



# Organic Food – A Concept for Sustainability and Feeding a Growing Population

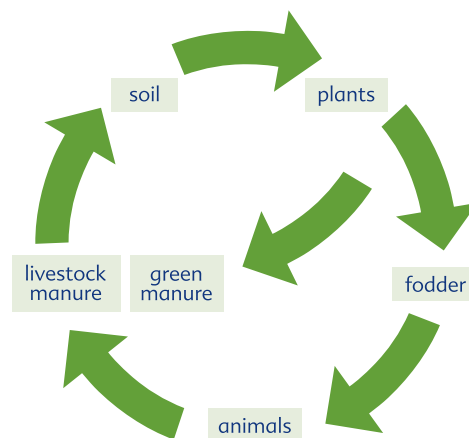
## 1<sup>st</sup> HiPP Scientific Symposium on Organic Food

Since the origins in the early 20th century, organic agriculture and food production have come a long way. Today, organic agriculture is regarded as a more sustainable alternative to conventional farming, which is a main contributor to greenhouse gas production, environmental pollution, soil quality decline, and biodiversity loss. This view is supported by scientific evidence, as demonstrated by international experts at the first HiPP Scientific Symposium on Organic Food, showing that organic agriculture is more beneficial to the environment and food quality than conventional agriculture, and is positively associated with health of consumers. Moreover, organic food contains less pesticide residues that may cause detrimental health effects even in very low concentrations, especially in fetuses and children. Aside from these advantages, organic agriculture has proved to be more cost-efficient than conventional agriculture. This is particularly the case if the true costs of conventional farming are taken into account. Most importantly, organic food production is regarded as vital to safeguard a safe and nutritious food supply for the growing world population in the years to come.

The history of the organic movement started about 100 years ago in Europe with philosophy and teachings that were based on observation of nature and respect for natural laws and subsequently transformed in practical farming methods by organic pioneers.<sup>1</sup> Since then, organic farming and food production developed into a worldwide food system which is guided by the four principles of organic agriculture (ecology, fairness, care, and health).<sup>2</sup> According to Dr. Carola Strassner,

Professor for Sustainable Food Systems and Nutrition Ecology (University of Applied Sciences, Münster, Germany) and chair of the symposium, the central working principle of organic farming is the ideal of a closed cycle (fig. 1): plants grown on the soil of a farm are either used as foodstuff or entered back in the cycle as nutrients, i.e. as (preferably composted) green or livestock manure, to keep the fertility of the soil which is regarded as the capital of organic agriculture.

Fig. 1: The central working principle of organic agriculture: the closed cycle.



Source: Prof. Carola Strassner

### Worldwide accepted: organic practices

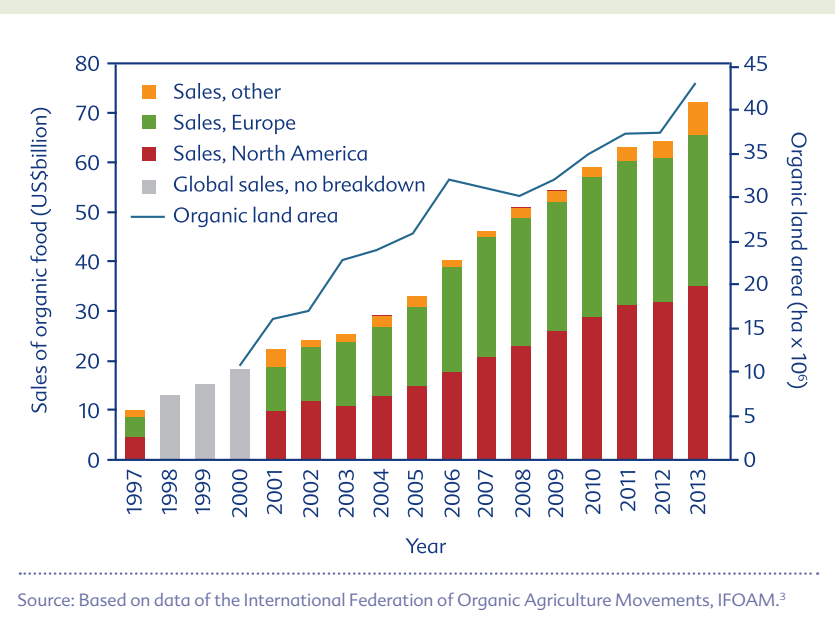
At any point in the cycle, said Strassner, central organic practices are employed which are common to organic agriculture worldwide, such as multiannual rotation with crops that fix nitrogen, restriction of synthetic fertilizers, natural pest management, or the use of organically produced seed. The livestock production is linked to the amount of fodder that can be produced on the land. Animals are housed according to their species-specific needs and treated in order to keep their welfare, the feed is organic and mainly self-produced. The nitrogen content may limit the amount of microbial, animal or plant material returned to the soil. Genetically engineered organisms or any products thereof are categorically forbidden in organic farming systems.

It is important to make the point that the quality of organic food is the result of the entire agricultural process, said Strassner. “No single measure seen alone will make food organic”.

Organic and non-organic food differs in many more respects. For instance, organic crop and animal production is regulated in a highly detailed manner by specific measures and criteria. When it comes to food processing, the use of additives is restricted. “Especially flavor enhancers, synthetic colorants or other synthetic materials that would suggest to consumers that a product is something other than it actually is composed of are excluded”, said Strassner.

Traditionally, in the organic sector, farmers and consumers have been more closely connected, and today new collaborations are observed, such as community-supported agriculture enterprises, many of which are organic farms, which bring producers and consumers into direct contact. What is unique in Strassner’s opinion is the global third-party verification system that guarantees the organic food production process.

**Fig. 2:** Increasing global sales of organic food and land area for organic production 1997-2013.<sup>3</sup>



### Conversion to organic agriculture may not be enough

The question arises, however, if it is enough to convert conventional in organic agriculture in order to ensure a healthier society, or if it is necessary to look for more sustainable diets and lifestyles as well.

According to Strassner, an increased interest in organic food can be observed not only on an individual level, but also in communities or regions or even states such as the Indian state of Sikkim, which has declared itself organic. Decisions like this have a lot to do with the impact of resources like water on public health and nature and the rising costs of keeping the quality of these resources.

### Still contentious – but increasingly successful

In the past 40 years, hundreds of scientific studies have been performed comparing organic and conventional farming. Still organic agriculture is a contentious issue, said

Dr. John Reganold, Ph.D., and Regent’s Professor of Soil Science and Agroecology (Washington State University, Pullman, USA). Critics argue that organic agriculture requires more land in order to produce the same amount of food as conventional agriculture and that adopting organic agriculture on a large scale could potentially threaten wildlife, forests, and biodiversity.

Nevertheless, the number of organic farms, the extent of organically farmed land, as well as the market size for organic foods have steadily increased (fig. 2).<sup>3</sup> The global market for organic foods has grown from about 40 billion US\$ in 2013 to about 90 billion US\$ in 2016, with about 90 % of global sales occurring in North America and Europe. In the US, organic food and beverage sales in 2017 accounted for 5.5 % of the total food and beverage sales (1997: 0.8 %).

Many surveys have shown that consumers buy organic food mainly to avoid pesticides, genetically modified organisms (GMOs), irradiation, and hormones and antibiotics in meat to protect the environment, to increase

the intake of dietary nutrients, to have better tasting food, to protect children, or to preserve family farming.

As Reganold pointed out, agriculture is not just organic or conventional. Organic and conventional farming systems may be looked upon as extremes (“like bookends on a shelf”), with other farming systems in between.

### How sustainable is organic farming?

Organic farming is perceived as being more sustainable than conventional farming. To find out if this is true, Reganold assessed the performance of organic farming in the light of the four metrics of sustainability (as defined by the US National Academy of Sciences): adequate yields of high quality, environmentally safe, economically viable, and socially responsible.<sup>3</sup>

### Impact on crop yields ...

Five reviews or meta-analyses of yield studies show that, under favorable climate and soil conditions, organic crop yields are generally lower by 8–25 %.<sup>3</sup> The difference vs. conventional farming is larger for fruit and wheat (27–28 % lower yields), but relatively small for rice, soybeans, corn, and grass-clover (6–11 %).

“Organic farming can do better, however, under severe drought, with equal to higher yields being observed”, reported Reganold. Furthermore, it has been shown that crops both bred and then grown under organic conditions tend to close the yield gap between organic and conventional farming.

### ... food quality ...

14 of 17 reviews or meta-analyses found evidence of organic food being more nutritious than conventional foods.<sup>3</sup> Usual findings were higher concentrations of vitamin C, antioxidants, as well as omega-3 fatty acids.

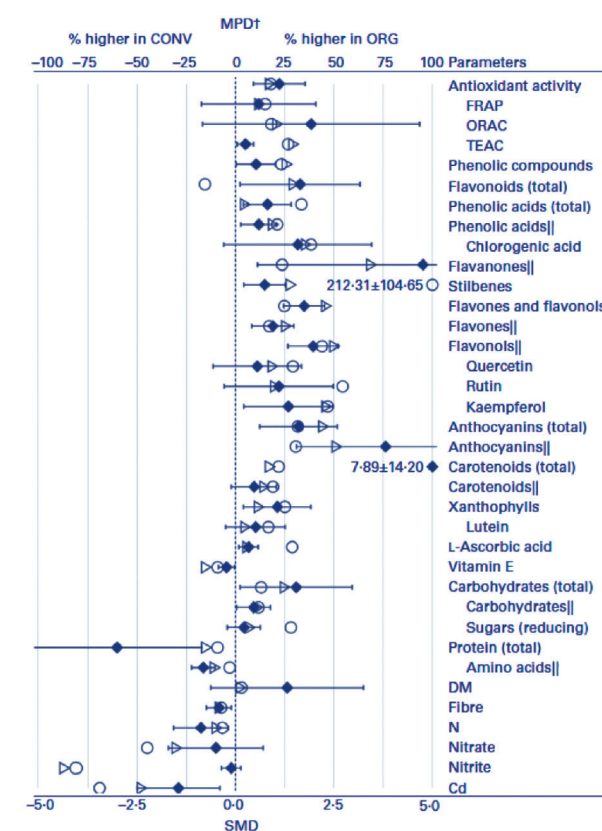
For instance, in a meta-analysis of 343 publications substantial higher concentrations of antioxidants were found in organic food, many of which have been linked to a reduced risk of chronic diseases including cardiovascular disease and certain cancers (fig. 3).<sup>4</sup>

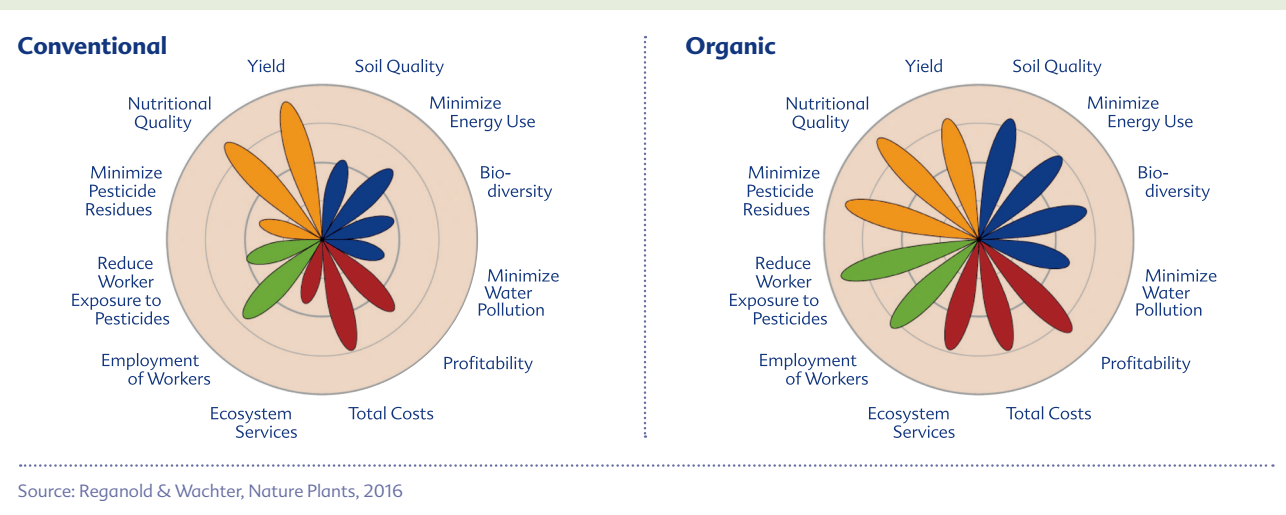
Four reviews or meta-analyses concluded that little or no pesticide residues were found in organic foods. Children who eat conventionally produced foods had significantly higher levels of organophosphate pesticide metabolites as compared to children who used to eat organic foods. In 2012, the American Academy of Pediatrics declared that an organic diet reduces the exposure of children to pesticides.<sup>5</sup>

A European Parliament Report (December 2016) came to the conclusion that

- women’s exposure to pesticides during pregnancy impacted negatively on their children’s IQ, neuro-behavioral development, and the risk of ADHD (Attention Deficit Hyperactivity Disorder).
- organic food may reduce the risk of allergies and obesity.
- the use of antibiotics in conventional animal production is a key driver of antibiotic resistance in bacteria, whereas the restrictive use of antibiotics on organic farms was found to improve animal health, prevent diseases, and minimize antibiotic resistance.<sup>6</sup>

**Fig. 3:** Results of the meta-analysis for antioxidant activity, macronutrients, nitrogen compounds, and cadmium in organic vs. conventional food.<sup>4</sup>



**Fig. 4:** Performance of organic farming relative to conventional farming according to the criteria of sustainability.<sup>3</sup>

### ... and environmental quality and safety

Fifteen reviews and meta-analyses found that organic farming systems are associated with better soil quality, less soil erosion, and little or no risk of synthetic pesticide pollution of ground and surface waters.<sup>3</sup> In addition, organic systems were usually more energy efficient. Organic systems performed better in terms of nutrient leaching, mainly nitrogen and phosphorous, and greenhouse gas emission on a per area basis. According to Reganold, the differences for nutrient leaching and greenhouse gas emissions may decrease or even reverse, however, if organic and conventional systems are assessed on a unit of production basis.

Organic farming has been found to have greater below- and above-ground biodiversity (birds, insects, soil fauna, microbes), and greater diversity of functional groups, such as herbivores, pollinators, predators, and producers (plants), said Reganold.

### Organic agriculture more profitable

One meta-analysis has been published by Crowder and Reganold examining the profitability of organic farming. The authors of the meta-analysis found

that the yields of organic farming were lower by 10–18%, whereas the total costs were about the same. But with price premiums, organic agriculture was significantly more profitable (by 22–35%) and associated with higher benefit/cost ratios (by 20–24%) than conventional agriculture.<sup>7</sup> The price premiums received by the organic farmers (29–32%) were much higher than the price premiums needed to match the profit of the conventional producers (5–7%).

As Reganold pointed out, negative externalities associated with agriculture were not taken into account in economic studies. “Putting a price for instance on soil erosion or biodiversity loss would make organic agriculture even more profitable”.

### Improved social well-being

Social well-being in organic vs. conventional farming systems has been assessed in few studies only. However, in those few studies done, organic farming was found to have some sociocultural strengths, said Reganold. Interaction between organic farmers and consumers has increased, and organic farming is associated with greater employment of farm workers. Exposure of farm workers to pesticides

and other chemicals is reduced, which is “a big deal at least in less-developed countries”.

With organic farming, the four areas of sustainability are well balanced, concluded Reganold, in stark contrast to conventional farming, which “pushes yield at the expense of other sustainability metrics” (fig. 4).<sup>3</sup>

Taken together, organic farming/food offers many advantages (tables 1, 2). This is reflected by the global organic market which is expected to increase to 140–160 billion US\$ by 2020. But can organic farming play a significant role in feeding the growing human population? “Absolutely”, said Reganold, “and so can other innovative farming systems, such as agroforestry, conservation agriculture, integrated and mixed farming, which share common practices and values with organic farming”. In Reganold’s view, a blend of multi-functional farming systems will be needed, “but organic farming is the one that is driving it”.

### Impact of toxic chemicals and organic food on child health

According to US estimates, the prevalence of some brain-based disorders in children, such as autism, has dramatically increased.<sup>8</sup> “About one in 10

children meets the criteria for ADHD, one in 15 for depression, one in 50 for conduct disorders”, reported Bruce Lanphear, MD, and Professor for Simon Fraser University in British Columbia (Canada). This may be due to a variety of risk factors that can impact on the developing brain, some of the most important of which are exposure to toxic chemicals during early brain development.

The detrimental effects of environmental toxins have been recognized in the context of environmental disasters like in Minamata (Japan), where mothers who had ingested mercury-contaminated fish gave birth to children with severe brain damage (congenital Minamata Disease). “This changed the way we think about the placenta as a bar-

rier to poisons and how the fetus — especially the fetal brain — is particularly susceptible to toxic chemicals”, said Lanphear. Environmental disasters, however, only represent the tip of the iceberg. In the last decades, evidence has accumulated that low-level exposure to ubiquitous toxic chemicals is responsible for shortened gestation, intellectual deficits, and mental disorders in children.

Several factors may contribute to the increased vulnerability of the developing brain.<sup>8</sup>

- The blood brain barrier is not fully formed in the fetus and, thus, more permeable to toxic chemicals.
- Rapidly growing cells are often more vulnerable to toxic chemicals.

- Brain growth occurs over a longer duration as compared to other organs.
- The fetus and child may lack enzymes to detoxify contaminants.
- Young children often are more heavily exposed to contaminants.

### Even very low concentrations matter

In the US, toxic chemicals like lead, mercury, PCB (polychlorinated biphenyls), organophosphate pesticides, bisphenol A (an organic endocrine disruptor), and PBDEs (polybrominated diphenyl ethers) are found in almost all pregnant women and children. Children are exposed to dozens of toxic chemicals or chemicals suspected of being toxic; the vast majority of the many thousands of chemicals that people are exposed to have never been tested for toxicity.

“The chemical industry is trying to reassure us that the concentrations of chemicals are too small to cause harm”, said Lanphear. “But drugs designed to alter behavior, like methylphenidate, which is commonly prescribed to treat children with ADHD, are active at levels about the same or even lower than the levels of toxic chemicals found in the blood. In his video “little things matter” Bruce Lanphear demonstrates very vividly how already small amounts of toxic substances influence children’s IQ.

QR-Code to the video  
“little things matter”



Many chemicals are toxic to fetuses or children even at very low concentrations. For instance, as the prenatal PBDE exposure increases from 10 to 100 ppb, the IQ of the children decreases by 5 points. A similar effect has been described for organophosphate pesticides.

For many toxins there doesn’t appear to be a threshold that defines a safe level of exposure. On the contrary, some chemicals, like lead, induced the proportionally greatest decrements in

**Tab. 1: Advantages of organic farming/agriculture vs. conventional farming/agriculture.**

- Higher sustainability
- Improvement of animal health, minimization of antibiotic resistance
- Greater below and aboveground biodiversity
- Greater diversity of functional groups (herbivores, pollinators, predators, producers)
- Better soil quality, low erosion, less pollution
- Less nutrient leaking, less greenhouse emissions
- Higher energy efficiency
- Higher profitability
- Improved social well-being
  - increased interaction between farmers and consumers
  - greater employment, cooperation among farmers
  - reduced exposure to pesticide and other chemicals

**Tab. 2: Advantages of organic foods vs. conventional foods**

- Higher nutritional value
- Better taste (fruits, vegetables)
- Little or no pesticide residues
- Reduced risk of allergies or obesity
- Less cancer diagnoses

intellectual capabilities in children who had the lowest levels.

“As the level of lead in children’s blood increases from 0 to 100 ppb, the IQ score drops by about 6 points. An increase from 100 to 200 ppb results in an IQ drop of additional 2 points and an increase from 200 to 300 ppb to an IQ drop of another point”, reported Lanphear.

### Regulation of toxins fails to protect children

The effects of environmental toxins on the developing brain may be judged as subtle, in Lanphear’s view a misleading judgement, because little shifts in children’s IQ scores have a big impact on the rate of children who are gifted (IQ > 130) or challenged (IQ < 70).<sup>8,11</sup> For instance, a downward shift in the mean IQ score by 5 points would increase the number of children who are challenged by 57%.<sup>3</sup> In Lanphear’s opinion, “it is overwhelming to imagine the cumulative impact of exposures to 3 or more toxins”.

“These results show that the way we regulate toxins, assuming that there is a safe level, fails to protect children”, concluded Lanphear.

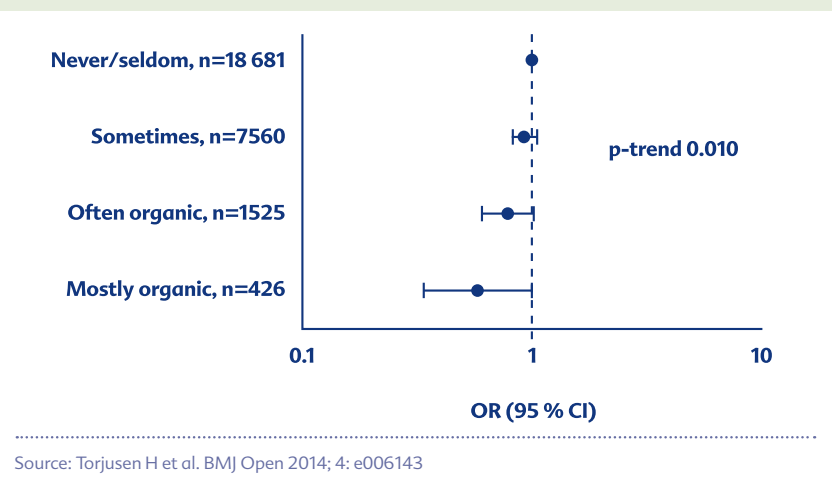
The same holds true for adults. For instance, very low levels of benzene in the blood are associated with a steep increase in leukemia risk.<sup>12</sup> Lowest levels of particulate matter (PM<sub>2.5</sub>, i.e. 50% of fine inhalable particles have diameters of 2.5 µg or less) or blood lead were shown to be responsible for a steep rise in the risk of dying prematurely from heart disease.<sup>13,14</sup>

In Lanphear’s opinion, probably most chronic diseases are the result of the cumulative impact of many risk factors. “Cardiovascular diseases are not just from cholesterol, smoking or lead, it is not just from arsenic or lack of physical activity – it’s from all of these”.

### Organic food and the risk of diseases

Few studies have been performed to examine if there is a direct effect of

**Fig. 5:** Organic vegetable consumption and the risk of pre-eclampsia among 28192 pregnant women in the Norwegian Mother and Child Cohort Study 2002-2008.<sup>15</sup>



organic food on the occurrence of diseases. For instance, in a prospective cohort study with more than 28,000 pregnant women, increasing consumption of organic vegetables was associated with a significant reduction in risk of pre-eclampsia (fig. 5).<sup>15</sup>

Women, who used to consume organic food during pregnancy, were 58% less likely to deliver a child with hypospadias,<sup>15</sup> which according to Lanphear is the second main type of reproductive birth defect. This condition is thought to be a consequence of ubiquitous exposure to anti-androgenic chemicals, like phthalates.

In a French prospective cohort study with 69,000 participants, people who ate more organic produce had a 25% lower risk of malignancies, especially of lymphoma and breast cancer.<sup>17</sup> In the subpopulation that consumed organic food most frequently, lymphomas were reduced by 76%. Lymphomas and breast cancer are both environmentally sensitive type of cancers, explained Lanphear.

### The prevention paradox

Over the last decades, a lot has been learned about the causes of chronic

diseases – which is key because the knowledge of causes can help to prevent diseases. Yet, most of the economic resources are spent for the treatment and the search for cures of people with high risk (clinical strategy) and very little for tackling the risk factors that make people sick in the first place (population strategy). The problem with the clinical strategy, however, is that the majority of disease, disability, and death occurs in those who are at low or moderate risk (prevention paradox).

Thus, unless a threshold exists and low-level exposures of toxic chemicals impact on people’s health, and unless we focus on people who are at low or moderate risk, the clinical high-risk strategy will fail to prevent the majority of chronic diseases, said Lanphear.

### Avoid exposure to chemicals in general

The best approach to handle the risk is to avoid the exposure to chemicals. Lanphear quoted a rule of thumb: “If we didn’t evolve with it – avoid it”. More specifically, Lanphear suggested eating fresh, organic and unpackaged foods, avoid canned foods and minimize the use of pesticides around the

home. Most importantly, efforts to update chemical management policies and reduce industrial pollutants should be supported, including organic foods.

Finally, Lanphear made the point that the popularity of organic foods is growing even though many scientists are more skeptical than the public regarding the claims about organic foods. Most of the available studies, however, focus on the relationship between the toxicity of certain chemicals and child health, not on the benefits of organic food. Therefore, in Lanphear’s opinion it is worth thinking about conducting randomized clinical trials of organic diet to provide more robust evidence of the benefits of organic food.

### Organic food is not too expensive ...

The dream of producing cheap food for everybody is an illusion, said Tobias Bandel, co-founder of Soil & More Impacts, Hamburg (Germany). On the contrary, as a result of climate change and increasing soil erosion, food will become much more expensive if nothing is changed. “We need to understand, how we can manage our farms differently. Otherwise, in a few years food will no longer be affordable for most of the people”.

For Bandel it is a moral duty to make sure that this will not happen. “Because we have solutions: practices like crop rotation and crop diversity, green manure, intercropping, recycling of biomass, or reasonable tillage”, he said.

In Bandel’s opinion, it is high time to recognize the true costs of conventional food because conventional food production business is getting more and more in trouble. For instance, in Nicaragua, the area suitable for growing coffee is considered to decrease dramatically in the next decades, and the same is true for other crops over the world.

### ... but conventional is too cheap

True cost accounting is necessary because conventional farming accepts

erosion in order to achieve high profits. This means that farms are destroying their assets, said Bandel. “The loss is irreversible: What’s gone, is gone”.

Conventionally growing maize, for example, needs inputs and as a consequence leaching occurs. If growing maize is continued over the years, more inputs are needed, leading to more leaching, erosion and carbon dioxide emission. Thus, costs do increase not only because of higher inputs. The increase in true costs is much higher (fig. 6).

Bandel reported on a pilot study performed in collaboration with the accounting firm Ernst & Young in order to assess the true costs of conventional vs. organic fruits and vegetables, looking at soil, water, biodiversity, climate, health etc. Algorithms of the accounting firm were applied on data collected from different farms around the world. The investigators found out, for instance, that eating of 1 kg of conventionally grown apple will cause an individual health damage (in terms of reduction of the individual contribution to the gross domestic product, e.g. due to sick leave) by 21 cents.

This cost might be 7 cents or 2 cents, said Bandel, depending on how „organic“ the producing farm is.

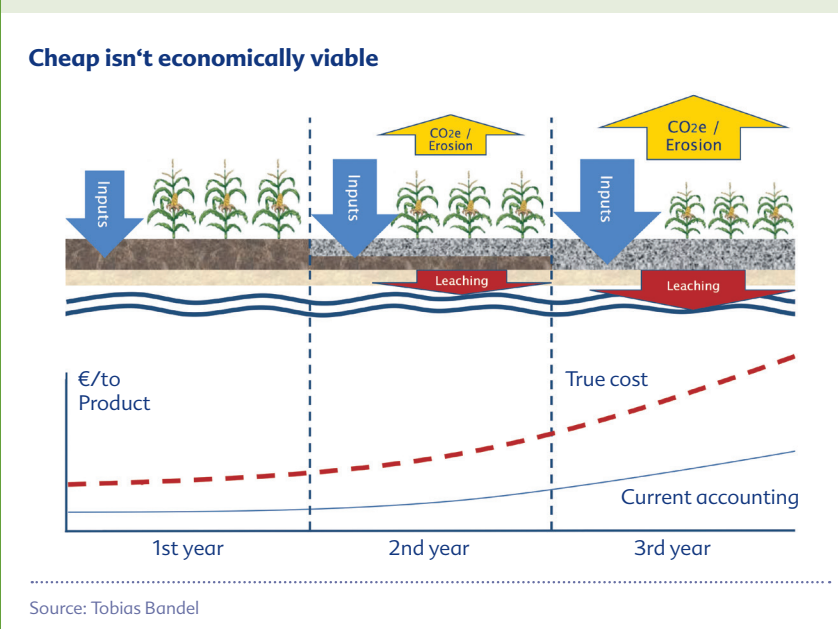
The investigators concluded that improving soil fertility should be rated as an investment rather than as costs. Building up soil represents a value that can be added on the balance sheet, said Bandel. This would mean that farmers who spend more money on soil fertility could get better credit conditions in future.

### Unexpected allies

In the recent years, the problems with conventional farming became so obvious that the movement for more sustainable agriculture was joined by hitherto unexpected allies like food or beverage producing companies or investment firms that push for more sustainable production methods in order to save costs.

The underlying logic is that the increasing deterioration of soil organic matter goes along with increased leaching and, therefore, with higher costs due to increased need of nutrients and water.

**Fig. 6:** Continued growing of crops leads to increased inputs, leaching, erosion, and costs.



Other examples are insurance companies and accounting firms, which have realized that the way they used to do financial accounting of firms that are heavily dependent on agricultural commodities was incomplete: environmental and climate impacts had not been adequately taken into account. „They recognized that what they consider today as profitable, might not be profitable any more in 5 – 10 years“, said Bandel.

### Improved soil fertility – better credit conditions

Many industrial companies have identified soil organic matter as the key driver for economic sustainability at farm level. For instance, the Cool Farm Alliance (comprising food retailers, food manufacturers, input suppliers etc.) encourage farmers to implement tools (like the Cool Farm Tool) in order to track the environmental impact

and the development of soil organic matter over time, thereby enabling them to make more informed on-farm decisions that reduce their environmental impact. In order to stabilize soil organic matter, the Cool Farm Alliance promotes reduced tillage, cover cropping, composting, manure adding, and residue incorporation.

But it's not only about farming, said Bandel. It will be difficult to feed 9 billion or even more people if we don't start to alter our consumption behavior and to reduce the food waste“. In addition to postharvest loss or loss associated with logistics, consumers throw 30–40% of the food they bought away. Food waste is a problem also in less developed countries like India where every year millions of tons of rice are spoiled due to storage conditions. «

### HiPP baby food: Supreme quality in harmony with nature

For more than 60 years, the family-owned company HiPP has been committed to the production of organic baby food. As a pioneer in this field, HiPP was swimming against the tide at the time and also faced great resistance as they developed their organic farming practices. However, by putting their heart and soul into it, they managed to set new standards for baby food and beyond.

HiPP became one of the best-known brands in Germany and a symbol of ecological, economic and socially sustainable entrepreneurship.

The supreme quality of all our HiPP products is based on the careful selection of raw materials. HiPP experts advise and assist our producers throughout the entire production process – from seed selection to animal health all the way through to safe transport methods. HiPP's organic contract farmers feed and keep their animals in a species-appropriate manner. When it comes to our farming methods, environmentally friendly crop protection, natural fertilisation as well as maintaining soil fertility are our top priorities. This way, we are able to produce foods that are both sustainable and environmentally sound. The checks we subject HiPP formulae to focus on analysing their natural nutritional value, but also on eliminating the occurrence of critical substances. At HiPP, parents can rely on nutritionally sound products, age-appropriate recipes and strictly controlled organic quality. This is why we label our products with the HiPP Organic Seal. It represents our company standards, which are even stricter than those required by the EU's Organic Regulation to obtain the EU's Organic Seal. It guarantees a tight control and safety system, the utmost diligence, environmentally friendly farming methods, and the purity of the processed raw materials. In most cases, the specific requirements for farming and processing, as well as the thresholds that HiPP has set, are far stricter than required by law.

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### Legal Notice:

1<sup>st</sup> HiPP Scientific Symposium on Organic Food  
Kranzberg, 30 October 2018

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