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Original citation & hyperlink:
Schmutz, U & Foresi, L 2017, 'Vegan organic horticulture: Standards, challenges, socio-economics and impact on global food security' *Acta Horticulturae*, vol (in press), pp. (in press)

ISSN 0567-7572

Publisher: International Society for Horticultural Science

The original publication is available at www.actahort.org

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Vegan organic horticulture – standards, challenges, socio-economics and impact on global food security

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Abstract

Vegetarian and vegan diets have seen an increased interest in recent years all across the world. This is the case for 'vegans' who aim for 100% vegan food, but also for so-called 'flexitarians', meat and fish eaters including one or more vegan and vegetarian days in their weekly diets. This paper focuses specifically on vegan organic horticulture produced in greenhouses or in the open field. Vegan organic production (in contrast to vegetarian = eating no meat) excludes all animal inputs into plant production (e.g. manure, blood-meal or horn-meal). It uses ecosystem services supplied by the soil micro-fauna or wild bees for pollination, but uses no domesticated animals or any of their by-products like manure, horn or leather. This paper critically analyses vegan organic horticulture regarding three main topics: Firstly, it describes its current use in organic horticulture and agriculture. Based on this status-quo analysis it critically discusses the standards currently used for vegan organic horticulture and highlights on-going discussions in the organic movements on 'stockless', 'stockfree', 'vegan organic' and 'veganic'. Secondly, it discusses the agronomic challenges for intensive organic horticultural production. How to manage soil fertility long-term in such systems, while also reducing other external inputs (finite fossil fuels, like oil and peat) into the organic farming system? Thirdly, the paper studies the socio-economics of a large-scale uptake of vegan diets, or more vegan days in flexitarian diets. How can vegan organic contribute to make organic overall more resource efficient and help in the transition to more sustainable diets and consumptions, worldwide?

Keywords: Organic greenhouse horticulture, vegan organic, flexitarian diets, organic standards, scenario modelling

INTRODUCTION

Vegan organic production excludes all animal inputs into plant production, for example composted manure but also blood-meal or horn-meal fertilisers from conventional animal production which are allowed under current EU organic regulations. Vegan horticulture and agriculture uses ecosystem services supplied by the soil micro-fauna or wild bees for pollination, but uses no domesticated animals or any of their by-products like manure, horn or leather. This excludes also bee-keeping, although wild bees and other pollinators are encouraged. This paper critically analyses vegan organic horticulture regarding current use in organic horticulture and agriculture. It critically discusses the standards currently used for vegan organic horticulture and highlights challenges, socio-economics and impact on global food security.

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CURRENT STATUS OF VEGAN ORGANIC PRODUCTION

It is reported that up to 25% of all organic farms in Germany are stockless, meaning with no or very low livestock (Schmidt, 2004). Very low livestock is defined as less then 0.2 Live-Stock Units (LSU) per hectare. There are currently 23,271 organic farms (Willer and Lernoud, 2015) in Germany and a quarter would be about 5,800 farms. Many of them are arable, fruit and wine growers, full and part-time farms, but also specialist horticulture farms are among them. In Europe, defined geographically, there are 334,870 organic farms; while in the EU part of Europe there are 258,773 organic farms (Willer and Lernoud, 2015). If, like in Germany, a quarter of all organic farms in Europe would be without livestock this would be **80,000 organic farms without livestock** in Europe. This is a large number of holdings. Not all of them would necessarily want to become vegan organic, but it shows a European wide potential for the growth of 'vegan organic' even without converting currently conventional stockless farms. There is also 'vegan organic' interest and existing farms in many parts of the world like Canada, USA, Mexico, Argentina, India, Australia and New Zealand.

RESEARCH ON ORGANIC STOCKLESS AND STOCKFREE SYSTEMS

Currently there are very few academic publications on vegan organic agriculture or horticulture. Hagemann and Potthast (2015) have conducted a Web of Science search for the term 'stockfree organic' and found zero articles in February 2014. However, using the term 'vegan agriculture' or 'vegan farming' resulted in a few papers. We extended the search using web-based search engines to capture non-academic articles and practical research papers. Here again 'vegan', 'vegan organic', 'vegan horticulture' and 'vegan agriculture' were used. We also searched for papers in German and Italian on this subject.

From the German literature there is a comprehensive study on 'Viehloser Ackerbau' (stockless arable organic) produced for the German Federal Research programme on organic farming by Schmidt (2004). This includes farms with few and no livestock and is restricted to larger-scale arable crop rotations. It gives detailed practical examples from twelve farms in different German regions and climates and enhances this information with a survey among farm advisors. It also describes cropping details for twelve research sites (including ones in Denmark and the UK) where stockless arable rotations are researched and presents a comprehensive list of future research needs based on expert knowledge collected through questionnaires and two workshops with advisors, farmers, scientists and other stakeholders.

This project however did not include specialised horticultural farms or those who would be called stockfree or vegan with the aim to exclude all inputs from animals. As described above the report shows that about 25% of organic farms had no or low livestock. Low livestock was defined as less than 0.2 LSU/ha and therefore excludes all bio-dynamic organic farms as Demeter standards require more then 0.2 LSU/ha. The sample size was large, with 6,600 farms it covered about 42% of all German certified organic farms. Within the 25% stockless farms, 4% were working together with livestock farms. When only full-time organic farms were considered, the percentage of low or no livestock was 10%. One of the main characteristics for having little or no livestock on arable farms was less labour, large size farms and higher natural soil fertility. These findings may indicate that the drive to lower livestock in these farms is somewhat similar to conventional stockless systems: reducing labour and running farms on larger units on fertile land.

Unlike in certified 'vegan organic' there is no attempt to exclude all inputs based on animal systems, and the word vegan (same word in German) is not mentioned once in the Schmidt (2004) report. Our analysis is shared by Bonzheim (2014) calling stockless (viehlos) organic a pragmatic approach and vegan organic a more idealistic one. Anja Bonzheim (2014) conducted qualitative interviews with five vegan organic growers and has also contributed to the definition and use of the word bio-vegan ('vegan organic') within the German academic literature. She found through interviews that motives of vegan organic farmers and growers

for the exclusion of all animal inputs are ethical, ecological and social, and hence 'vegan organic' can be distinguished from stockless farming. The latter being more economically motivated within the existing values of organic.

Besides the different motivations, both forms face similar technical challenges in terms of fertility management, especially in horticultural annual crops with high nutrient demand as grown in greenhouses. Therefore, on a pragmatic level, knowledge exchange between the two types stockless and 'vegan organic' can be considered very helpful.

DIFFERENT TERMS: VEGAN ORGANIC, VEGANIC, STOCKFREE, STOCKLESS?

In this paper we follow the distinction made between 'stockless' and 'vegan organic' as defined by the motivations of farmers and growers. The term '**stockless'** is not used by anyone within the vegan movements as it indicates something is missing (– less), while '**stockfree'**, (– free) of animals is indicating that animals are not necessary and horticulture and diets can easily do without them completely.

In the further text we only focus on stockfree organic but use the word '**vegan organic**'. In the United Kingdom both words are used with a very similar meaning:

- **'stockfree'** is used as a more neutral technical term denoting the fact that the organic growing is free from all animal inputs (Hall and Tolhurst 2010; Tolhurst 2015 pers. comm., www.stockfreeorganic.net) and the fertility building techniques can be adopted by many farms even those which still have livestock or are bio-dynamic.
- **'vegan organic'** is used by the Vegan Organic Network (www.veganorganic.net) and denotes more a campaign and social movement towards vegan diets or more vegan food and drinks within flexitarian diets.

Since both terms 'stockfree' and 'vegan organic' describe the same practices we explain why we chose to use the word 'vegan organic': Firstly it translates better in different languages and secondly it is also already widely used by many consumers and understood as a diet. It can also be used to describe other technical innovations like vegan anaerobic digestion (Schmutz, 2012). Finally, as the movement grows, stockfree would be more difficult to explain to consumers compared to the easy universal word vegan, which also works well as a logo on a product. Both arguments, ease of translation in multiple languages and widespread use also work against the word '**veganic**' as a combination of vegan and organic. Using only the word **vegan** might be possible, but this would not automatically mean organic and then a vegan logo would only guarantee to include no animal inputs, but might have inputs like e.g. insecticides, pesticides or genetic manipulation of organisms (GMO).

Even in organic diets it is often not possible to eat and drink 100% organic all the time, but any percentage of organic consumption helps contributing to the principles of the organic movements (IFOAM, 2015). A similar conclusion might be drawn regarding 100% vegan diets and fexitarian diets, especially if the remaining meat and fish consumption is 100% organic.

STANDARDS FOR 'VEGAN ORGANIC' HORTICULTURE

A leading example of private standards for vegan organic production is the Vegan Organic Network (2007) in the United Kingdom. The purpose of the standard is to *"regulate commercial stockfree organic growers on registered holdings and act as a guideline to other growers. These Standards attempt to be inclusive to involve many growers and transform systems of food production."* For a registered holding to attain the vegan organic logo it is necessary to comply with the stockfree and organic standards and to be inspected by an EU accredited organic certification body. In the case of the Vegan Organic Network in the UK it is GB-ORG-05, Soil Association Certification Ltd., as they are able to certify the national/EU organic standard and additionally are licensed to add the private vegan organic standard in one inspection. The conversion from organic to 'vegan organic' is straightforward as no additional conversion period is required. Further details of the standard are given below

(Vegan Organic Network, 2007):

Animals on the holding

The licensee cannot keep animals for food production or commercial gain on the registered holding (companion animals, or animals that assist blind people are excluded). No animal manures or products of animal or fish origin can be used and growing animal fodder or bedding litter is also excluded (Vegan Organic Network, 2007).

Soil management

Protecting soil life (for example, microbes and earthworms) and soil structure are important and this can be achieved by regularly replenishing organic matter, growing green manures (overwintering and under-sowing), keeping the soil permanently mulched with decaying plant material and minimising tillage (Vegan Organic Network, 2007).

Sources of fertility

Primary sources of soil fertility are plant-based composts, mulch, hay made from materials on the farm. This includes agroforestry sources and digestate from anaerobic digesters if produced with vegan organic material.

Secondary sources are the same inputs from other certified organic systems.

Restricted sources are e.g. Leaf mould and plant-based composts made from green waste by local authorities *("restricted because they cannot be assured to be free from toxic or genetic engineering contaminants, or animal residues")*, plant-based composts from un-grazed upland meadows, plant wastes and by-products, from food processing industries (e.g. spent hops, barley) or seaweed (*"need to show that it is collected away from pathogen contamination"*).

Supplementary nutrients

Permitted soluble fertilisers and alginates

- Supplementary soluble fertilisers and tonics created on the holding e.g. based on comfrey (*Symphytum officinale*), nettle (*Urtica dioica*) and herbs like chamomile (*Chamaemelum nobile*) and tansy (*Tanacetum vulgare*)
- Compost teas created on the holding
- Dried seaweed meal, liquid seaweed and other commercially available foliar feeds suitable for organic systems that are free from animal inputs
- Commercially available compound fertilisers and liquid feeds suitable for organic systems that are free from animal inputs

Permitted fertilisers

- P: Natural rock phosphate (e.g. Tunisian rock phosphate); Calcined aluminium phosphate rock (e.g. Redzlaag where soil pH > 7.5)
- K: wood-ash (from wood not chemically treated after felling)
- Ca and Mg: Dolomitic limestone, gypsum - calcium sulphate, ground chalk & limestone, Epsom salts (for acute magnesium deficiency), Magnesium rock
- Clays (e.g. perlite and vermiculite)

Restricted fertilisers

- Sulphate of potash, sulphur
- Calcium chloride - for bitter pit in apples
- Industrial lime from conventional sugar production
- Natural rock potash - providing it has a relatively low immediate solubility in water and low chlorine content
- Trace elements: stone meal (ground basalt), boron, copper, iron, manganese, molybdenum, cobalt, selenium, zinc

Prohibited fertilisers

- Any animal by-product of livestock or fish origin
- Worm compost
- Human faeces and urine, sewage sludge
- Extracted peat
- Soluble fertilisers as the main source of fertility

Propagation

Recommended are vegan organic grown seed and transplants from the own holding, but equally permitted are commercial organic seeds and vegetative reproductive material. It is also recommended to source propagation composts from the holding, but equally permitted are commercial stockfree vegan organic composts (Vegan Organic Network, 2007).

Disease, mollusc and insect control

Should be a matter of prevention by using a mixed cropping and rotational cropping to break pest and disease cycles, providing permanent predator belts, including incorporating undisturbed perennial plants, planting attractant species of flowers in strips (e.g. *Phacelia* spp.). Further measures include:

- Installing some body of stagnant water to attract beneficial insects and creatures
- Compost to encourage beneficial antagonistic microorganisms and have an inoculating effect against disease
- Good husbandry and hygienic practices
- Physical barriers e.g. netting, fleeces, brassica collars
- Quartz sand as a repellent

Standard principles

Natural pesticides, insecticides and biological controls should not be used.

Other standard principles exclude the use all biocides based on animal derivatives the use of flame weeding and steam sterilisation of soils, and *"Ducks should not be kept to eat slugs and snails"*. In addition, inputs and practices which are not necessarily animal derived or harmful to soil fauna like of peat and coir, the use of monocultures in greenhouses, fossil fuel use are banned in 'vegan organic' and this is more of a refection that the general national/EU standard has not yet addressed these controversial issues for organic farming. The use of plastic mulches is allowed but restricted: *"Plastic mulches should not be used routinely"* (Vegan Organic Network, 2007).

Other standards outside the UK

There are other standards like veganic in North America, but they are similar to the one described earlier as the website www.goveganic.net puts it for the USA and Canada: *"The standards are modeled significantly after the vegan organic (stockfree-organic) certification that was developed in the UK"*. As a private organic standard **veganic** is run as a participatory guarantee system (PGS), which involves the farmers and consumers in the process of developing and administering the certification. In the German speaking countries the UK vegan organic standards have also been adopted and translated and called **bio-vegan** (www.biovegan.org), biological and ecological being the most common German equivalents to organic and all three words are protected by the EU organic legislation.

In Italy, ICEA (www.icea.info), Instituto Certificazione Ethica e Ambientale has also developed standards and uniquely they are combining vegetarian and vegan production. Besides food, ICEA certifies a wide range of products like cosmetics, textiles, tourism, buildings, urban landscapes, social accountability and biofuels. The documents are therefore provided in English (ICEA, 2014) and being business orientated ICEA sees a growing market

in vegetarian and vegan food certification. The problem with the standard from an organic perspective is, that they require no organic production in addition to vegetarian or vegan. For example the standard for vegetarian allows conventional eggs (they should be out-door, but how is this verified?) and conventional free-range hens are often fed imported feeds like soya and maize with GMOs and may have residues of fungicides and insecticides in the country of feed production. Without organic certification at source this is difficult to exclude. In addition, in vegan agriculture and horticulture synthetic fertilisers (not animal based) and herbicides may still be used.

DISCUSSION – CHALLENGES TO VEGAN ORGANIC GREENHOUSES

Biological pest control

For a greenhouse environment the standard principle: "*Natural pesticides, insecticides and biological controls should not be used*" is arguably the most problematic as greenhouses work especially well with biological pest control. It is not clear why biological control, which is happening already by introducing habitats, and host plants, should not be further used. In addition, just relying on pollination services by wild bees may not be enough in a greenhouse environment. Bees could be used for pollination without collecting their honey and replacing it with a different, organically certified sugar.

One explanation for the underuse of biological pest control may be that most of the stockfree growers are not very specialised concerning greenhouse crops and hence when writing the standards did not see the advantage greenhouses can offer regarding pest control and climate management, compared to the disadvantages they have to the open field, where only relying on natural prevention and a diverse natural environment and crop rotation makes perfect sense.

Fossil fuels, peat and coir

Other issues can be more easily achieved in vegan organic greenhouses including the phasing out of fossil fuels, peat in growing media and not replacing it with coir. The exclusion of coir (a natural fibre extracted from the husks of coconuts) can be considered more of a transport issue (and reveals a UK-centric view of the Vegan Organic Network in the Global North). If vegan organic horticulture is run in countries were organic coconuts, are regularly grown then coir would be a local plant-based by-product from a perennial crop.

The phase-out of fossil fuels including peat is already on the agenda in the EU and enforced in some member countries, for vegan organic to take a lead here would be advantageous, but it can be expected that the wider non-vegan organic greenhouse world will catch up soon.

High nutrient demand in vegan organic greenhouses

In our view the most challenging issue for vegan organic intensive greenhouse production would be the availability of enough nutrients for plant demand. Some more radical vegan and organic views may conclude greenhouses are too intensive, expensive and therefore should not be used at all as a matter of principle. However, this is neither the view of the Vegan Organic Network (2009) nor the view of nearly all professional organic and 'vegan organic' growers. They argue that greenhouses provide a useful addition to a farm, for propagation of plants, seed production, season extension, out-of season production and local supply of fresh produce all year. Contested is the amount of greenhouses on a farm and in a region and the amount of centralisation and specialisation, which then leads to long food supply chains, pollution and exploitation of resources (water) at the site of concentrated industrial production.

Vegan organic fertilisers from the holding or linked farms

The requirement of 'vegan organic' to use the farm as the primary source of soil fertility will act as a natural constraint on too many greenhouses on a farm or in a region. Like producing feed for an organic dairy on the surrounding pasture and arable land there is land required around the greenhouses to grow enough plant-based composts, mulches and other biomass. This should be done to maximise the biodiversity of the cropping and also to compensate for the area taken out by the greenhouses from natural habitats and "paying back" with a more diverse landscape around the greenhouses.

A vegan organic greenhouse requires a basic crop rotation and because of greenhouse constrains this will be most likely be less wide then in the open field and may only include short and medium green manures, under-cropping with green manure or rotation of key crops like tomato, pepper, cucumbers, beans or lettuce.

Besides fertility from the soil, as the main source, a vegan organic greenhouse requires also a considerable amount of additional nutrients. For this a mixture of sources is required: compost, mulch, pellets or liquid fertiliser. Around a greenhouse (on the own holding or linked local organic farms) such a mixture can be provided by a permaculture and agroforestry system combined with leguminous crops grown as fertiliser and a vegan anaerobic digester (Schmutz, 2012). Good facilities and skills for composting several plant-based materials are also needed. The anaerobic digester and the processing of fertiliser from leguminous and other crops may require a larger then farm-scale approach and a linking up of several organic farms in a region.

Socio-economics of vegan organic greenhouses

From the above it can be concluded that vegan organic greenhouses are technically feasible, although they might be considered more challenging by many organic growers. Most vegan organic growers would agree that they are "knowledge intensive", meaning they require a good general organic knowledge and a secure market to plan many years ahead.

The next question is regarding their socio-economics. Here the answer is even more straightforward. On a production level replacement of animal based fertilisers with plant-based ones from the holding or from linked farms may increase costs only marginally. Schmutz et al. (2011) have fertility costs in a none-vegan, organic unheated tomato example at 2-4% of total variable costs. The fertility costs include green waste compost, straw mulch, vinasse (a by-product of sugar beet processing), lime and undersown yellow trefoil (*Medicago lupulina*). If vegan organic inputs would be e.g. 50% more expensive they would still only be 3-6% of total variable costs. Better fertility management may however result in more stable yields and it is clear that vegan organic greenhouses could "pay" for the fertility grown around them. In addition, vegan organic consumers are often very committed and e.g. various types of community supported agriculture (CSA) provide a good business environment to make the investments required in terms of agroforestry trees, biomass processing, anaerobic digestion, or renewable sources for greenhouse heating. Vegan consumers can also spend proportionally more on their food as they make big savings by not buying organic meat and hence can be considered less price sensitive then average consumers.

DISCUSSION – VEGAN ORGANIC AND FOOD SECURITY

Can or must vegan organic feed the world?

The feasibility of vegan organic to leave its current niche, and "feed the world" is a hotly debated issue. Opinions range from "vegan diets are not healthy or at least not normal", brought forward by meat eaters and especially the conventional meat industry, to an equally fundamental stance sometimes taken by vegans who consider meat-based diets unhealthy and clearly not "normal". It is however clear that globally 'diet diversity' is the best way to describe the multiplicity in diets. Vegan and vegetarian diets and those who exclude certain meats for religious and spiritual reasons are far more common then it may look from a Europe-centric worldview. The often-repeated assumption that when people become more educated and have more disposable income they would automatically increase meat consumption is wrong on a global scale, although it might be right for some countries during a limited period of rapid income growth.

However, the much more worrying aspect is the impacts diets have. The United Nations, concerned about the global environmental impact of agriculture, are clear in their report that "*A substantial reduction of* (agriculture's) *impacts would only be possible with a substantial worldwide diet change, away from animal products*" (UNEP, 2010). This "*substantial worldwide diet change, away from animal products*" is exactly what the vegan and equally the organic movement would want to see as a vision and in German it is often called "Agrar-Wende = Agri-Revolution" (Gottwald and Boergen, 2014).

The vegan and organic movement also share the same critic of industrial farming, where animals have no rights to fresh air, natural daylight or freedom of movement, and welfare is measured in terms of cost-efficiency. The two movements however draw different conclusions: (1) exclude all animals from agriculture, or (2) develop organic livestock systems based on the principle of care (IFOAM, 2015) and a rights-based approach for domesticated animals.

Gottwald and Boergen (2014) try to make the case for organic animals when they ask "*why do we still need some domesticated animals?*" The arguments brought forward against a total vegan world are that domesticated animals are among the oldest cultural heritage human culture has produced, which have co-evolved with us while we became equally domesticated. Domesticated farm animals are not wild and need protection by humans in a caring farm environment. In return for this protection humans should provide highest welfare and decide on the time death, but strictly regulated within organic standards. Domesticated animals are clearly not necessary for successful farming systems, however in certain environments, (e.g. mountains, tundra) they provide milk and meat, fibre and fuel from plants not digestible to humans, which could not be produced in any other way.

Limits to vegan organic?

Gottwald and Boergen (2014) having defended organic livestock and the need for organic animals in some production system, still agree with the need to cut meat consumption in Europe and all other Western countries substantially (as a minimum 50% reduction). Therefore, the question is rather once the estimated 15% vegan, vegetation and flexitarian organic diets (1%, 2%, 11%) have been promoted and doubled twice at what level of meat-free diets do we have to start worrying about the remaining organic farm animals? This point is clearly somewhat in the future, but reflecting on it can give interesting insights into the growth paths of vegan organic horticulture.

MAPS scenario modelling of uptake in vegetarian and flexitarian diets

We used the MAPS (Metropolitan Area Profiles and Scenarios) modelling tool for the metropolitan areas and the case study of metropolitan London (Wascher et al., 2015). London as a world city has one of the most diverse ethnicities and hence its current multicultural diet mix can be used as a proxy for future diet diversity in the Global North. The modelling predicts that the food demand of 26.5 million people projected for 2030 in Greater London (10 million) and its surrounding metropolitan region, defined as East and Southeast England (16.5 million), can be met by 100% organic production, a healthy organic diet, and a moderate reduction (4%) in food waste from the land available in the total metropolitan region. This includes only food and drink which can be grown in this maritime climate of Europe and hence excludes e.g. coffee, tea, tropical fruit, olives, soybeans and many other tropical and sub-tropical crops being part of the multicultural diets of London.

The scenario modelling shows that the 100% regional food supply is about 62% of the total area per person required for all food and drink consumed. This 62% ratio does not change much by shifting from current unhealthy to 'healthy diets', or 'healthy organic diets', or even one additional vegetarian day in a organic healthy diet. However, once 2 vegetarian days per week are introduced or half a week vegetarian (3.5 days/week) this ratio of home produce to import changes to 57% and 54%, respectively. If all days are vegetarian = 100% vegetarian (vegan was not separately modelled) only 47% of the food then demanded, is predicted to be produced in the maritime climate available.

From this scenario modelling we conclude that vegetarian diets at a very high percentage (either 50% vegetarians among organic meat eaters, or 50% vegetarian days in a flexitarian diet) could shift the food demand partially to a different climate. Vegetarian diets may still reduce the overall land demand considerably. While this potential shift towards imports from different climates might be desirable to some (looking for more housing and golf courses), it might not be the intention of a food policy which would like to make full use of all the foods which can be produced in a mild maritime climate with sufficient rainfall (free-range organic dairy, beef, sheep etc. in case of the UK). However, the modelling used the current diets in London and may underestimate the future innovation potential in organic greenhouses, legumes, nuts, agroforestry, and permaculture systems. Within 30 years it may well be possible to grow Mediterranean and Sub-tropical crops like e.g. olives, tea, tree-nuts, soybeans, lentils, quinoa, peanuts, sweet potatoes or artichokes much more widely and commercially viable then currently done in the UK. Especially innovations in organic legumes and tree nuts for human consumption could shift the demand back to more home grown produce, but this could also happen in meat based diets phasing out remaining feed imports.

CONCLUSIONS

It can be concluded that vegan organic greenhouses are technically and economically feasible. They might be considered more challenging by many organic growers and most vegan organic growers would agree that it is "knowledge intensive", meaning it requires a good general organic knowledge and a secure market to plan many years ahead. Committed consumers and community supported agriculture schemes (CSA) provide a good support infrastructure to grow the sector. Because of the low feed conversion rates of conventional and organic livestock this additional land to support vegan organic greenhouses would be less then what is required to feed organic chickens, pigs, farmed fish, or sheep and cattle. Growing crops to feed plants in greenhouses can be equally a part of a diversified land use as currently organic livestock systems are and consumers of a 100% vegan organic diet do not have to worry that their diet requires more land then a meat or low meat based organic diet. On the contrary, because of the environmental impacts the UN promotes "*a substantial worldwide diet change, away from animal products*", together with organic this is known as "Agar-Wende" = Agri-Revolution" in German.

But what would happen in a 100% vegan organic landscape to farmed animals? They can be considered an important cultural heritage of humanity. Many landscapes are dependent on livestock like upland pastures, prairie, alpine mountains, tundra, but also cider orchards for grass cutting with sheep, replacing all this with biomass production for energy and feeding plants may not be the preferred vision of rural citizens and tourists alike. In addition, scenario modelling indicates that although 100% vegan/vegetarian reduces land use considerably, in the Global North, it may shift the remainder partly to southern climates.

However, even those who argue organic livestock is still needed, agree that a substantial reduction in meat consumption (and an equally substantial increase in vegan organic) is necessary; substantial means cutting average meat consumption by more then 50% as a minimum, and producing only organic livestock. This in turn means vegan, vegetarian and flexitarian organic diets should be the norm rather then the exception following the UN's guidance. If this happens - surely it could be called a revolution.

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