OF&G White Paper

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Future of Farming

Executive Summary

At a time when food security and sustainability demand that we address the challenges faced by our global food system, the inherent benefits of organic food production systems offers real and practical solutions.

Global agriculture is facing huge challenges. According to the UN, the global population is expected to reach 9.7 billion by 2050. Combined with a growing demand for a meat and dairy rich diet, some predict this will require global food production to rise by 50% to 100% to meet this growth.

At the same time, emissions modelling suggests that agriculture-related emissions alone will take up almost 100% of the world's carbon budget by 2050 – suggesting agricultural activity alone could trigger a 2% rise in temperature. Clearly, business as usual isn't going to work.

Some see the answer in new systems, such as Sustainable Intensification (SI) where yields are increased without adverse environmental impact or cultivation of more land. This would be achieved through greater efficiency, new technologies and managing agriculture to use ecosystem services, such as biological pest control, to optimise food production.

The sustainable intensification (SI) model offers some promising ideas, but fails to address fundamental issues. Primarily, a system based on increasing intensification of resources by making better use of land, water and biodiversity, suggests that agriculture remains intent on extracting cash value from natural resources rather than protecting them for future generations.

In fact, simply producing more food is not going to answer the long terms needs of mankind. The World Economic Forum points out that to sustainably feed future populations, it is vital to reduce food waste and curb per capita consumption of meat and dairy. Currently, food availability in developed countries represents 150 to 200% of nutritional needs in calorific terms – rising to 300–400% if indirect calories fed to livestock are included. Put simply, rich countries have more food surpluses than ever before.

Intensification also raises questions about the treatment of farmed animals – from animal welfare concerns to the climate impact of grain fed intensive farming system.

The issues surrounding intensive farming of livestock are highlighted by the growing problem of antibiotic resistance, caused partly by the reliance on antibiotics as a prophylactic method of disease control in livestock. In order to ensure their continuing effectiveness in treating human disease, use of antibiotics must be restricted to treating animals only when they are ill. Research is increasingly showing that this can only be achieved by putting animals under less stress and by increasing the resting periods of animal housing. In short, by reducing the intensity of animal production.

What we need is a fundamental change in food and farming policy that supports a high nutrition diet while protecting natural resources and limiting climate change.

This is where organic food production can lead the way. While other farming systems address some aspects of the sustainability challenge, only food produced using organic principles and practices addresses these many challenges at once.

Organic producers know that food production systems must begin with soil health and management at their core. All agricultural practices have to be considered in the context of the best soil management – avoiding inputs, such as agrochemicals, that can have a negative impact on the soil. It is only by putting soil at the very heart of agricultural policy that long term, sustainable food production can be ensured.

The cornerstones of an organic food system are soil health and vitality; animal welfare; the need to work with, rather than against nature, and positively impact on biodiversity. These result in the production of nutritious, healthy food that avoids contamination by pesticides.

It is recognised that yields of some organic crops (but not all) can be lower than the same non-organic crops and this can be for various reasons. Often this is due to the lack of research and subsequent knowledge of the farmer but if mankind is to survive then the debate around yield has to be set within the context of diet as well as in investment in research and development. Our diet has evolved over the millennia, one of the great evolutionary advantages we possess and western diets have even changed significantly over the last 50 years. The truth is that we can eat well, remain healthy and feed a global population of nine billion sustainably but it will be on a different diet to the current diet of the western world.

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Executive Summary contd.

Organic offers a farming ethos that focuses on local supply, that relies on the minimum of external inputs and that offers high nutritional quality. It, also, delivers on the broader needs of society in providing a clean and flourishing environment, that helps mitigate climate change, and that doesn't rely on antibiotics to deliver its welfare outcomes or agrochemicals and fertilisers derived from fossil fuels to ensure food is produced.

What organic systems do not allow is a 'pick and mix' approach where particular elements can be extracted in isolation – organic is a whole system approach.

Given this holistic systems based approach in organic production, the sector has codified the principles and practises that are deemed acceptable in organic production, and these were first set in law in the early 1990s. In a free market economy the standards provide a 'line in the sand' to help bring consistency, integrity and equivalence within the market and ensure the veracity of the organic food people buy.

Everyone has an innate need to understand what something is and to be able to clearly identify it. In the current environment with 'sustainability' now more than ever on people's lips there is a serious danger that all things that purport to have some degree of 'sustainability' are seen as equal. This will undoubtedly lead to confusion and a subsequent loss of confidence by the consumer as people find out that what they believed they were buying into is not what they thought it was. It goes to the heart of the increasing demand from consumers for the need to understand how and where their food is produced and manufactured. The need for absolute clarity on sourcing, provenance and integrity is paramount.

Organic certification is important in demonstrating that food is produced to a recognised set of legal standards because in a world of 'facts' and 'alternative facts' it is critical that we can clearly identify organic food. In so doing everyone has the confidence to make an informed decision about what they are buying and more importantly the fundamental principles they are buying into.

Sustainable Intensification

The question of how mankind can redesign agricultural systems in the face of the very significant and accepted challenges the human race faces is fundamental to the survival of our race.

It was suggested at the Sustainable Intensification Research Network Annual conference[1] that despite 'great' recent progress, there is a requirement to increase total food production before the world population stabilises.

The UN DESA, however estimates the current world population of 7.3 billion is expected to reach 8.5 billion by 2030, 9.7 billion in 2050 and 11.2 billion in 2100[2].

There is an ambition for agriculture to produce more food without increasing environmental harm and to have positive contributions to natural and social capital, which has been reflected in calls for a wide range of different types of more sustainable agriculture.

In the light of this there have also been calls for nutrition-sensitive, climate-smart and low-carbon agriculture. This would appear to be a great deal to ask and the question was posed as to whether agricultural systems across the world could or would respond positively?

The solution proposed was the adoption of what is referred to as Sustainable intensification (SI). This is defined as a process or system where yields are increased without adverse environmental impact and without the cultivation of more land. The concept suggested is thus relatively open, in that it does not articulate or privilege any particular vision of agricultural production.

In 1985 Stuart Hill of McGill and earlier Hawkesbury College in Sydney, developed a concept of change in agricultural systems that helps plot steps towards new and more effective systems. Hill observed "there is something seriously wrong with a society that requires one to argue for sustainability," and suggested there were three critical stages:

1. Efficiency
2. Substitution
3. Redesign

Step 1: Efficiency

Efficiency focuses on making best use of resources within existing system configurations. It is suggested that this would include targeting inputs of fertiliser and pesticide to reduce use and cause less pollution and damage to natural capital and human health. Precision agriculture is another example, using GPS, robotics and drones to reduce both financial costs and environmental externalities. Machine design can reduce the use of fossil fuels. In these ways, the unnecessary use of external inputs is avoided.

Step 2: Substitution

Sustainable Intensification, it is proposed, prioritises using new technologies and practices to replace existing ones that may be less effective on both productivity and sustainability grounds. It suggests that the development of new crop varieties and livestock breeds is one example of substitution replacing less efficient system components with new ones. Beetle banks substitute for insecticides; releases of biological control agents can also substitute for inputs. Hydroponics is an extreme example of substitution, where water-based architectural systems replace the use of soils. No- and zero-till systems substitute new forms of direct seeding and weed management for inversion tillage.

Substitution implies an increasing intensification of resources, making better use of existing resources (eg land, water, biodiversity) and technologies.

Step 3: Redesign

This final step centres on the design of agro-ecosystems to deliver the optimum amount of ecosystem services to aid food, fibre and oil production whilst ensuring that agricultural production processes improve natural capital.

Redesign harnesses agroecological processes such as nutrient cycling, biological nitrogen fixation, allelopathy, predation and parasitism. The aim is to minimise the impacts of agroecosystem management on externalities such as greenhouse gas emissions, clean water, carbon sequestration, biodiversity, and dispersal of pests, pathogens and weeds.

Redesign is fundamentally a social challenge, as there is a need to make productive use of human capital in the form of knowledge and capacity to adapt and innovate and social capital to resolve common landscape-scale or system-wide problems (such as water, pest or soil management).

Redesign is a game changer: it accepts there is no single solution to the productivity and sustainability challenges in agriculture. Systems will need to learn and develop, addressing new opportunities and challenges as they emerge. Thus sustainable intensification is a paradigm for continuous learning, where means will differ temporally and spatially to achieve desired ends.

The concept of SI maintains that there are many pathways towards agricultural sustainability, and no single configuration of technologies, inputs and ecological management is more likely to be widely applicable than another.

1 Sustainable Intensification Research Network Annual Conference 3/11/16 – Jules Pretty presentation on "Sustainable Intensification – Concepts, Prospects and Redesign" http://sirn.org.uk/2016/11/16/sustainable-intensification-efficiency-substitution-and-redesign/

2 The current world population of 7.3 billion is expected to reach 8.5 billion by 2030, 9.7 billion in 2050 and 11.2 billion in 2100, according to a new UN DESA report, "World Population Prospects: The 2015 Revision", launched Dec 16 https://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf

Whilst much of what was proposed makes sense, it will not deliver the necessary outcomes. New technologies and an increased focus on the environmental and social impacts along with social partnerships within the food system are all practical common sense proposals, but the adoption of this broad brush 'sustainable intensification' approach fails to address some fundamental issues.

In fact, the suggestion that increasing intensification of resources by making better use of existing ones (e.g., land, water, biodiversity) suggests that the agricultural system outlined remains intent on extracting a cash value from natural resources rather than necessarily protecting them for future generations.

Global Food Security

The current dominant thinking for global food security is that humanity "needs" to increase food production by between 50% to 100% by 2050. The consensus is that this is partly due to population growth, but mostly because the world population is moving towards more meat- and dairy-intensive diets.

However the World Economic Forum point out, in a paper entitled "Food: how much does the World need?" that simply producing more food is not going to be the answer.

To sustainably feed a planet of nine billion, it is vital to cut food waste and curb per capita consumption of meat and dairy in those countries that already consume too much[3].

The simple fact is that food waste in the developed world means that increasing global food production would not eliminate world hunger. In reality food availability in rich countries represents 150-200% of nutritional needs in calorific terms. If include indirect calories are included – those fed to livestock that could have gone to people – the figure is 300% to 400%. The fact is rich countries have bigger food surpluses than ever before[4].

If the word "need" is to be applied here, the "need" is for a moderate level of consumption of highly nutritious food, with less waste, and less reliance on meat for protein.

This would appear to be at odds with the current paradigm which is that the 'need' for significant growth in food production, seems to be more about a global food system driven by the conversion of natural capital into cash rather than a demographic or nutritional necessity.

The costs of increasing food production are significant. Emissions modelling suggests that agriculture-related emissions alone will take up almost 100% of the world's carbon budget by 2050. Agricultural emissions alone trigger a 2°C global temperature increase[5].

A combination of grain fed intensive meat and dairy production results in a particularly high carbon footprint, making this type of livestock farming a key contributor to total agricultural emissions, pointing again towards the importance of diet and consumption mix as well as reducing food waste. The continued dependence on fossil fuels to produce artificial fertilisers and pesticides within conventional agriculture is, also, a key aspect within these emission figures.

Use of Agrochemicals

While the synthetic nitrogen fertiliser produced by the Haber Bosch process is credited with feeding a third to half the present world population, it is very energy intensive. The process itself converts atmospheric nitrogen (N2) to ammonia (NH3) by a reaction with hydrogen (H2) using a metal catalyst under high temperatures and pressures.

The major source of hydrogen is methane from natural gas and between three and five percent of the world's natural gas production is consumed in the Haber Bosch process[6]. While clearly conventional farming requires artificial nitrogen fertiliser there are significant issues with its production.

The biogeochemical cycles of nitrogen have been radically changed by humans as a result of many industrial and agricultural processes. Nitrogen is an essential element for plant growth, so ensuring it is available for crops is a main concern. Human activities now convert more atmospheric nitrogen into reactive forms than all of the Earth's terrestrial processes combined. Much of this new reactive nitrogen is emitted to the atmosphere in various forms rather than taken up by crops. When it is rained out, it pollutes waterways and coastal zones or accumulates in the terrestrial biosphere. A significant fraction of the applied nitrogen makes its way to the sea, and can push marine and aquatic systems across ecological thresholds of their own. One regional-scale example of this effect is the decline in the shrimp catch in the Gulf of Mexico's 'dead zone' caused by fertiliser transported in rivers from the US Midwest[7].

Closing yield gaps via agricultural intensification is often cited as a method to increase food supply without increasing food production's environmental footprint. While per acre productivity yields did significantly increase during the second half of the 20th century, this rate of growth has now slowed, with increases of only about 1% per year[8].

3, 4, 5 World Economic Forum – "Food: how much does the world need?" Author Tristram Stuart. Published 7th May 2015 https://www.weforum.org/agenda/2015/05/food-how-much-does-the-world-need/

6 Smil, Vaclav (2004). Enriching the Earth: Fritz Haber, Carl Bosch, and the Transformation of World Food Production. Cambridge, MA: MIT Press. ISBN 9780262693134.

7 Stockholm Resilence Centra "The Nine Planetary Boundaries" author Steffan et al. 2015 http://www.stockholmresilience.org/research/researchnews/tippingtowardstheunknown/thenineplanetaryboundaries.4.1fe8f-33123572b59ab80007039.html

8 World Economic Forum – "Food: how much does the world need?" Author Tristram Stuart. Published 7th May 2015 https://www.weforum.org/agenda/2015/05/food-how-much-does-the-world-need/

GMO Technology

Genetically modified organisms (GMOs) technology has been heralded by some as the answer to feeding the planet. In a recent New York Times article, however, it states that UN data demonstrates that the United States and Canada who have widely adopted the technology have gained no discernable advantage in yields – food per acre – when measured against Western Europe, a region with comparably modernised agriculture but which has largely rejected GMO technology to date[9].

A National Academy of Science report found that over the last 20 years 'there was little evidence' that the introduction of GMO in the US had led to yield gains beyond those seen by conventional crops. The report goes on to say, however, that herbicide use has increased.

The United States Geographical Survey states that in the US over the last two decades insecticide and fungicide use has fallen by a third but herbicide use has increased by 21%, this compares with Europe which over the same period has seen fungicide and insecticide use fall by 65% and herbicide use fall by 36%.

The industry that produces GMO varieties are, however, benefiting in many respects as these companies make and sell both the genetically modified plants and the pesticides that go on them. This analysis does not appear to indicate that GMO is a solution to world's food needs.

Deforestation

So, in the face of no other alternative it would seem the only other way to increase food production, within the current paradigm, is to increase the amount of land under cultivation. It means destroying the world's remaining wild habitats, especially forest. Between 12% and 20% of current CO2 emissions are from deforestation, and up to one third of historical CO2 emissions are from deforestation and land use change. Deforestation's heavy carbon footprint contributes to agriculture's responsibility for 30-35% of global greenhouse gas emissions. Deforestation also has dangerous ramifications for biodiversity loss[10].

Thus, increasing food production using the current conventional approach to food production and food manufacture will require expansion of the agricultural frontier, a process that destroys biodiversity, interrupts hydrological cycles, and surrenders humanity to severe climatic change, all of which will stop humanity's ability to feed itself.

Food and Farming Policy to Protect the Soil

What is called for, therefore, is a fundamental change in food and farming policy that supports the protection of natural resources, reduces waste, limits climate change, provides high nutrition, and has a benign impact on the environment for future generations.

A new food and farming policy is required that starts with protecting the soil. All life depends on it but it is not a new area of concern. As Franklin D Roosevelt said over 70 years ago, when promoting the first measures in the world to protect soil, that "The Nation that destroys its soil destroys itself." He understood the value of soil and the importance to economies and societies of protecting it.

The soil face pressures now that Roosevelt could never have envisaged with increasing demands for food and fuel from a growing global population, but with little consideration by conventional farming practises on them.

Soil erosion due to wind and rainfall has already resulted in an annual loss of around 2.2 million tonnes of topsoil in the UK. Climate change has the potential to increase erosion rates through hotter, drier conditions that make soils more susceptible to wind erosion, coupled with intense rainfall incidents that can wash soil away[11].

Soils are an important store of carbon, with those in the UK containing around 10 billion tonnes of carbon, half of which is found in our peat habitats. Releasing this store into the atmosphere would create emissions that are equivalent to more than 50 times the UK's current annual greenhouse gas emissions. As the climate warms and rainfall patterns change, there is a growing risk that emissions to the atmosphere from soil will increase, in turn causing further climate change as well as reducing the soil's productive capacity[12].

Food production systems must begin with the soil health and management at their very core. It is healthy soil that will be a cornerstone for the future existence of mankind. All agricultural practises, therefore, have to be considered in the context of the best soil management and any external inputs that have a deleterious effect on the biological activity of soils should be actively avoided. Only by putting soils at the very heart of agricultural policy can we be sure of long term, sustainable food production.

A recent comprehensive analysis found that conventional farming practices (often large monocultures) generally result in higher yields (sometimes significantly so, other times only marginally better). However conventional farming practices often result in a much larger impact on the land they occupy as well as the surrounding area.

9 New York Times 29/10/16 "Doubts about the promised bounty of genetically modified crops" Author Danny Hakim http://www.nytimes.com/2016/10/30/business/gmo-promise-falls-short.html?_r=0

10 World Economic Forum – "Food: how much does the world need?" Author Tristram Stuart. Published 7th May 2015 https://www.weforum.org/agenda/2015/05/food-how-much-does-the-world-need/

11 Defra Soils Policy Team "Safeguarding our soils" September 2009. https://www.gov.uk/government/.../safeguarding-our-soils-a-strategy-for-england

12 Policy Team "Safeguarding our soils" September 2009. https://www.gov.uk/government/.../safeguarding-our-soils-a-strategy-for-england

Such practices also tend to lead to less resilient systems that are dependent on a specific range of sometimes narrow conditions and external inputs (such as fertilisers) which if not met could result in massive crop losses[13].

Where farms don't use artificial fertilsers and agrochemicals, however, these often have lower yields (though not always significantly lower), but have a smaller impact on the land they occupy and its surroundings. These farming practices are also very knowledge intensive, and often times it is the lack of research and subsequent knowledge that is responsible for a farm's lower productivity.

Increasing knowledge can be key in improving farm yields on these types of farms and it can also provide other benefits such as an improved resilience of the overall system. For example these farms often develop a healthier soil that among other things can retain more water thus requiring less irrigation while being more drought tolerant. This could be vital as the earth continues to warm and water available for irrigation becomes more scarce[14].

Animal Welfare and Intensive Farming

In addition to protecting soil, the welfare and respect shown to farmed animals is a key consideration. As previously outlined, the consumption of meat needs to decline to address the climate impact of grain-fed intensive farming systems.

Society needs to recognise the true value of the meat it consumes. The animals within the farmed system must be allowed to develop naturally, without being pushed physiologically out of economic necessity, and they must be allowed to express their natural behaviours.

The current focus on antibiotics brings into sharp focus the challenges faced by the current intensive food system. To avoid significant resistance building that will ultimately mean antibiotics will loose their efficacy then livestock farmers will have to reduce their reliance on antibiotics as a prophylactic method of control of disease in livestock and limit their use to only treating animals when they are ill.

It is becoming obvious, from current work undertaken within the food industry, that to achieve this we need to reduce the level of stress on animals and increase the rest periods on housing[15]. In other worlds significantly reduce the intensity of animal production. Ruminants should, also, only be fed on predominantly forage based diets, which would reduce their emissions that impact on climate change.

All these policies would make meat more expensive but, if we are to reduce consumption, this would be a responsible and pragmatic way to change consumer behaviour.

13 Resilence v Yield: A difficult choice. Author Dan moutal Published June 2012
http://planet3.org/2012/06/19/resilience-vs-yield-a-difficult-choice/

14 Resilence v Yield: A difficult choice. Author Dan moutal Published June 2012
http://planet3.org/2012/06/19/resilience-vs-yield-a-difficult-choice/

15 Sainsbury Farming Conference Nov 2016 – Moy Park

Agriculture has to work in balance with nature. The continued reliance on crop protection products (pesticides) is having a significant effect on wildlife in farmed areas. The current worldwide agrochemical market is estimated to be worth $214.2 billion in 2015 concentrated in the hands of four global corporations[16]. What was first identified in the 1960s in Rachel Carson's 'Silent Spring' continues today with issues such as chemical resistant black grass and the significant impact of neonicotinoids on bee populations.

The full impact of crop protection products on the soil ecosystems are unknown, however, what we do know is that 42% of the land cultivated today is degraded[17] and more than three quarters of the important natural habitats in the EU are now in an unfavourable state, and many species are threatened with extinction[18]. These things can be mitigated to a degree under the conventional farming system but ultimately it will only be when soil health and biodiversity are at the heart of the farming system that there will begin to be a meaningful long term improvement.

Nutritional Quality of Food

A key element in any new farming policy has also to focus on the nutritional quality of food. A new report from the Global Panel on Agriculture and Food Systems for Nutrition, released at FAO September 2016, makes alarming reading. Data from the report shows that while income growth can help to alleviate hunger, it does not guarantee accessibility to healthier, quality diets. While many people today have better diets than before, the intake of foods that undermine diet quality has increased even faster. For example, the sale of ultra-processed food and beverages rose from one-third of those in high income countries in 2000 to more than half by 2015.

"We must rethink how we look at nutrition and food systems. Nutrition is not just an health and social development issue, but an investment that can spur economic growth," states Dr. Akinwumi Adesina, President of the African Development Bank and member of the Global Panel. "Nutrition fuels grey matter infrastructure—the minds of the next generation that will drive progress and innovation. If we do not act, we will fail to unleash the full potential of millions of people around the world."

16 Agrochemicals Market by Type (Fertilizers & Pesticides), Fertilizer Type (Nitrogenous, Potassic, & Phosphatic), Pesticide Type (Organophosphates, Pyrethroids, Neonicotinoids, and Bio-Pesticides), Subtypes & Crop Type - Global Trends & Forecast to 2020 – Published by Markets and Markets – September 2015
http://www.marketsandmarkets.com/Market-Reports/global-agro-chemicals-market-report-132.html

17 Conference - Why Soil Matters? Key note speech by Olivier de Schutter – November 2015.

18 European Commission: The mid-term review of EU biodiversity strategy shows progress in many areas, but highlights the need for greater effort by Member States on implementation to halt biodiversity loss by 2020 Published October 2015.
http://europa.eu/rapid/press-release_IP-15-5746_en.htm

The report calls on governments, donors and global partners to put food systems at the center of global action, including the Sustainable Development Goals. While policy must be tailored to meet country needs, priority actions at the global and national levels include:

- Prioritise improvements in women's diet quality;
- Develop policies to regulate product formulation, labeling, advertising, promotion and taxes to incentivise production of high-quality foods and inform consumers;
- Use public sector purchasing power to institutionalise high-quality diets;
- Improve availability, affordability and safety of fruits, vegetables, pulses, nuts and seeds; and
- Foster increased collaboration and data access across agriculture, health, social protection and commerce.

"This Report makes clear the enormous challenge posed by malnutrition and poor diets generally to the detriment of many millions of individuals and indeed whole economies," said Sir John Beddington, former UK Chief Scientific Advisor and co-chair of the Global Panel on Agriculture and Food Systems for Nutrition. "The level of effort required to address this problem is not dissimilar to the sort of effort that has been used by the international community to address the issues of HIV/AIDS, malaria and other pandemic diseases[19]."

The challenge, therefore, is to find a system of food production that addresses the issues identified and ensures that food production is 'sustainable'. To achieve this, it is vital to address the fact that the use of finite resources to underwrite the propagation of crops and animal systems is not sustainable. Whilst it is currently not possible to power agricultural equipment without the use of fossil fuel (although this will change) it is possible to grow crops without the reliance on artificial chemicals and fertilisers derived from fossil fuels.

Organic Production Benefits & Opportunities

Organic production techniques were first developed to address the very challenges we face. The key principle of organic production from its conception has been the need for a holistic and circular process for food production.

Organic food production is dependent on the cycling and recycling of nutrients, on respect for the environment and respect for the animals, and in the belief that by delivering this human nutrition would be enhanced, as would the lives of those who worked within the food sector.

If the current dietary choices continue i.e. significant consumption of intensively reared meat and dairy consumption, then we will struggle to feed the population without the use of finite resources.

It was identified in the article in Nature that "farming without the use of chemical fertilisers and pesticides could supply needs in some circumstances. But yields are lower than in conventional farming, so producing the bulk of the globe's diet will require agricultural techniques including the use of fertilizers, the study concludes[20]."

The same article references diet, however, it is important to understand what diet we are talking about. As already outlined, conventional farming practices have both the highest yield and the lowest resilience. This combined with the fact that the human population continues to grow means we are already pushing the planet to its limit and in some cases beyond. If mankind is to survive then the debate around yield has to be set within the context of diet.

Our diet has evolved over the millennia, one of the great evolutionary advantages we possess and western diets have even changed significantly over the last 50 years.

The truth is that we can eat well, remain healthy and feed a global population of nine billion sustainably but it will need to be on a different diet to the current western one. In reality it is unlikely we will be eating a 99p burger in 2050.

The cornerstones of an organic system are soil health and vitality; animal welfare; the need to work with, rather than against nature, and to positively impact on biodiversity. These result in the production of nutritious, healthy food that avoids contamination by pesticides.

What organic systems do not allow is a 'pick and mix' approach where particular elements can be extracted in isolation – it is a whole system approach.

Given this holistic systems based approach in organic production the sector has codified the principles and practises that are deemed acceptable in organic production, and these were first set in law in the early 1990s.

In a free market economy the standards provide a 'line in the sand' to help bring consistency, integrity and equivalence within the market and ensure the veracity of the organic food consumers purchase. They set a standard to which businesses must comply to ensure that the products are produced to organic principles.

Significance of Organic Standards

Setting a universally accepted standard does restrict the opportunity to easily move the principles of organic production forward. The organic sector continues to review and improve standards wherever possible.

A clear set of principles, universally agreed, are required and that in turn demands a practical and transparent way of ensuring consistent application of how these principles must be implemented.

19 The Global Panel on Agriculture and Food Systems for Nutrition, "Food Systems and Diets: Facing the challenges of the 21st Century" released at FAO September 2016 http://glopan.org/news/globally-increasingly-poor-diets-now-pose-greater-risk-health-unsafe-sex-alcohol-drug-and

20 Seufert, V., Ramankutty, N. & Foley, J. A. Nature http://dx.doi.org/10.1038/nature11069 (2012).

Some in the industry are frustrated by the imposition of the standards as they are seen to stifle innovation and can appear bureaucratic. But if there were no legal framework, the arguments about what is or is not organic could become divisive and destructive. Standards help to create a framework of integrity, transparency and trust and help to guarantee good outcomes that address the challenges that we face.

There has been a growing mistrust by the consumer of the food sector in general. More than ever people are seeking food with provenance and with a real story and assurances behind it. This can be as binary as having two descriptors on the packet in preference to one but the rise in conscious consumption is driving change: the desire to save money, concerns about the world's resources, mistrust around the ability of institutions to take responsible decisions on behalf of the public, while feeling that it's the right thing to do.

This, unsurprisingly, chimes with the challenges faced by humanity as a whole and while the purchasing of organic food by consumers may not necessarily be made from a wholly informed position (although some consumers are highly informed), the reality is that they "get it"; be it through concerns about animal welfare, the environment, food quality or health.

In the wider political context there is a real and visceral demand for change. To address this requires a rebalancing of the economic system bringing the production (and jobs) back to a more localised supply and demand model.

Policy makers must begin to address the major challenges that the food system faces. By more widely supporting the adoption of organic production methods they can begin to address some fundamental issues we face and move toward a more resilient food production system.

While policy makers can help with creating the right socio-economic environment for change, the food sector as a whole must begin to recognise its place in driving change by more actively addressing both the challenges we face and consumer purchasing motivations.

Food manufacturers and retailers need to embrace a more local and self sustaining model. This would minimise impacts on the environment (e.g. the reduction of metaldehyde in water courses)[21], on animal welfare with knock on implications to human health (e.g. in the use of prophylactic antibiotics in animal production systems) and on the significant energy demands and climate impacts of artificial fertilisers and pesticides.

Organic production and standards need to evolve but they provide a consistent regulated framework.

There is much the organic sector can do beyond assuring organic provenance to improve the lives of those that produce food and to improve supply chains that then allow greater interactions with the people who consume it. These issues are recognised by organic organisations and work around this is already underway. Further work also needs to be undertaken to really start to understand the complexity of the soil biome and its interactions with crops through varietal choice and soil management techniques. It is by delivering on these elements, however, that we can begin to deliver the quality of food and the engagement with everyone that is now needed.

From a broader social perspective it is important that the profit margins generated by agriculture are largely retained by farmers rather than exported to the providers of the external inputs required by non-organic farmers to allow them to farm. The financial benefits should lie with the farmer and his/her management and practical skills and not with the multi-national corporations that supply many of the external inputs.

Society needs resilient farming systems that focus on local supply, that rely on the minimum of external inputs and deliver high nutritional quality. They also need to deliver on the broader needs of society in providing a clean and flourishing environment, that helps mitigate climate change, and that doesn't rely on antibiotics to deliver its welfare outcomes or agrochemicals derived from fossil fuels to ensure food is produced.

The position of multi-national corporate power within the food system also needs to be addressed and rebalanced.

Organic Production Addresses the Challenges

There are other farming systems that are addressing some aspects of the sustainability challenge but at the moment it is only food produced using organic principles and practises that address so many of the challenges at once.

As progress is made towards more sustainable food production it is important that all assurance schemes are recognised and celebrated for what they deliver. Sustainability is a journey after all; it is not an act but a habit. It is critical, however, that on the journey to deliver sustainable outcomes that all assurances with sustainable credentials are open and transparent in what aspects they are seeking to address.

While organic production methods are not perfect, the adoption of these techniques currently offers us the greatest opportunity to address many fundamental issues. It is, therefore, critical that the consumer understands why organic is different. While other assurances should be applauded and supported, organic must be recognised for the value it delivers both now and for future generations.

Everyone has an innate need to understand what something is and to be able to clearly identify it. In the current environment with 'sustainability' now more than ever on people's lips there is a serious danger that all things that purport to have some degree of 'sustainability' are seen as equal. This will undoubtedly lead to confusion and a subsequent loss of confidence by the consumer as people find out that what they believed they were buying into is not what they thought it was. This goes to the heart of the increasing demand from consumers for the need to understand how and where their food is produced and manufactured so the need for absolute clarity is paramount.

Organic certification is important in demonstrating that food is produced to a recognised set of legal standards because in a world of 'facts' and 'alternative facts' it is critical that we can clearly identify organic food. In so doing everyone has the confidence to make an informed decision about what they are buying and more importantly the fundamental principles they are buying into.

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