

## **Challenges for Transitioning Conventional Farming in the Sudan to Organic** Mohamed Ahamed Bushara

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**ABSTRACT** : United States Department of Agriculture (USDA), defines organic agriculture as a production system which voids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives. To the maximum extent feasible, organic farming systems rely upon crop rotation, crop residues, animal manure, legumes, green manure, off-farm organic wastes, mechanical cultivation, mineral supply bearing rocks and aspects of biological pest control to maintain soil productivity and tilth, to supply plant nutrients and to control insects, weeds and other pests. Therefore, organic agriculture combines tradition, innovation and science to benefit the shared environment and to sustain and optimize the health and productivity of interdependent communities of organic agriculture, in the modern sense of the term, is a highly regulated form of ecological agriculture. The legalities of organic agriculture are codified in a number of formal standards that define the regimes that producers or processors need to work within in order to claim organic status. These organic standards besides stipulating the prohibition of use of certain inputs also demand strict adherence to a range of practices by the farm. This paper reviews the process of conversion from a conventional to an organic system which requires complete deterrence from application of chemical inputs, significant changes at the farm level particularly within soil and major changes in the attitudes of the farmers, besides other costs and obstacles that affect transition process. On the other hand, it highlights the chances and prospects in favor of organic farming in the Sudan.

**KEYWORDS:** *Conventional farming, Organic farming, Organic default, Biological transition.*

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### **INTRODUCTION**

The organic movement began in the 1930s and 1940s as a reaction to agriculture's growing reliance on synthetic fertilizers. The 1940s has been referred to as the pesticides era (1). Sir Albert Howard is widely considered to be the father of organic farming. Rudolf Steiner, an Austrian philosopher, made important strides in the earliest organic theory with his biodynamic agriculture. Before 1940, when the population was smaller than it is today, it was common for farmers

throughout the world to grow food organically, and yields were similar to medieval times. However, as the world's population increased, growing organically was no longer a feasible way to feed society. A more efficient way to feed a population that had almost doubled in size has become necessary. This led to the introduction of intensive technologies, including fertilizers, mechanized cultivation, and biocides such as fungicides and herbicides, which helped produce greater yields for

the larger population. These farming practices have become integral parts of what we know as conventional farming<sup>(1)</sup>. Factors responsible for yield increase include use of new plants varieties that use fertilizer more efficiently; cultural practices (e.g., increased mechanization in crop harvesting<sup>(2)</sup>). However, many of these practices deplete natural resources (nonrenewable energy) and degrade crop quality and the environment<sup>(3,4)</sup>. Conventional practices contribute to: 1) depletion of nonrenewable energy resources to produce pesticides, fertilizers, and to power mechanized equipment, 2) air, water and health hazards, and 3) reduction of soil quality. For example, in some areas in the United States, growers used excessive rates of synthetic fertilizers to attain high yields, but contaminated ground water<sup>(5,7)</sup>. Increased frequency of tillage without addition of organic amendments leads to reduced soil organic carbon and increased soil erosion where soil surfaces were left bare<sup>(8)</sup>. In some regions of the United States, such as Florida, growers used soil fumigants (primarily methyl bromide) to ensure pest control under intensive crop production for many decades. However, the use of these fumigants has linked to ozone depletion<sup>(9)</sup>. Based on these concerns, researchers and producers are looking for alternative agricultural production system that can reduce damage to the environment. Among these alternatives is organic farming. More work was done by Rodale in the United States, Lady Eve Balfour in the United Kingdom, and many others across the world<sup>(10)</sup>. Organic farming is viewed as an environmentally friendly and consumer oriented approach to food production. Conventional producers perceive a need to change to organic for a variety of reasons. Some see

organic farming as profitable system. Others are attracted because they feel it is personally satisfying or environmentally sound and healthier to conventional farming. In general, motivations for organic farming typically are either farm-related or personal<sup>(11,12)</sup>. Farm-related motivations include husbandry (e.g., previous problems with conventional production) or financial factors (e.g., higher prices for fresh organic products). Personal motivations include personal health (e.g., less exposure of farm workers to pesticides) availability of food grown by locally owned, small family farms and religious, philosophical, political and environmental benefits. Other scientists highlight many reasons for conversion to organic including the followings:

- **Yield increase:** Studies showed that in southern Brazil, maize and wheat yields doubled on farms that changed to green manures and nitrogen fixing leguminous vegetables instead of chemical fertilizers<sup>(13)</sup>. In Mexico, coffee growers who chose to move to fully organic production methods saw increases of 50% in the weight of beans they harvested. In an analysis of more than 286 organic conversions in 57 countries, the average yield increase was found to be impressive 64%<sup>(14)</sup>.
- **Less energy consumption:** It has been reported that in some countries 10 calories of fossil energy was used to produce one calorie of food energy. In a fuel-scarce future, such energy demand won't stack up: (15) Studies in the United Kingdom showed that, on average, organically grown crops use 25% less energy than their chemical counterparts. Certain crops achieved even better reductions including organic leeks (58% less energy and broccoli (49% less energy)

- **Reduction of green house emissions and climate change:**  
The production of ammonium nitrate fertilizer, which is indispensable to
- conventional farming, produces vast quantity of nitrous oxides (a green house gas with global warming potential some 320 times greater than that of CO<sub>2</sub>). The production of one tone of ammonium nitrate creates 6.7 tones green house gases and was responsible for around 10% of all industrial green house emissions in Europe in 2003 <sup>(13)</sup>. The techniques used in organic agriculture to enhance soil fertility in turn encourage crops to develop deeper roots, which increase the amount of organic matter in the soil, locking up carbon under ground and keeping it out of the atmosphere. A study showed that if the United States were to convert all its corn and soybean fields to organic methods, the amount of carbon that could be stored in the soil would equal 73% of the country's would-be Kyoto targets for carbon reduction <sup>(14)</sup>.
- **Improve water use efficiency:** Agriculture is officially the most thirsty industry on the planet, consuming staggering 72% of all global fresh water at a time when the United Nations says 80% of our water supplies are being over-exploited <sup>(16)</sup>. Organic agriculture due to its emphasis on healthy soil structure, avoids many problems associated with compaction, salinization and soil degradation, which are prevalent in intensive systems. Organic manures and green mulches, applied even before the crop is sown, promote mineralization processes in soils. Mineralized organic matter is one of the essential ingredients required physically and chemically to hold water on land <sup>(17)</sup>.
- **Conserve ecosystem:** Organic farms actively encourage biodiversity in order to maintain soil fertility and natural pest control. Organic producers regard a healthy ecosystem as essential to healthy farm, rather than a barrier to production. More than 70 independent studies of flora, invertebrates, birds and mammals were reviewed within organic and conventional farming systems. It was concluded that biodiversity is enhanced at every level of the food chain under organic management practices, from soil micro-biota through to farmland birds and the largest mammals <sup>(18)</sup>.
- **Increase nutritional benefits:** Studies showed that organic crops contained higher levels of 21 essential nutrients than their conventionally grown counterparts, including, iron, magnesium, phosphorus and vitamin C. Organic crops also contain lower levels of nitrates, which can be toxic to the body <sup>(19)</sup>. Other studies have found significantly higher levels of vitamins as well as polyphenols and antioxidants in organic fruits.
- **Job creation:** The implications of decline of rural labour force as a consequence of the industrialization of agriculture are becoming increasingly very serious. A skilled agriculture workforce will be essential in order to maintain food security in the coming transition towards a new model of post-fossil fuel farming. Many of these skills have already been eroded through mechanization and a move towards more specialized and intensive production systems. By its nature, organic production relies on labour-intensive management practices <sup>(20)</sup>.

**Criticisms and misconceptions about organic agriculture:-**

The International Federation of Organic Agriculture Movement has compiled the following criticisms and frequent misconceptions about organic agriculture:

- Pesticides residues in conventional foods are always within safe level.
- There is no consistent evidence of a nutritional difference between organic and non-organic food.
- Organic industry groups spread fear of non-organic products in order to increase their market shares and profits.
- Organic farming increases the risk of food poisoning: organic food potentially contains more dangerous bacteria (such as *E.coli*) because organic farming uses animal manures and mycotoxins due to the absence of fungicide use.
- Many natural foods contain allergenic substances that have considerable health impacts.
- Some natural pesticides used in organic farming have been proven to have harmful effects on health. For instance, Pyrethrin sprayed on organic fruits is highly toxic and Rotenone is a potent neurotoxin long used to kill fish.
- The natural pesticides are more dangerous than conventional pesticides because they are less efficient and therefore require the application of huge quantities. This also true for fungicides (e.g., organic grape producers contaminate the soils with large quantities of copper because they are not allowed to use modern fungicides) In addition, some organic pesticides are as poisonous as synthetic ones (e. g., nicotine and pyrethrum).
- Since yields are much lower in organic agriculture widespread adoption of organic agriculture would require farmers to expand farming into marginal and natural areas to grow the same amount of food, thus destroying more fragile ecosystems and reducing biodiversity.
- Organic farmers rely primarily on compost, animal manure, or green manure crops to supply soil fertility. The nutrients in these organic sources typically do not match crop demand.
- In areas where there are no natural reserves of phosphorus available, organic agriculture can not work because the only way to maintain soil fertility is to bring in synthetic phosphorus fertilizers.
- The physical mechanisms for weed control can be more damaging to the soil ecology than chemical techniques. For example, zero-weeding sterilizes the soil by injecting high pressure vapours, killing not only weed seeds, but also insects, worms, and bacteria of the soil.
- Organic food is too expensive, promoting it will reduce fruits and vegetables consumption, which are healthy, but expensive.
- The organic movement is increasing the growing gap between rich and poor through supplying healthy food for the rich and unhealthy food for the poor.
- Organic certification is not reliable, since it is only based on paper trail, and hence organic producers are too often cheating reports.
- Organic food does not look very appetizing.
- Organic farming yields are too low to feed the growing population.
- Organic agriculture is labour-intensive, which means that an increased burden is placed on families.

- Organic farming is not easy, and organic farmers are alienated by hours of work and work-related stress due to pest's invasion and diseases that endanger their crops and incomes. Most organic vegetable growers end-up with irreversible back problems due to hand weeding and other manual operations. In this sense, organic farming is not healthier for farmers than non-organic.
- Organic farmers can use toxic natural pesticides based on the argument that substances produced by living organisms are not really chemical, but rather organic constituents of nature. In reality, the distinction between lab-created products and products created by living organisms does not make sense scientifically, since every biological process is fundamentally a chemical process.
- Organic certification is another protectionist measure designed to maintain the dominance in global markets for producers from developed countries by hampering access by small developing country producers to developed markets. Certification costs are a significant financial burden on producers in developing countries and create barriers to participation in the organic sector. World standards of business do not take into consideration the current capacities and infrastructure of most developing countries.

#### **Determining Farm's profit during transition management:-**

Farm profit during the transition is determined by a combination of five kinds of effects:

1. **Biological transition effect:** this refers to the impacts on farm profits due to natural processes that result from shifting to organic methods, and may be either negative or positive. Negative biological effects result from reduced yields or increased costs of the new organic practices, while positive impacts may result from practices such as the substitution of leguminous nitrogen for purchased fertilizers, or reliance on biological controls instead of chemical pesticides. Unfortunately, positive biological effects are often not realized until after the transition period.<sup>(21)</sup>
2. **Price effect:** it refers to the impact on farm profits from a change in the prices of its commodities. In situations where organic produce commands price premiums, the price effect is positive. On the other hand, if organic production systems result in increased pest damage or other factors that reduce the grade of the product, the price effect could be negative. Finally, the price effect can be non-existent in situations where yields are maintained and commodities are sold in conventional markets at regular prices.
3. **Learning effect:** it refers to the reduction in income due to the farmer's lack of experience or information regarding organic methods. This effect can be quite significant in cases where the organic technology is complex and risky, and the farmer is inexperienced. However, where the organic technology is relatively easy to adopt and the systems are relatively simple, the learning effect may be negligible. One of the major barriers to adoption of organic systems is the lack of technical information and advice regarding organic methods, which can significantly increase the farmer's apprehension and uncertainty regarding financial outcome of the transition.
4. **Rotation adjustment effect:** When converting from a conventional

farming system to an organic system, it may be necessary to introduce or alter crop rotations, and the particular selection of crops required for these rotations can lead to a reduction in income. This referred to as the rotation adjustment effect. For example, if the conventional crop mix was intensive and the transition involves introduction into rotation of less profitable crops, such as pasture, the financial losses in the early years of the transition can be severe. On the other hand, if a conventional farming system featured adverse rotation including legumes, the rotation adjustment effect may be minimal or even zero.

5. **Perennial effect:** This refers to the long-term effect on farm profits after considering the effects of rotation adjustment, biological transition effect, price effect and learning effect. Depending on whether organic farming is inherently advantageous or not from the stand point of year to year profitability, the perennial effect may be either positive or negative.

#### **Basic steps to organic production:**

##### **1. Soil Fertility:-**

The foundation of organic farming lies in the health of the soil. A fertile soil provides essential nutrients to a growing crop plant, and helps support a diverse and active biotic community. Strategies the transitional farmer will employ to build the soil are crop rotations, animal and green manures, and cover cropping<sup>(22)</sup>.

- **Crop rotations:**

Many farmers find that rotating crops improve the tilth or aggregation of the soil. Planning a crop rotation requires a farmer to plant crops during different times and locations on the same field. Usually the succeeding crop will be of a

different variety and species than the previous crops. Crop rotations can also be used to promote soil fertility, reduce erosion, reduce the buildup of pests, and spread out financial risk in case a crop fails. Farmers who include a legume in the rotation can increase the availability of nitrogen in the soil. Rhizobia that form on the nodules of legume roots convert nitrogen from the atmosphere into organic nitrogen, which then becomes available to plants.

- **Cover cropping:**

A cover crop provides soil cover and can help loosen compacted soil through the root growth and improved water filtration. Cover crops also help prevent soil erosion by both water and wind, suppress weeds by keeping the sun from reaching weed seeds, and reduce insect pests and diseases. If a legume is used as a cover crop, it can provide nitrogen to the soil. Non legume cover crops can take up excess nitrogen, phosphorus, and potassium from previous crops and recycle them to the following crop.

- **Green manures:**

A cover crop that is tilled into the soil while it is still green is referred to as a green manure. Green manures are important under an organic farming system because they help to add organic matter and nutrition to the soil. When a green plant is incorporated into the soil, it contains high amounts of nitrogen and moisture and becomes a food source for soil microorganisms and earthworms. During the process of decomposition by the organisms in the soil, organic matter and nutrients become available to the crop plants. Additional benefits from using green manures include the suppression of weeds and soil borne diseases.

- **Animal manures:**

Livestock manure has traditionally been used to fertilize soils on both organic and sustainable farms. Manure can be applied to the field in

either a raw or composted form. The Final Rule has specific requirements for using raw or composted manure, which the organic farmer must follow. Raw manure supplies nutrients to the soil, adds organic matter, and encourages biological processes in the soil. However it is important to know what is in the manure since some may contain contaminants. It is best to compost manure, since the heat created during composting may kill most of the contaminants. Before adding either raw or composted manures, farmers should have the soil tested so he or she can add the proper amount of raw or composted manure to their plots and avoid nutrient imbalances <sup>(23)</sup>.

### **2. Weed Management:-**

Weed management is based on prevention. As the soil health improves, weed populations decline <sup>(24)</sup>. Weed populations may also be reduced by using crop rotations, eliminating weeds before they set seed and reproduce, and not allowing weeds onto the farm. Some crops can be grown to out-compete weeds for sunshine and food. Mulches help suppress weeds by preventing light from reaching them or by significantly decreasing the amount or quality of light reaching the weed seed or leaf. Also, there is evidence to suggest that using certain mulches with naturally occurring allelopathic chemicals can help prevent the germination of weed seeds.

### **3. Pest Management:-**

Insect pests are going to be found in any ecosystem. Under conventional management regimes, a majority of pests may be eradicated with insecticides, but these chemicals also eliminate benign and beneficial insects. Repeated applications lead to the pests' increase resistance to pesticides, necessitating the use of

ever-higher concentrations of insecticide. Eventually, the pest population may rise, leading to massive infestations. Under the organic system ecological balance is the main goal, instead of complete eradication. Ecological balance is maintained through the use of beneficial insects, predatory or parasitic mites, and spiders to keep pest populations down. To attract beneficial populations, farmers manipulate the farmscape by growing hedges and planting flowers. In situations where particularly severe infestations occur, the Final Rule states that farmers may use bio-rational pesticides that are not as harsh as conventional pesticides as a last resort. These include microbial insecticides such as *Bavaria bassiana* (a fungus that attacks a wide range of both mature and immature insects), soaps that interfere with an insect's ability to respire, pheromones used as bait for traps and as disruptors of mating cycles, and botanical plant extracts such as neem that interfere with an insect's metabolic processes. Farmers use integrated pest management (IPM) to determine the best approach to pest control. IPM involves monitoring to identify the pests. A pest management system is designed after conducting research into the insect pests' life cycle and into that of the pests' natural controls <sup>(22)</sup>.

### **Challenges during conversion to organic:**

During transition to organic production systems, growers experience a period of suppressed yields, followed by a return to yields near or equal to those achieved with conventional production <sup>(25), (26)</sup>. This transition effect has been attributed to time required for changes in chemical, physical and biological properties of soil necessary to enhance nutrient cycling, plant growth, and development of biological pest control

within the system. During the transition period, growers spend time testing and searching for cultural, chemical and biological practices, following organic system guidelines to reduce pest pressures by building soil beneficial organisms and restoring soil organic carbon. These changes may take longer than one year. In some cases, growers may need to adjust existing equipment or purchase additional equipment to cope with the extra stubble for seeding or transplanting <sup>(27)</sup>. Other challenges are coping with yield losses due to abrupt changes in soil and pest management, and reduced profitability. Apart from the aforesaid financial burden, the process of conversion may be hindered due to other transaction costs as well. Some of them are:

1. Lack of access to relevant knowledge and information.
2. Dearth of training facilities and the non-existence of an adequate extension system
3. Enormous amount of mandatory documentation involved in the process of inspection and certification, which is too cumbersome to maintain for those small farmers, who are illiterate
4. Difficulties in obtaining reliable information on domestic and international market (say, on suppliers, prices and qualities); more so because the marketing and information services available in the country all relate to conventional products only.
5. Lack of demand in the domestic markets.
6. Constraints on access to international markets.
7. Institutional barriers, such as, scarcity of professional institutions capable of assisting the farmers throughout production, post-production and marketing processes.
8. Inadequate availability of different organic inputs, such as organic seeds, bio-fertilizers, biopesticides etc.

### **Prospects in favour of organic farming in the Sudan:**

Much of the Sudanese agriculture is carried out under default organic management which simply means the farmers has no access to chemical fertilizers, pesticides or other organically prohibited amendments for financial and other reasons. These farms are rely exclusively on natural methods of building soil fertility and combating pests and diseases, but are not inspected and verified by any organic certification agency. The problem is that default organic farmers never made choice to be organic. There is no guarantee no pledge and in fact, no reasons that these farmers will not start using unsustainable chemical pesticides, fertilizers and genetically modified organisms as soon as they gain access to them. Without knowledge of sustainable chemical free alternatives and the damage that these toxic materials can cause to their land and health, farmers will undoubtedly embrace easy solutions to long standing problems of fertility, insects and diseases. An effective organic system is needed to address the issue of educating farmers as to the depth of what it means to be truly organic so that they can make a choice to farm organically or not. Such a system needs to be affordable and easily accessible. It also needs to be as inclusive as possible so that every farmer who wants to make an informed, educated choice to be organic can do so and know that he is a part of an important worldwide movement in agriculture today. The great majority of Sudanese farmers are peasants, indigenous people and small family farmers with very little capital, who still using traditional methods, and techniques to farm their lands. These farmers, have little alternative but to rely on locally available natural resources to maintain soil fertility and combat pests and



diseases. What ever may be the reasons, the fact remains that the diverse farming systems managed by such small farmers could be considered as “organic” as they do not rely on synthetic chemical pesticides or fertilizers and use technologies that optimize nutrients flows and use local resources such as native seeds and traditional knowledge. The lucrative market of the developed world has so far acted as the primary driving force behind the adoption of converting the conventional farming in many developing countries to organic. There is a huge potential for organic farming to flourish in this country and given an appropriate institutional and policy framework it will not be very difficult to promote the existing default organic to category of certified organic farms. This will enable those small farmers to take advantage of the lucrative market for certified organic products in the developed countries, which can directly contribute towards the improvement of their economic well being. Moreover, besides being a technological or market option, organic farming could be the only way out for sustainable rural development in the traditional and rain fed mechanized farming in the Sudan.

### CONCLUSIONS

- Appropriate research and extension services should be developed to avail all the relevant information on organic farming, in general, and its specific technical details to farmers
- Farmers should be educated on the benefits of organic farming, specially regarding ways in which organic processes strengthen and sustain the land without chemicals..
- Certification and labeling capacities should be developed within the country so as to overcome the prohibitive costs involved in getting

certification done by external agency.

- Certification processes should be simplified and made accessible to all farmers.
- Biofertilizers, bioagents, biopesticides and other organic inputs should be made available to the landlords at sufficient quantities and reasonable prices.
- Domestic market for organic products, which currently does not yet exist should promptly be encouraged and developed.
- Marketing linkages, both domestic and international, should be ensured for organic products.
- Subsidies and other financial support schemes should be undertaken to help farmers bear the initial expenses for converting to certified organic farms.

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