Conventional farming

Conventional farming, also known as industrial agriculture, refers to farming systems which include the use of synthetic chemical fertilizers, pesticides, herbicides and other continual inputs, genetically modified organisms, concentrated animal feeding operations, heavy irrigation, intensive tillage, or concentrated monoculture production. Thus, conventional agriculture is typically highly resource-demanding and energy-intensive, but also highly productive. Despite its name, conventional agricultural methods have only been in development since the late Nineteenth Century, and did not become widespread until after World War 2 (see: Wikipedia:Green Revolution).

Conventional farming is usually contrasted to organic farming (or sometimes sustainable agriculture or permaculture), as these respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity.\(^1\) Rather than using synthetic fertilizers, pesticides, growth regulators and livestock feed additives, organic farming systems rely on crop rotation, animal and plant manures as fertilizers, some hand weeding and biological pest control.\(^2\) Some conventional agriculture operations may include limited polyculture, or some form of Integrated Pest Management. (See: Industrial organic agriculture).

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Conventional versus organic farming

Advantages and disadvantages

Any newly developed technology will have positive and negative consequences. If we analyze the positive and negative aspects of the way that we produce food, perhaps we will be able to improve upon the good things, and reduce the negative impacts. With conventional farming it is possible to produce much larger quantities of food, on less land and with less manual labor than ever before in history.

With rising food costs and millions of people starving all over the world, it seems like we have a moral obligation to use conventional methods to produce large amounts of food at affordable prices. However, because many of the effects of conventional farming are unknown, and because of how many of the effects may be irreversible and harmful, it may be safer to stick to what we have been doing for hundreds of years. It may be considered irresponsible to continue using pesticides, irradiation and GMO's when we really don't know what the side effects are.

Ecology

There is a common perception that organic farming is more ecologically sustainable than conventional farming. As a result of industrial farming conditions, today's mounting environmental stresses are further exacerbated, including:

- Water pollution, including fertilizer runoff causing eutrophication
- Chemical leaching

There are many factors in how sustainable farming practices are, besides use of artificial chemicals. E.g.:

- Land degradation
  - Erosion
  - Soil compaction
- Transport used - not just distance, but the type of transport.
- Water usage (including declining water table)
- Loss in biodiversity

Human health

Organic foods are usually assumed to be healthier than conventionally-produced foods. Hundreds of studies have attempted to assess the whether conventionally-produced foods have different health effects from organically produced ones. In the last few years a few meta-studies have drawn differing conclusions based on those earlier studies. One meta-study of 237 studies conducted at Stanford concludes that “There isn't much difference between organic and conventional foods, if you're an adult and making a decision based
solely on your health.".[4] Another meta-study lead by researchers at Newcastle University based on 343 earlier studies found that conventionally-produced crops contained 18-69% less antioxidants, were four times as likely to contain pesticide residues, and had, on average 48% higher concentrations of heavy metals (including cadmium) than organically-produced crops.[5]

Potential conflicts of interest have been identified in both of these cases, as the institutions involved with these studies have received funding from agriculture business interests in both the conventional and organic sectors.

Many supporters of organic agriculture rely on personal experiences and beliefs when choosing organic over conventionally produced food. "Although, as scientists, we may deplore the fact that people are swayed by non-scientific views, the fact is that a lot of them are. Despite the arguments presented by Trewavas, many people believe that organic production systems produce better food, care more for animal welfare and are kinder to the environment.".[6]

Yield

It is generally recognized that conventional farming produces a higher amount of food than organic. One meta-study found organic yields to be on average 80% that of conventional, but "the organic yield gap significantly differed between crop groups and regions.".[7] Another meta-analysis concluded that, "organic yields are typically lower than conventional yields. But these yield differences are highly contextual, depending on system and site characteristics, and range from 5% lower organic yields (rain-fed legumes and perennials on weak-acidic to weak-alkaline soils), 13% lower yields (when best organic practices are used), to 34% lower yields (when the conventional and organic systems are most comparable)."[8]

Modern farmland is claimed to produce 200 percent more wheat than the same area did 70 years ago. Hence switching to organic farming would lead to a reduction in output, e.g. by 20% for corn.[9] The figure is plausible, but we need more than one unattributed figure.[10]

Biodiversity

Several studies have compared the local biodiversity of conventional and organic systems. A meta-study at the Swedish University of Agricultural Sciences concluded,

"Organic farming usually increases species richness, having on average 30% higher species richness than conventional farming systems. However, the results were variable among studies, and 16% of them actually showed a negative effect of organic farming on species richness. [...] Birds, insects, and plants usually showed an increased species richness in organic farming systems. However, the number of studies was low in most organism groups (range 2-19) and there was significant heterogeneity between studies. [...] On average, organisms were 50% more abundant in organic farming systems, but the results were highly variable between studies and organism groups. Birds, predatory
insects, soil organisms and plants responded positively to organic farming, while non-predatory insects and pests did not. The positive effects of organic farming on abundance were prominent at the plot and field scales, but not for farms in matched landscapes.\textsuperscript{11}

A study at the University of Bristol comparing 10 conventional and 10 organic agricultural landscapes found that although the organic farms had a greater amount of non-cultivated or "semi-natural" areas, they did not have higher biodiversity in those spaces. However, there was greater biodiversity in the organic farms' arable fields.\textsuperscript{12}

There is a common concern that links yield (see above) and biodiversity. The assumption is that if organic agriculture has lower yields, this will increase the need for more areas under cultivation, and hence have a negative impact on region- or world-wide biodiversity. It is unclear whether any studies have been done to test this assumption.

**Social and economic aspects**

A study regarding agricultural knowledge distribution from Cardiff University found that, "the conventional food chain [...] tends to distribute knowledge towards input suppliers, and the organic food supply chain [...] distributes knowledge back towards the farm," due to their differing economic features.\textsuperscript{13}

**Pesticides**

*From Pesticide edit*

**Pesticides** are substances used to kill insects, plants and other organisms that negatively impact crop yield. They can range from hazardous, artificially-isolated chemicals, such as many organochlorides, to relatively innocuous plant-based preparations, like neem oil. Pesticides can have unintended consequences such as killing off beneficial, predatory insects.

Most of the pesticides in our food, by far, are natural pesticides produced by the plants. This leaves open the question of whether the artificial chemicals are worse for us. After all, not all substances are the same, and some (such as DDT) linger in the environment for far longer. It's also true that something is harmful given to lab rats in large quantities, yet not significantly harmful in small quantities - or even beneficial, since there has been research suggesting that toxins in small doses actually benefit an organism by making it react to the mild stress.\textsuperscript{verification needed}

Many natural chemical compounds are also toxic or carcinogenic in large quantities, but we consume them in small quantities. Everything has a toxic dose - even water, salt or any nutrient.

There is a common perception that "the poisons are killing us." So why are we living longer than ever? If there is a negative effect from these traces of chemicals, the effect is much
smaller than positive changes in modern times (e.g. better medicines and medical treatments).

Note that these arguments are not saying that "pesticides are good for you" - using them inappropriately, without following directions, has the potential to be very harmful. But when used properly, they appear to not be significantly harmful, and may not be harmful at all. Worrying about them may do us more harm than the chemicals themselves.

Fertilizers

*From Fertilizers*  edit

Fertilisers are substances that can be supplied to the soil so as to improve the soil quality and promote the growth of any plants grown in this soil. Fertilisers come in several types and correct application differs depending on this type. Differences on application may include: method of introducing the fertiliser into the soil, the time of the year when the fertiliser is administered, etc...

There's actually little doubt that fertilizers harm ecosystems. But is this inevitable, and what are the alternatives? Limited use and precise application reduce the effect of eutrophication on waterways. More recent discoveries, e.g. the role of soil fungi, the impact of compost teas, and terra preta, show that there may be much greener ways to create abundance in food production. However, this knowledge is still in its early years - the knowledge is still being developed, and the valuable knowledge that already exists has not yet spread widely.

Nitrogen sources

Borlaug said:[10]

Even if you could use all the organic material that you have--the animal manures, the human waste, the plant residues--and get them back on the soil, you couldn't feed more than 4 billion people (and) you would have to increase cropland area dramatically...

At the present time, approximately 80 million tons of nitrogen nutrients are utilized each year. If you tried to produce this nitrogen organically, you would require an additional 5 or 6 billion head of cattle to supply the manure.

This appears to not consider the impact of nitrogen fixation, for example by legume crops. (This is another argument for vegetarianism and veganism being greener - less methane-producing cows, and more legume crops to replace them, which will also produce nitrogen.)

Currently, enormous amounts of nutrients are thrown away in our sewage. Through humanure this can be salvaged, but may not be suitable for many food crops, especially where the food is close to the ground.
GMOs

From Genetically modified organisms  edit

A genetically modified organism (GMO) is an organism whose genetic material has been altered using genetic engineering techniques. Genetic engineering essentially involves incorporation of gene(s) from an different species - even across Kingdom - into the host genome. Thus, genes from animals and bacteria may be inserted into a plant genome, to create a novel transgenic plant. Transgenic breeding is thus different from the traditional selective breeding, and therefore novel gene products (like proteins) from the GMO may have some unexpected environmental effects.

Several antibodies and medicines have already been commercially produced by using genetic engineering. For example, mammalian insulin is being produced by recombinant DNA in bacteria. This make the hormone much cheaper than natural insulin derived from conventional biosynthesis. However, when genetic engineering is applied in agriculture for production of crops, there are many uncertainties and risks.

Unlike insulin or other GM drugs and hormones manufactured in the laboratory, GM crops cannot be controlled or revoked, once they are released in nature. In addition to the possible harmful effects on ecosystems (including agro-ecosystems), introduction of the GMOs into the human food chain poses an unprecedented risk to public health.

Genetically modified food has caused considerable controversy since the early 1990s, when it was first introduced. However, this controversy only relates to GM organisms that have been created using the transgenesis method. Cisgenesis has been proven equally safe as regular plant breeding by the EFSA.

Conventional food production often utilizes GMO's which are different from plants and animals that have been selectively bred. There are environmental drawbacks of using GMOs. One is that it is difficult to control the reproduction of plants, especially when they are growing in an open environment, and not contained within a structure such as a greenhouse. When there is a farm with GMOs nearby another farm, there can be a problem with crossbreeding between the two varieties of plant. This can result in genetic drift which can have negative impacts on farms that produce heirloom varieties. When this effect is coupled with the terminator gene (a gene inserted in plants by companies that produce GMO's, which prevents their seeds from producing viable offspring) this can have devastating effects on heirloom varieties, and for farmers who have been keeping their variety for generations.

References

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