Talk 4: A Scientific Critique of Modern Agriculture
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Introduction
This paper focuses on food independence of communities in the context of changing agricultural production techniques. It looks into food production methods that humanity has applied from ancient times to date. It contrasts modern technological farming methods with those of the traditional communities and tries to decipher the true motivation behind each case.

The paper appreciates the role that science has played over the years in improving food production for better nutrition and for sustained food security. At the same time it interrogates whether modern scientific farming methods can be in harmony with nature given their multiple side effects. Further, it attempts to answer the question whether science has safer and better agricultural alternative practices that have no adverse effects to nature. It shall attempt to answer the question why such alternatives are not in use, if available.

Towards the end, the paper makes some considerable suggestions regarding modern scientific agricultural practices. It also identifies key stakeholders and the roles each can play to address the challenges discussed. The ideas raised on this paper are intended to provoke deeper thinking and further discussions in food production among the Conference participants, scholars, government officers, policy makers, those it mentions or implicates and any other interested party with the aim of soliciting for solutions to the raised issues.

Is science compatible with healthy agricultural practices and conservation of nature?
The history of agriculture by human beings ever since they discovered farming about 10000 BCE is characterized by effort to improve crop and livestock productivity. Traditional agrarian communities of the ancient times, just as the indigenous ones today, had throughout history been researching and deploying scientific methods that increased their farm yields.

Communities that engaged in crop farming improved production and quality of their yields by selecting the best seeds from one season and replanting during the next one. Over time, they discovered to leave one farmland untilled to replenish its soil nutrients for a season or two before returning to plant on it again. This way, they were guaranteed of both increased and quality of their farm produce. On the other hand, the communities that practiced livestock improved the quality of their breeds by allowing cross breeding and allowing inbreeding only among desired animal breeds. The results were always largely pleasant as expected.

Among the traditional fishing communities, they had deep understanding of breeding patterns of fish and would stop fishing at a certain part of a river or lake or ocean when they noticed the earliest signs of depletion in stock of a certain type of fish and therefore moved to another point long enough to allow breeding of more fish.
These practices are still in use today among many indigenous communities of the world. The farming methods confirm the important role that science has always played for humanity in agricultural production. Besides, none of these traditional methods has been known to harm nature.

**Modern Technological Agriculture**

With modern technological advancement, farmers today have at their disposal far superior methods of food production that guarantee high yields and which cannot compare to the modest production methods of indigenous communities. There is availability of high yield food crop seeds; modern fertilizers that can enrich soil and instantly improve plant quality; and potent chemicals that can destroy weeds and kill agricultural pests. The net effect of these technological advancements has been increased global food production. This has come at a time when the world population rapidly increased to 7 billion people, and with it increased demand for food.

Whilst modern technological advancement has enhanced food production to a level that the world is now capable of comfortably feeding its population, that production has not been complemented by fair or effective distribution to all the people. There are many parts of the world, as in Africa, where people still starve to death for lack of food while in other parts food waste runs into millions of tons per year.

The modern technological advancement in agriculture is accompanied by a side of it that may easily explain the paradoxical situation described above. Agriculture is now big business, probably the biggest in the world, generating billions of dollars in profits globally to both individuals and big corporate companies. The motivation to make profits supersedes just the need to feed the needy.

Indigenous communities practiced and still practice agriculture for self-sustenance. Any surplus is/was stored for use before the next harvest. Commercial farming on the other hand is motivated by profits. The higher the profit and the more frequently it can be made, the more lucrative the business is. More sophisticated ways are therefore needed to achieve this end and modern agricultural technology offers multiple choices to that effect.

Though everyone has to eat to live, not all the people would like to be farmers and for that reason there is need to avail such people opportunity to buy food. This situation has motivated the growth of commercial agriculture almost everywhere in the world.

Under the guise of increasing food production to feed the growing world population, commercial agriculture sector has organised itself in more sophisticated ways right from production to storage and distribution. Motivated more by profits than the need to feed the world, scientific agricultural methods are increasingly applied with limited caution to their accompanying side effects. Some notable areas of concern in this regard are discussed below.

**Seeds**

The traditional farming methods ensured existence of a wide diversity of seeds for food production. They improved agricultural production by selecting the best seeds from one harvest and planting them in the next rain season. People freely exchanged seeds to promote farm productivity and food security, and no one had sole rights to any seeds. Seeds belonged to the community. This is still the case among indigenous communities whose farming methods have not been externally interfered with.

On the other hand, modern agriculture uses the laboratory to engineer limited varieties of seeds that are high in production and can fit specific weather conditions. The seeds are then patented and ownership rights reserved by companies. Anyone who wants to plant them has to buy them. Seed production today is therefore big business which is controlled by few corporate companies that produce seeds for almost all types of major and staple foods in the world. It is controlled by transnational companies backed by aggressive marketing that is fast pushing natural seeds towards extinction as the corporate tighten grip on farmers and global food systems.

Today, just ten corporations control half of the global market for commercial seeds. Most of them are also pesticide manufacturers focusing on crops from laboratory engineered seeds which they produce and that support chemically intensive agriculture.
establishing public plant breeding systems. With the rise of transnational companies, the public plant breeding systems have in recent times been reduced to contractors of these transnationals. Even universities and national agricultural research institutions are caught up in similar arrangements with many in contract with these corporates.

Whilst it could be true that commercially produced seeds have superior yields to traditional seeds, a number of factors associated with them are not endearing or even discussed as loudly as is in the case of their marketed value. Most of these laboratory engineered seeds cannot be replanted as the next yield may be dismally too low. Where they have managed to extinct and replace the natural seeds, they have left the affected communities with just one option of buying new seeds every planting season thereby conferring an unanticipated new and expensive cost to the affected communities and converting the same communities to permanent seed markets. This means that unlike in the past, everyone in such communities cannot plant unless they buy new seeds. Their right to own their own free seeds has been taken away with the disappearance of the natural seeds.

Further, the laboratory engineered seed varieties produce harvests whose methods of storage defy the timeless traditional methods that communities have used across ages. In some situations the failure of indigenous communities to understand this has led to food poisoning, in some cases leading to death. Where appropriate storage methods of harvests from these new seeds have to be applied, it would require expensive synthetic chemical treatments which add new and unanticipated financial pressure to the budgets of the affected peasant communities. On a related note, the DNA formations of the laboratory engineered seeds remain a controversial subject with regard to the health effects to the consumers of the foods they produce. Different types of ailments that were not common in the past, as various forms of cancer, have been associated with foods produced from these seeds. Lots of researches are still being conducted in this regard.

**Fertilisers**

Many Indigenous communities still depend on natural methods of rejuvenation of soils for improvement of soil fertility and increased farm yield. Such include crop rotation, organic manure, leaving the land untilled among others. Through use of these natural methods, the indigenous agrarian communities were able to produce enough yields to sustain themselves from one season to another and surplus for use for other social purposes including for barter trade in exchange of what they did not have.

The advent of modern technology agriculture has increased food production tremendously per any unit of land under use. The increase is particularly powered by chemical fertiliser which is today a huge commercial enterprise with patented range of fertiliser products owned by multinational companies and which generates billions of dollars in profits across the world. These private enterprises compete with one another for market share of their respective products across the world. To maintain or expand their market shares, they keep inventing an ever growing range of fertiliser products with varied abilities to improve crop productivity.

These fertiliser products have reached almost all parts of the world today including many indigenous agrarian communities which have been enticed to use the products for higher farm yields. This has been achieved at the

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Source: *The Grain*

The companies patent the seeds and market them aggressively in different parts of the world where respective types of foods are consumed in large quantities. Such seeds include those of major foods as rice, maize, wheat, vegetables, fruits and many other different types. In many parts of the world including Sub-Saharan Africa, commercially produced seeds are quickly replacing the indigenous natural seeds of traditional communities.

Some governments have been trying to maintain protection and control over natural seeds through
expense of their traditional methods which, though may have lower yields, have no side effects. The foods they produce are also comparatively more nutritious.

The soil is home to many types of living organisms, thousands of which are invisible to the naked human eye. Besides residing in the soil, they play a big natural role of mixing, aerating, making of humus and generally making the soil favourable for plant life including food crops. The use of chemical agriculture is detrimental to this type of life. Many fertilisers introduced to the soil for increased farm yield are also lethal to many species of these organisms and have decimated many of them from farmlands in which they are applied. The natural ability of the soils to rejuvenate has been eliminated. In such situations, the farmlands can now only produce any harvest with continued application of chemical fertilisers.

As the fertilisers increase agricultural harvest, their chemical traces end up systemically in the produce itself and therefore get consumed as food. The health effects to consumers continue to be documented by health researchers but there is no doubt that they are adverse. The chemical fertilisers also remain in soils and during rains they are washed away as poisonous runoff that ends up in water bodies used by unsuspecting people, livestock, wildlife and marine life. The adverse effects continue to be documented by research scientists.

**Pesticides**

Globally, over 4.6 million tons of about 500 different chemical pesticides that are applied in mass are sprayed into the environment. With this massive application, only 1% of the sprayed chemical pesticides are effective. 99% of the sprayed pesticides are released to untargeted soils, water bodies and atmosphere and finally absorbed by almost every living organism affecting food chains. Many of these pesticides contain mercury, arsenic, and lead which are harmful to the environment and toxic to all forms of life including human. Different scientific studies have determined that soils under farm chemicals have lost anything between 30% and 75% of their organic matter from poisoning by these chemicals.

Before 1870, natural pesticides were used to fight agricultural pests. Since 1945, the man-made inorganic pesticides terminated the era of natural pesticides. Since then most pesticides have been synthesized by humans, and they were named chemical pesticides. Pesticides have today become big business running into hundreds of billions of dollars in trade annually. With companies competing to control global market shares for increased profits, safety measures to the environment and life of different species including human have been relegated and exposed to grave dangers of poisoning from these chemicals. The competition for profits explains the disappearance of organic pesticides as this was a likely traditional knowledge that everyone could easily adopt by using easily and freely available herbs or raw materials from the natural environment.

Most of the leading manufacturers of pesticides are also the top manufacturers of modern crop seeds and synthetic fertilisers. The six largest manufacturers of agrochemicals (BASF, Bayer, Dow, Monsanto, Syngenta and DuPont) already control 77% of the global market. For herbicides, their market share is even estimated to be as high as 98.5%. Syngenta and Bayer are the leading companies in the pesticide market. Both have a share of around 20% of the global market. BASF, Dow and Monsanto each hold around 10% of the international pesticide market.

Many countries lack capacity and competencies necessary to enact enough or even effective laws to regulate the activities of these private interests to guarantee safety of their products to both consumers and the environment. The private companies capitalise on these weaknesses to influence adoption of weak national laws that promote corporate market shares without regard to other important factors as human health and protection of nature. The problem is worse in developing countries especially in Africa even though trade in these products is limited on the continent. It is however steadily increasing with time.

**Impact on climate**

Most fertilisers are petroleum-based with huge component of chemical nitrogen. These fertilizers contribute immensely to green house emissions, about 15% of global green house emissions.
Mechanised commercial food transport is a mega undertaking across the world by air, land, and sea. It is also estimated that more than half of all food produced for commercial use gets spoiled. Further, food processing and subsequent preservation through refrigeration are practiced on a massive scale across the world. The sum total of these activities contributes heavily to greenhouse emission.

**Land grabbing for food production**

Due to the need to generate more profits, and given unavailability of adequate arable land in their countries of origin, commercial farming companies have discovered new ways of acquiring land overseas. They are entering into land lease agreements with governments to use the land to produce food for export to international markets that in most cases have nothing to do with the countries where they farm.

This commercial agricultural land lease practice is increasingly happening in poor countries, some of which experience constant acute food shortages including in Sub-Saharan Africa that suffers endemic food shortage. In many cases the land availed for lease to commercial farming corporate is forest land belonging to indigenous communities. In such situations, the land is cleared of its natural vegetation leading to loss of biodiversity and negatively altering ecosystems. In some cases, affected communities are forcefully evicted from their ancestral lands to pave the way for large scale agricultural farming. Out of such arrangements, host governments generate revenues in form of rents while the companies earn the right to produce food targeting export markets. The losers are the indigenous communities whose social order is permanently disrupted as they are scattered to look for different homes elsewhere.

Corporate firms that lease huge tracts of agricultural farming also engage in an intensively mechanized and highly chemicalised farming to maximize on production while minimizing on costs. They deploy chemical fertilisers, pesticides, herbicides and other forms of chemicals that minimize the costs of production so that they can maximize on profits. The result of this is altering soil textures, killing millions of soil organisms and polluting rivers, lakes, oceans and other water bodies by the chemicals during rains when the runoff ends up in these water bodies. These activities have huge contribution to greenhouse emissions into the atmosphere, thereby contributing to climate change especially global warming.

**Using the law to sustain or suppress safe agricultural practices**

The rise of corporate farming has boosted global food production. As the main interest by corporate in farming is profit, there has been a continuous global effort to create rules to govern production, storage and trade in food in favour of transnational corporates. Most of these rules are within the framework of WTO and increasingly as national laws.

Relying on the favourable global trade rules, private multinational agro companies are adopting more aggressive methods to produce more products in order to generate more profits. The rules set a range of standards to be met by all players including peasant farmers. For example they set standards on seed varieties to use, storage specifications, packaging and transportation including terms of selling the produce. In most cases, the rules are set in favour of big corporate firms with capacity to meet these regulations to the exclusion of peasant and indigenous farmers.

However, communities are not so completely powerless in protecting themselves. Where they have access to right information and support, they can fight and win battles against the excesses of the corporate. They can mobilize and push their governments to put in place good laws that can protect natural seeds; that can promote use of organic fertilizers; that can promote use of environmentally-friendly pesticides; and that can guard against land grabbing by multinational commercial farming corporates.

- **The example of Mexico and Venezuela**

In 2007, Mexico passed a Seed Law that in many ways criminalizes the natural indigenous food seeds while promoting and protecting the production and sale of genetically modified seeds owned by multinational companies. The Law requires all seeds to be produced on farm or bought, without any other alternative. It makes illegal the exchange of seeds or receiving because this means once exchanged or received, the seeds have neither been bought nor been produced by the receiver.
Even if one produces his own seeds with intention of selling, there are numerous and complicated certification requirements by the law that even some established companies would find challenging to meet leave alone the peasant farmers. But the transnational corporates are well set and equipped to meet such conditions with ease.

Mexico’s Seed Law was enacted with immense technical support and influence from a national association of seed sector players called Mexican Association of Seed Producers (AMSAC). Even though the Association calls itself Mexican, its board members includes major seed multinationals: Syngenta, DuPont, Monsanto, Pioneer, Vilmorin among big others. It is no wonder that the law, with so many hidden clauses that technically outlaw natural seeds of the peasants, came into effect.

Across the border in Venezuela, the national parliament of that country on the other hand passed a new progressive Seed Law in 2015 that protects the natural seed. Unlike in Mexico where the process was led by multinationals, in Venezuela the campaign to enact the new law was driven by peasant farmers, indigenous people and environmentalists from across the country who demanded a complete rewrite of the seed law, the initial draft of which had been in favour of, and had been influenced by the multinational seed companies.

The new law imposes strict regulation on all hybrid seeds and prevents research, production, import and distribution of all GM seeds in order to protect natural seed as well as environment and human health. It outlaws seed patenting and promotes sustainable and natural agriculture methods such as natural cross breeding, seed saving and sharing. Under this law the country will have a National Seed Institute or seed controlling system to regulate, audit and control the quality of imported seeds to prevent and punish all violations against the GMO ban.

Conclusion: What can be done?
Whether it is manufacturer of high yield seeds, fertilisers, farmland leases or even trade in food, there is no doubt that modern commercial farming and food distribution are motivated by one major objective, to make more and big profits and tighten control of the market. The interest to feed people, protect their health, protect the environment and other forms of life are all secondary if at all are on the list of priorities. The big players in agro industry have capacity to influence the sector in ways that promote their interest in profit to the disadvantage of other areas of concern as human health, environment and fair trade in food.

This paper has already indicated in earlier parts that since ancient times throughout ages up to about 1870, humanity had always applied safe science to improve food productivity and security while preserving other forms of life and nature in general. With the modern scientific advancement, humanity has better means today than at any other time in history to produce seeds, fertilisers and pesticides that pose no harm to human health, harmless organisms and nature. In fact these ancient technologies are still in use among indigenous communities though not spoken about since they do not guarantee profits as do the modern technologies of synthetic fertilizers, pesticides and genetically engineered seeds.

Left in the hands of commercial interests, the problems associated with agro industry can only worsen with time. There is therefore need for conscious and deliberate effort to rethink of sustainable ways of addressing these challenges by first putting the wellbeing of nature and life at the centre of new agro technologies and innovations. To this end, different stakeholders need to take action to arrest and reverse the worsening trends. Key among the stakeholders are described below:

Government
Any legitimate government has the mandate to protect the wellbeing of its citizens. In this regard, governments need to put in place effective regulations that protect, preserve and promote natural agricultural practices, especially ones that have been passed on through generations from ancient times, and which have no known side effects to nature or human life. The governments also need to regulate the activities of modern agro industry to ensure their activities are without health risks and negative impact to the environment.
The government should establish and sufficiently finance national institutions that effectively regulate a country’s agricultural activities including research and vetting of agricultural products and activities in the country. By financing such institutions domestically, it would protect them from falling to manipulation by vested private interests at the expense of public good.

**Communities**

When information is packaged and shared in easy-to-understand manner, the public and communities can absorb it and decide what to do to protect themselves. In this regard, public institutions involved in research or in custody of information on the adverse effects of modern agricultural technology to humanity and nature need to share this information. Peasant farmers’ organisations and indigenous community leaders can play key role in organising communities to champion for protection of farming practices that protect the environment and human life.

**Scholars, environmentalists and civil society**

Scholars need to intensify their research into modern agriculture with an interest in the safest and most sustainable practices that preserve nature while improving human health. Indigenous community knowledge is reliable repository of good agricultural practices. They also need to find effective ways of sharing their research findings with communities.

Environmentalists and Civil society organisations too could help in the dissemination of this information among communities in which they operate. They can also offer support to citizens to initiate and effectively engage in dialogues with government to stay committed to protecting and promoting safe agricultural practices from the excesses of transnational companies that are engaged in the agro industry.

**The sacred nature of food**

The food we eat comes from other forms of life. If life is sacred then food and farming must be sacred too. Throughout nearly all of human history, both food and farming were considered sacred. Farmers prayed for rain and for bountiful harvests. When it happened according to their prayers, they thanked the Devine Being for it through offering new farm produce even before they could taste it.

Those who treat food as sacred today are viewed as old-fashioned or just out of touch with reality. This is because science today is thought, mistakenly, to be capable of explaining everything about food and farming. Mistakenly because what is sacred about human life is also sacred about other forms of life including the food we eat that comes from the animate. There is a spiritual aspect of all forms of life which humanity Is yet to have full understanding about. A common thread of spirituality is the existence of an unseen order or interconnected web that defines the oneness of all things within a unified whole. We as people are a part of this whole. We may attempt to understand it and even influence it, but we did not create nor can we control it. Thus, we must seek peace through harmony within the order of things beyond our control including other forms of life, even if plants.

Today however, science has been used to give different view about food and farming given the revolution that it has brought about to humanity particularly since the industrial revolution. The same science that made industrial era possible is the same science that removed the sacred from matters of economics and politics and removed spirituality from the day-to-day matters of both individuals and their communities, including from food and farming.

Under this form of science, living things of nature had to be bent, twisted, bribed and coerced to bring them under control. But, nature inevitably fights back. The degree to which science has interfered with food and farming ostensibly to improve global food security has seen a surge of a range of negative and unanticipated impacts in the form new human diseases, environment pollutions and poisoning of food chains among others. All these are a way of the nature fighting back. It is an unsustainable form of pursuing food global food security as it has no regard for what is sacred about food.
The sustainable agriculture issue ultimately is rooted in a perceived need to be in harmony with the order of things — in spirituality. Finding harmony with a higher order of things which is above human intelligence requires an understanding of that order — wisdom not power and control. Sustainable farming means farming in harmony with nature — nurturing nature rather than dominating or manipulating it. Sustainable agriculture means fitting farming to the farmer and the farm — not forcing either to fit some predefined prescription for progress. Sustainable farming means farming in harmony among people — within families, communities, and societies. Sustainable farming means farming in harmony with future generations — being good stewards of finite resources. A life of quality is a shared life. A life of quality is a spiritual life.

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