroles) and long-distance transport of 'natural carbon dioxide' might have an unacceptable carbon footprint. Moreover, the Group anticipates a lack of availability of 'natural carbon dioxide' at many locations and likely difficulties in tracking the production process making it hard to prove the origin during organic inspection.

- Reg. 2021/1165 sets no specific requirements concerning the origin of carbon dioxide for the uses of carbon dioxide in organic production. In the Group's opinion, the use in microalgae production should be treated the same way as the other uses.
- The use of carbon dioxide in greenhouses is not explicitly mentioned in Reg. 2021/1165, but is nevertheless an accepted and implemented practise in organic greenhouse production (see EGTOP Report on Greenhouse Production). For this reason, the Group doubts whether the use in microalgae would need to be mentioned explicitly, to be allowed. In any case, the group suggests regulating both uses in the same way (either listing both uses, or not listing both uses).

Considering all the above, the Group concludes that the enrichment of water with carbon dioxide in land-based confined systems production aligns with the principles of organic production.

*Recommendation*

The Group considers carbon dioxide enrichment to be implicitly authorized. The Group leaves it to the Commission to decide whether carbon dioxide needs to be listed explicitly as authorized for this purpose, and in this case, where and how this should be placed (i.e. in which article or annex).

### 3.2.2 Plant fibres as carriers for production of sprouted seeds

*Introduction, scope of this chapter*

Sprouted seeds production is a relatively new branch in agricultural production - since the 1980s in Europe. Sprouted seeds production is carried out on carrier mats. The mats serve to keep the sprouted seeds moist and to provide root space so that the seedling can grow itself and does not fall. In contrast to potting soils, the mats do not release any relevant amount of nutrients in the short period of growth.

The Group was asked whether plant fibres (e.g. hemp fibre, flax fibre, cellulose or coconut fibre) without additives and binders, only mechanically manufactured, can be used as mats for sprouted seed production.

*Authorization in general production*

Sprouted seeds are produced on carrier mats, which store liquid and provide support for the seedlings if necessary. Artificial substrates made of rock wool or polyethylene terephthalate (PET) generate much waste and cannot be composted. Especially with plastics like PET, substances that are harmful to health could be released. Perlite and vermiculite are substrates made from minerals. These can also not be composted. Under general legislation, there is no requirement to authorise mats for sprouted seed production.

*Authorization in organic production*

The use of culture media for sprouted seeds production is permitted if the media only serve for keeping the seeds moist and do not release nutrients (inert material) and if they are approved in accordance with Article 24.

In Annex II of the Implementing Regulation 2021/1165, products and by-products of plant origin are currently only permitted for fertilizer purposes/applications, but not for sprouted seeds production.

*Agronomic use, technological or physiological functionality for the intended use*

The plant fibre mats keep the sprouted seeds moist and provide root space so that the seedling can grow itself. They do not release any relevant amounts of nutrients.

*Reflections and conclusions*

"Growing media should ideally contain ingredients obtained from certified organic sources wherever possible. It is the Group's opinion that the use of all the materials listed in Annex I of the Reg. (EC) 889/2008 (including peat) should be allowed as ingredients in growing media for organic production" (cited from the EGTOP report on Greenhouse Production, chapter 3.9). Peat should, however, be avoided as far as possible for environmental protection reasons (climate, landscape).

The use of processed mineral substrates (e.g. rock wool) or synthetic substrates (e.g. styrofoam), as well as an additional enrichment of nutrients, has always been forbidden in the organic sector.

Regulation 2018/848 states in Annex II, Article 1.3(a) that the use of inert media is allowed for the production of sprouted seeds. In the Group's opinion, plant-based fibres without added nutrients can be seen as inert media *in this context*. The Group advises that such materials should come from sustainable production and emphasizes that peat use should be minimized or avoided as far as possible for environmental protection reasons.

The general EU food legislation (Reg. 178/2002), and the specific EU rules for the production of sprouts (for an overview, see ESSA 2023) are considered to be sufficient to secure that any material getting into contact with edible sprouts is safe and hygienically fit.

*Recommendations*

The Group recommends that plant-based fibres such as hemp fibre, flax fibre, cellulose or coconut fibre) should be authorized as carriers for organic production of sprouted seeds. If available, material from certified organic production should be used.

Due to uncertainties regarding the legal status of mats for sprout production, the Group does not make a precise recommendation in which form the authorisation should be made.

### 3.2.3 Frits (vitrous/ceramic matrix fertilisers)

*Introduction, scope of this chapter*

The Group was asked whether 'frits' should be authorised for EU organic farming (request presented by Italy). They are intended as micronutrient fertilisers with low solubility.

A frit is a mixture of inorganic chemical substances produced by rapidly quenching a molten, complex combination of materials, confining the chemical substances and thus manufacturing as non-migratory components of glassy solid flakes or granules. Frits can be made from various raw materials, resulting in different compositions of the frit. Possible compositions include phosphorus, potassium, calcium, sodium, aluminium, barium, boron, cobalt, copper, iron, manganese, molybdenum, silicon, and zinc. The primary members of this category are oxides, but fluorides may also occur.

*Authorization in general production*

The use of frits is authorized in Italy as PK fertilizer (Legislation D. Lgs 75/2010) defining them as 'product obtained chemically or by mixture, without the incorporation of organic fertilizing substances of animal or plant origin.'. This is likely since phosphate glasses (phosphate frits) are among the most common kind of frits. However, the request is for considering frits as *micronutrient* fertilisers.

In the EU fertilising products Reg. 2019/1009, an inorganic micronutrient fertiliser shall be 'an inorganic fertiliser other than an inorganic macronutrient fertiliser aimed at providing plants or mushrooms with one or more of the following micronutrients: boron (B), cobalt (Co), copper (Cu), iron (Fe), manganese (Mn), molybdenum (Mo) or zinc (Zn)'. Frits may be used as a component material belonging to CMC 1.

From a regulatory point of view, frits are classified by the European Chemicals Agency (ECHA) as 'a category that includes all of the chemical substances specified below when they are intentionally manufactured in the production of frit'. These substances include some mineral nutrients (both micro and macro) and several hazardous chemicals (including heavy metals). Among the first are included manganese, molybdenum, zinc, boron, iron, calcium, magnesium phosphorus, potassium. Among the latter are included arsenic, antimony, aluminium, barium, lead, nickel, silicon, bismuth, neodymium, niobium, cadmium, cerium, silver, chromium, sodium, cobalt, strontium, copper, tin, gold, titanium, tungsten, lanthanum, vanadium, lithium and zirconium.

The European Inventory of Existing Commercial Chemical Substances (EINECS) lists frits as chemicals (EC: 266-047-6).

It is worthy of considering that point 11 of Annex V of the REACH Regulation (Reg EC 1907/2006), establishes frits as a substance that can be exempted from registration 'provided that they do not contain constituents meeting the criteria as dangerous in accordance with Directive 67/548/EEC (repealed by the Regulation (EC) No 1272/2008, i.e. CLP Regulation – specifically with the limits set in Annex I) present in concentrations above the lowest of the applicable concentration limits set out in Directive 1999/45/EC (also repealed by Regulation (EC) No 1272/2008) or concentration limits set out in Annex I to Directive 67/548/EEC, unless conclusive scientific experimental data show that these constituents are not available throughout the lifecycle of the substance and those data have been ascertained to be adequate and reliable.'

However, Regulation (EU) 2019/1009 requires a REACH registration of this material, covering the use as a fertilising product, when used as a CE-marked product.

*Authorization in organic production*

From July 2022 on, all inorganic micronutrient fertilisers are authorised and the relevant limits for contaminants set in Reg. 2019/1009 apply.

*Agronomic use, technological or physiological functionality for the intended use*

Frits microelement fertilizers incorporating zinc, iron, manganese, and copper in crystalline polyphosphate showed low solubility in water but were well soluble in organic acids, which suggests good availability for plants.

Microelements are included in several organic compounds of the plants, responsible for different physiological and metabolic activities, including energy storage, electron transport and enzyme activity. Due to their functions in the plant, they cannot be replaced with other components and thus are essential for all plants.

*Necessity for intended use, known alternatives*

Micronutrients are essential for all crops. Farm manures and all organic fertilizers can also supply micronutrients. For example, pig manure is high in Cu and poultry manure high in Zn. Deficiencies can occur under certain soil conditions (e.g., calcareous soil).

Micronutrient fertilizers include four major types: inorganic salts, synthetic chelates, natural organic complexes, and frits. The most commonly used are inorganic sources, which include oxides, carbonates, and metallic salts such as sulphates, chlorides, and nitrates. Manganese oxide and zinc oxide are used to some extent, but are relatively insoluble. The sulphates of Zn, Cu, Mn, and Fe are the most common fertilizers in use, being quite soluble and immediately available to the crop. For B, borax is the fertilizer of choice, and for Mo it is sodium molybdate.

Natural organic sources most often used are the lignosulfonate complexes made from a by-product of the wood-pulping process in paper mills. Inorganic salts are reacted with these organic by-products to form complexes.

The synthetic chelates include HEDTA and EDTA, with EDTA salts being the most commonly used, usually sold as liquid preparations for soil or foliar applications.

*Origin of raw materials, methods of manufacture*

According to available scientific information, frits are ground glass or glassy substance used for example in ceramic tiles and in pottery. Phosphate glasses are produced by melting (temperatures between 800 and 1400 °C) and can be used as carriers of micronutrients. The manufacturing process is a physical processing that, after mixing the raw materials, includes their melting in a furnace followed by the fall into water, which induces a rapid quenching of the molten turning it into a glassy solid insoluble material. Frits are produced in various compositions to produce different glazes for end use applications such as sanitary ware, ceramic tiles, pottery and ceramic ware, glass decoration, etc. The Group was informed that frits for fertilisation purposes are produced specifically for this application.

*Environmental issues, use of resources, recycling*

The melting process makes the elements inert, transforming the original mix into a glass, without risks for human health or the environment. However, the process is quite energy-consuming, as the molten is obtained by heating the raw materials at high temperatures (800 – 1400 °C). A risk evaluation study of ceramic frits has also been conducted, coordinated by Universidad Jaume I in Spain and from the results of the ecotoxicity and toxicity tests, it was concluded that frits are neither very toxic, nor toxic, nor harmful, therefore making it unnecessary for them to be assigned any risk notation. However, the study addressed the production of frits for industrial purposes.

*Animal welfare issues*

Not relevant

*Human health issues*

Frits in general, can contain several hazardous substances. According to the information shown on the ECHA website[5], the harmonised classification and labelling (CLP00) approved by the European Union, considers that 'this substance may damage the unborn child and is suspected of damaging fertility, is very toxic to aquatic life, is very toxic to aquatic life with long-lasting effects, is harmful if swallowed, is harmful if inhaled and may cause damage to organs through prolonged or repeated exposure'. Moreover, 'the classification provided by companies to ECHA in REACH registrations identifies that this substance may damage fertility or the unborn child, causes damage to organs through prolonged or repeated exposure, may cause cancer, may cause harm to breast-fed children, is suspected of causing cancer, is suspected of causing genetic defects, causes serious eye damage, is suspected of damaging fertility or the unborn child, may cause an allergic skin reaction and may cause allergy or asthma symptoms or breathing difficulties if inhaled'. However, this applies mainly to frits used for the production of ceramics and pottery products, due to their content of different metals used in the mixtures.

*Food quality and authenticity*

Frits, in general, might contain several hazardous substances (see ECHA classification), depending on the composition of the matrix used for their production. However, the applicant has explicitly stated that the frits intended for use in organic production are manufactured to be used as fertilizers. For such materials, the Group has no concerns regarding hazardous substances.

*Traditional use and precedents in organic production*

None identified.

*Authorised use in organic farming outside the EU / international harmonization of organic farming standards*

Under the NOP standard, frits are considered as synthetic materials and therefore prohibited.

*Other relevant issues*

None

*Reflections and conclusions*

Even though there are alternatives for the supply of micronutrients, frits could be interesting because they are water insoluble but soluble in organic acids, thus potentially making the micronutrients contained in them available to plants. This is in line with the principles of organic production (see Reg. 2018/848, Art. 5(g)).

5 https://echa.europa.eu/substance-information/-/substanceinfo/100.060.024

The Group notes that only frits intentionally manufactured for fertilisation purposes fall under the definition of CMC1 in the EU fertilizer regulation 2019/1009. This excludes risks from hazardous contaminants as the products sold as fertilisers shall comply with contaminants limits set in that Regulation. On the other hand, frits intentionally manufactured for fertilisation purposes are associated with large energy consumption. Depending on the source of energy used, this may result in large carbon dioxide emissions.

Overall, the Group concluded that the use of frits in organic farming is in line with the objectives and principles of organic production.

*Recommendations*

In the Group's opinion, the use of frits should be authorized for organic farming as follows:

| Name<br>Compound products or products containing only materials listed hereunder | Description, specific conditions and limits |
|---|---|
| frits | CAS no 65997-18-4<br>Products complying with the definition and limitations of CMC 1 in Reg. 2019/1009 |

## 3.3 Products for use in third countries (Annex VI of Reg. 2021/1165)

### 3.3.1 Use of ethylene for flower induction in pineapple

*Introduction, scope of this chapter*

The request submitted by ECOCERT pertains the inclusion of ethylene in Annex VI of EC Reg. 1165/20211 as a flower inducer in pineapples in Third countries (i.e. non-EU countries).

*Authorization in general production*

Ethylene is authorised under the EU regulation 1107/2009 as a plant growth regulator for indoor uses. The authorization expiries on 31-08-2023. It is registered in several (19) EU member states. In the EU, open field use of ethylene is not allowed.

*Authorization in organic production*

At present, Reg. EU 2021/1165, Annex I, Part 4, allows the use of ethylene for post-harvest treatments, limited to banana degreening/ripening and on potato for sprouting prevention. With respect to Flower induction of pineapple, the situation is more complex:

- Until 2016, the use of ethylene for 'Flower induction of pineapple' was authorised in EU organic production (listing of ethylene in Annex II to Reg. 889/2008 without restrictions).
- In third countries that have an equivalence agreement with the EU (i.e. USA, New Zealand or Costa Rica), ethylene can be authorised for this purpose under their national standards and may continue to be allowed in the future.
- In third countries that do not have an equivalence agreement with the EU (e.g. many pineapple-producing countries in Africa), certifiers currently have the possibility to accept the use of ethylene for flower induction by referring to the principle of 'equivalence'. However, the principle of equivalence will be phased out. At the time when this report is written, certification in Third countries is in a transitional phase during which the principle of 'equivalence' may still be applied. In practice, the use of ethylene for flower induction will thus expire when the principle of 'equivalence' cannot be applied any longer.

Ethylene (for pineapple flowering induction) was positively evaluated by EGTOP in 2016.

*Agronomic use, technological or physiological functionality for the intended use*

Ethylene (or ethylene producing substances) has been used for pineapple flower induction in professional cultivation (large scale) since the 19th century. On small-scale cultivation for local market, flower induction may not be relevant. For export production, it is essential to be able to produce a uniform product, which ripens simultaneously, for reasons of transport logistics.

Environmental factors induce natural flowering while artificial flowering is induced by the use of chemical compounds, in general plant growth regulators. In both cases, the physiological process involves hormones synthesized by the plant, such as indoleacetic acid (IAA) and ethylene, the latter being the real inducing factor. Basically, the initiation of pineapple flowering depends on the physiological state and nutritional reserves of the plant, day length and temperature. Being a function of environmental conditions, natural flowering also varies from year to year according to the seasons and producing regions. In different producing areas, the rates of natural flowering are quite variable. Under natural flowering conditions, there are cases and areas where only 5 % - 10 % of the plants effectively produce fruits.

In small scale productions sites, ethylene is mainly used as activated charcoal (which can be dosed quite accurately), while in large scale production sites it is used as gas, often dissolved in water sprayed onto the plants.

*Necessity for intended use, known alternatives*

Its use is essential for synchronization of flowering in professional export oriented cropping systems. In conventional agriculture ethephon and calcium carbide (not in EU) are used. In organic farming no viable alternatives are known. Cold water (5°C) could also be used in organic production, but results are inconsistent and unreliable. Due to the large amounts of energy required to produce sufficient cold water in tropical regions, the Group does not see this as a sustainable alternative. Smoke can be used indoors, but pineapple production in many countries is practiced outdoors. Besides, the smoke has negative effects on the environment.

*Origin of raw materials, methods of manufacture*

The large majority of the worldwide annual commercial production of ethylene is currently based on steam cracking of petroleum hydrocarbons. It then undergoes separation by fractional distillation, or on catalytic dehydrogenation of ethane, its corresponding alkane, at high temperature. Various feedstocks, including ethane, propane, butanes, naphtha's and gas oils, are used to produce ethylene.

Alternatively, ethylene can be produced from ethanol.

*Environmental issues, use of resources, recycling*

Ethylene is a naturally occurring compound. Based on environmental fate data and the mode of use, EFSA concluded that release into the atmosphere is unlikely to result in transfer to other environmental compartments in significant amounts, and exposure to the soil and water is minimal. However, there could be some potential for drift when used outdoor (EFSA, 2012).

*Animal welfare issues*

Risk for any kind of animal is considered low (EFSA, 2012).

*Human health issues*

Based on inhalation data of limited validity, there are indications that ethylene exposure may result in the formation of adducts with DNA and protein, in haematological changes, liver effects, effects on the nervous system and asphyxia. However, the quality of the investigations, the characterisation and magnitude of the effects, and the concentration level at which these effects would appear could not be evaluated. No conclusion could be reached on the genotoxic or carcinogenic potential of ethylene, and on its reproductive or developmental toxicity. Due to the lack of data, no reference values could be set. A data gap is identified for toxicological information to allow the setting of ethylene reference values if the exposure levels of consumers, operators, workers and bystanders are shown to exceed natural background exposure levels (EFSA, 2012). The Commission's review report concluded that it may be expected that ethylene does not have any harmful effects on human or animal health or on groundwater or any unacceptable influence on the environment, as set out in Annex VI of regulation (EC) 2229/2004 as last amended by Regulation (EC) 1095/2007 (SANCO/2608/08 – rev. 3, 1 February 2013)

*Food quality and authenticity*

The use of ethylene for flowering induction of pineapple can positively impact pineapples quality on EU markets, as it promotes large quantity transportation with the same maturity degree and size.

*Traditional use and precedents in organic production*

Ethylene is allowed in organic production for post-harvest uses since the early implementation of EU regulation on organic farming and as a flower inducer in pineapple since 2016. The need for flower induction in pineapple is linked to the production for export (often to EU). Ethylene is used on small and large farms, where there is a need to harvest enough pineapples to justify the transportation (cargo) costs.

*Authorised use in organic farming outside the EU / international harmonization of organic farming standards*

It is allowed in the National Organic Program of the USA, in the Swiss Organic Regulation, in the Organic Legislation of Costa Rica and others.

*Reflections and conclusions*

The Group acknowledges that ethylene is needed as production mean in professional, export oriented organic cultivation. The Group would prefer agronomic solutions over the use of ethylene. In case of ethylene use, the group would prefer ethylene from a bio-based source (ethanol) over petrol-based sources. Considering the EFSA conclusions on environmental and health impact, the Group recommends not to interrupt the use of ethylene for flower induction of pineapple, until economically viable alternatives are available.

Ethylene has been used for flowering induction of organic pineapples for many years under the ‘equivalence regime’. In addition, it will also be allowed in the future in those third countries with a mutual recognition agreement with the EU (e.g. Costa Rica).

*Recommendations*

The Group recommends to include in Annex VI the use of ethylene for flower induction in pineapples.

| Number and Part of Annex | CAS | Name | Specific conditions and limits |
|---|---|---|---|
| 227A | 74-85-1 | Ethylene | For flower induction in pineapple |

## 3.4 Interpretation of organic production rules in the context of yams production

The principles of organic farming described in Regulation (EU) 2018/848), are agreed on by all member states. However, the translation to practical rules can be technical and should be backed by scientific facts. In several cases, the Commission itself can and has answered detailed questions (EC 2023). In other cases, the Commission passed the questions to EGTOP. In the context of yams production, the Group received several questions from member states for clarification of terminology and detailed guidance of yams cultivation. Because these questions touch on fundamental principles of organic production, the Group first outlines its views of these broader principles before answering the detailed questions.

### 3.4.1 Basic principles of nutrient supply in organic cropping

The nutrition of the plant should be through the soil ecosystem and based on organic (non-mineral) fertilisers (see also separate chapter below). This has well-founded reasons.

*Soil fertility and plant health*

Synthetic fertilizers disrupt soil life balances due to the direct availability of easily soluble mineral nutrients like Nitrogen, Potassium and Phosphorous. They can affect the soil composition and microbiome. This affects plant nutrition, health and water balance (Khan et al., 2007, Solanki 2020, Beste and Lorentz 2022).

*Climate and environmental issues*

*Energy consumption*: The production of mineral nitrogen fertilisers uses a lot of energy. Depending on the source of energy used, this may result in large carbon dioxide emissions. In 2018, mineral fertilizer production accounted for approximately 2.4% of global greenhouse gas (GHG) emissions. This is more than the share of global business aviation in the same year (Menegat et al. 2022). N-fixation through legumes that are grown in crop rotation alone may reduce GHG emissions by over 50 % (Köpke and Nemecek 2010). Organic farming system requires 1/3 less fossil energy/ha mainly due to not using synthetic nitrogen nor synthetic pesticides (Hülsbergen 2023).

*Pollution*: Globally less than 50 % of the fertilized nitrogen (synthetic and organic) reaches the plants, the rest is lost in the environment, causing pollution of ground and surface waters, nitrous oxide and ammonia emissions, and eutrophication (Zhang et al. 2021, BIZ 2023). Eutrophication is one of the threats to biodiversity (ICROFS, 2015), while nitrous oxide is an important contributor to climate gas emission from agriculture. Often excessive use of synthetic fertilisers, as a result of the use of economic optimisation of fertilisation calculations, shows a lower N efficiency and higher leaching levels (FAO 2007, Hülsbergen 2023).

According to current scientific knowledge, organic fertilization in balance with the soil ecosystem is preferable for these reasons.

### 3.4.2 Clarification of terminology

*What does ‘living soil’ mean?*

Art. 3 No. 70 of Regulation (EU) 2018/848 and Annex II No. 1.1 of Regulation (EU) 2018/848) mentions ‘living soil’. In this paragraph, the Group explains its views on what ‘living soil’ means in the context of organic farming.

Soils are dynamic ecosystems. They are formed when a rock on the earth's surface is transformed under a specific climate and a community of plants, animals and microorganisms develop and provide organic matter. The soil-forming factors are parent rock, climate, relief, water regime, vegetation, and presence of soil organisms. A whole food web lives in the soil, and with it a large number of organisms that feed on the fungi, bacteria and other types of flora and fauna present in the soil. In a complex food web, microorganisms and soil animals decompose organic material and form new substances, which are nutrients for other soil organisms and plants or, as humic substances, have a favourable influence on soil structure and nutrients exchange. Soil organisms may either loosen the soil or stick together soil particles and make a decisive contribution to the formation of soil structure, promoting aeration and increasing water infiltration and storage capacity. The symbiosis of some soil microorganisms (mostly fungi and bacteria) with plants facilitates the plants' access to nutrients and protects them from diseases and pests. In a soil with high biological activity, these soil ecosystem functions - habitat, regulation and production - can be optimally fulfilled depending on the location (Gupta et al. 2008, Beste 2015). These comprehensive functions cannot be provided by artificially composed nutrient substrates (FAO 2020). The importance of soil as a limited resource has been underlined by the EU through the launch of several initiatives within the so called ‘Soil Mission’, which aims, among others, at conserving soil organic carbon stocks, reducing soil pollution and enhancing restoration, improving soil structure to enhance soil biodiversity and reducing the EU global footprint on soils.

In conclusion, a ‘living soil’ could be defined as ‘a soil providing ecosystem services derived from a healthy, complex web of organisms living in it and characterised by an organic matter content that supports the soil life and its uses’.

*What does ‘in connection with subsoil and bedrock’ mean?*

Recital 28 of Regulation (EU) 2018/848 mentions 'in connection with subsoil and bedrock'. The paraphrase specifies that the roots of growing plants should be in contact with a natural soil formed at the site. For example: Roots also grow into the grown soil when boxes are open at the bottom.

In the case of yams grown in boxes, the Group considers that the roots are eventually in contact with the naturally grown soil. If it is ensured that this soil is managed according to the rules of organic farming, this form of cultivation is in line with organic principles.

*What does 'plant production is based on nourishing the plants primarily through the soil ecosystem' mean?*

Recital 28 of Regulation (EU) 2018/848 mentions 'plant production is based on nourishing the plants primarily through the soil ecosystem'. In the EGTOP Report on Greenhouse Production dating from 2016 (chapter 3.3.1.2), the Group has explained its views on nutrient supply in organic farming. A key statement is that 'Soil fertility and an active soil ecosystem are the basis for plant nutrition in organic systems'. A similar view was also expressed by FiBL (2005).

There is no doubt that organic farmers have to apply fertilizers. However, they should primarily 'fertilize the soil' with slow-release fertilizers like compost, solid manure, etc. Such fertilizers contain insoluble nutrients that are not directly available to crops. The soil food web, converts fresh residues into soil organic matter (SOM), and plays a central role in each of the soil functions considered essential for agricultural production. It is now widely understood that diverse soil organisms work together to recycle nutrients, protect water quality, provide for plant nutrition, and enhance crop resilience to stresses. Plants can release carbohydrates, amino acids, lipids, and vitamins through their roots to stimulate microorganism's activities in the soil. Rhizospheric bacteria participate in the geochemical cycling of nutrients especially nitrogen, phosphorus and micronutrients such as iron, manganese, zinc and copper, and determine their availability for plants and soil microbial community. They enhance crop yield by increasing plant nutrient availability, producing growth hormones and can also be involved in controlling pathogens and pests (Dotaniya and Meena 2014). In recent years, research has been able to provide concrete evidence that plants directly utilize organic nutrients or whole molecules (White et al. 2018, Chang et al. 2021). This type of interaction between plant roots and soil microbiome nourishes plants in a healthier and more balanced way, than easily soluble fertilizers, which have been proven to disturb the microbiome, particularly mycorrhizal fungi (Solanki 2020).

A practical consequence of the principle of 'nourishing the plants primarily through the soil ecosystem' is that nutrients shall be applied in a form which is not easily soluble but requires solubilisation by soil life. This is addressed by the principle of restricting inputs to 'low solubility mineral fertilizers' in Article 5(g)(iii). The principle is applied to all nutrients where this is possible in particular to N, P, K, Ca and Mg. However, the Group points out that this principle shall be followed whenever possible (note the word 'primarily' in the principle's sentence). Organic farmers have some flexibility to deviate from this principle under exceptional circumstances, e.g. when weather conditions prevent sufficient mineralization, though using only low-soluble fertilisers. Nevertheless, the Group acknowledges that in fertilizers such as farmyard manure, biogas digestate, and other organic fertilisers which are used in organic farming, a certain proportion of the N is also available in soluble form (ammonia).

Since the rate of mineralisation of stabilised organic material such as compost and animal manure is not easily predictable and N availability is not always synchronised with the needs of the plants, the Group recommends that nutrient balances should be calculated for each crop and field to determine the need for application of authorised mineral nutrients in organic cropping systems. For each climate zone and soil type, these calculations can be different.

These principles enhance and maintain 'soil fertility', referred to in Article 6(a) of Regulation 2018/848. This mode of plant nutrition differs from production systems such as hydroponics, where plants are grown in a liquid nutrient solution. In hydroponic systems or systems where plants are rooted in an inert substrate, all nutrients have to be applied in (easily) soluble form and there is no interaction between the substrate and the crops: therefore, they are not allowed in organic farming.

### 3.4.3 Implications for the production of yams

*Agronomic background*

Yam is a 2-year crop. In the first year, cultivation takes place in the naturally grown soil on the field. In the second year, different methods are used to facilitate harvesting of the tubers.

*Option 1: cultivation in wooden boxes*

The approx. 1.5 m high wooden boxes, limited by a wide-meshed, grid at the bottom, are placed on naturally grown soil (grassland). The boxes are filled with a mixture of soil (arable soil) and the farm's own compost, after which the annual yam plants (approx. 25 - 40 cm long) are inserted. As the root bulb of the yam plant grows to over a metre in length, the roots also grow into the grown soil below the boxes. When the yam roots are harvested (approx. November to December), the substrate in the boxes is removed and temporarily stored in soil windrows. The substrate from the soil windrows is then spread out (height approx. 40 to 50 cm), mixed with materials and products permitted in organic production (compost) and from May onwards greening with green manure takes place. The greenery is mulched (approx. August) and the upper rooted layer is milled over. This substrate is then filled back into the boxes from January of the following year and replanted with yearlings.

*Option 2: cultivation in river sand with humus layer*

For cultivation, trenches about 1.20 m deep and 0.7 m wide are dug in the grown soil (arable land or grassland). The trenches are filled with a 0.9 m high layer of pure river sand and a 0.3 m high humus layer (a mixture of the farm's compost and purchased cattle manure). The roots of the plants can grow into the surrounding soil.

*General legal provisions for organic production*

According to Article 5(1)(f)(ii) of Regulation (EU) 2018/848, organic crop cultivation shall be soil-related. The term "soil-related crop production" is defined in Art. 3 No. 70 of Regulation (EU) 2018/848 as production in living soil or in soil that is mixed or fertilised with materials and products that are allowed in organic production in connection with the subsoil and bedrock (see 3.4.2).

*General reflections of the Group*

In the Group's opinion, the production of yams in elevated beds and trenches is possible, provided that the production system is designed so that the roots can reach the naturally grown soil. Based on this general reflection, the Group answers the questions on yams production as follows:

*Question no 1: allowed materials*

The Group was asked what kind of material is allowed for such method of cultivation (e. g. wooden boxes, concrete containers, plastic bags/containers ...).

Reply by EGTOP: No restriction is set out. The Group has some concerns about contamination risks, e.g. about wood preservatives or plastic, so the Group points out that the materials from which the containers are made should have the lowest possible risk of containing or releasing hazardous pollutants.

*Question no 2: substrate composition*

The Group was asked whether there are any restrictions regarding the substrate-soil-relation/ratio used in such boxes/containers.

Reply by EGTOP: As a general rule, organic crops, except those which are naturally grown in water, shall be produced in living soil, or in living soil mixed or fertilised with materials and products allowed in organic production, in connection with the subsoil and bedrock (Annex II, 1.1. Regulation (EU) 2018/848). There are no dedicated rules for yams production.

*Question no 3: height of elevated beds*

The Group was asked whether there are any restrictions concerning the height of the containers, including the height of filling with substrate.

Reply by EGTOP: There are no restrictions on the height of the container or the height of the mixture filling the container. As a guiding principle, the container height must ensure that soil contact is possible during normal root development (yams can root over one meter). If yams are cultivated in trenches, the Group notes that there are no restrictions on the depth of the trench and the filling with river sand and humus.

*Question no 4: mesh flooring of elevated beds*

The Group was asked whether there are any provisions regarding the open mesh flooring (size of the mesh openings, size of the holes in the bottom of containers).

Reply by EGTOP: The open mesh must ensure soil contact during normal root development and must not hinder root penetration into the soil underneath the container.

## 4. MINORITY OPINIONS

None.

## 5. LIST OF ABBREVIATIONS / GLOSSARY

None.

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