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The Scope of Organic Farming in Environmental and Health Hazards: Modern Organic Farming vs. Traditional Models with Especial Concentration in Sudan

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I. Introduction

The Philosophy of organic farming is to get an organic product, free from contamination from a farm, using natural resources and its biodiverse without exhausting the environment or in other way to keep it in a balance. The organic farming system uses the concept of sustainability to produce safe food, fit nutrition, preserves of natural flora and livestock and keeps social justice (Løes, 2014,). The simplest definition of organic agriculture is refraining from chemical fertilizers and pesticides (Løes, 2014) and the advantage from that is the biofertilization, biocontrol, bioproducts, soil rehabilitation and poor soil enrichment (Mohammed Osman, 2010). The aim of this mini-review to raise the awareness about modern organic farming and its scope in the environmental and health hazards and how to cope these with traditional models that already have been exited in Sudan; furthermore which benefit and risks to such practices is exiting now in Sudan and finally how to address the traditional knowledge and to correct the current existing problems to be competitive in the modern organic farming market inside and outside the Country.

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II. Organic Farming Tools

a) Organic farming inputs

1. Seeds bed which can be described in triangle of the living soil status, crop nutrition and seeds. Soil type, its fertility problems and the climate conditions must be considered. The selected different adapted crops must be in intercropping or rotation and/or accordance with farmer preference or business. Used seeds must be from organic sources and/or treated organically.
2. *Soil fertility:* The maintenance of soil fertility is important in sustainable land use. Since the organic farming system is less dependent on external input; the fertilization coming mainly from recycling and composting of food and farm wastes (manures and organic residues). In addition using sludge of waste water treatment (Bioremediation of sludge in Bioreactors). Adding C- enriched materials is fundamental concept in organic farming (Brevik *et al.*, 2015). Furthermore using natural and Biofertilizers is other arm of fertilization in such system (Mahdi et al., 2010.
3. *Weed, diseases and pest management (biocontrol):* Catch or cover crop is normally inserted in crop rotation to manage weed control. However using manure has positive effect in securing crops that are sufficiently competitive against perennial weeds (Olesen et al., 2007). Using natural and bioproducts for pests and diseases control (Berg, 2009)..
4. *Crop rotation:* The basic guidelines of rotation design for organic systems can be exclusively in ten points as below starting from that deep rooting crops should follow shallow rooting crops; nitrogen fixing crops should alternate with nitrogen demanding crops. Wherever possible, catch crops, green manures, and under sowing techniques should be used to keep the soil covered. In addition crops which develop slowly and are therefore susceptible to weeds should follow weed suppressing crops. Alternate between leaf and straw crops. Where a risk of disease or soil borne

pest problems exists, potential host crops should only occur in the rotation at appropriate time intervals. Use variety and crop mixtures when possible. Alternate between autumn and winter sown crops. Furthermore suitability of individual crops with respect to climate and soil, balance between cash and forage crop, and the seasonal labor requirements and availability must be considered (Mohler and Johson, 2009).

5. *Irrigation water:* The clean uncontaminated water with pesticides or biological pollutants is very important for irrigation. Here to mention the gap between conventional and organic farming systems is crucial especially when using underground water. When using recycling water type A water is only used for organic agriculture.
6. *Livestock Husbandry:* Insertion of animals in mixed farm can serve as biocontrol and adding values of its manure as organic fertilizers (Ducks, chicken and goats). No artificial materials in fodder have to be added (vitamins, hormones or drugs) to feed the animals. Freeland chicken and natural grazers livestock are examples of such husbandry (Soil Association organic standards EU, 2016).

b) Organic farming types farm design

In the different four main organic farm types namely, livestock systems, grassland and Fodder crops, arable land and horticultural crops, the idea beyond the modern organic farm is using the farm resources or less input from outside the farm to fulfill the highly different goals (Løes, 2014). To reach such goals, the farms history and biography must be studied. This study has to be linked with current resources and frame conditions to plan the future. The simplicity of farm management is the basement to comfort the family. The farm must be self-sufficient is term of animals fodder and bio-organic fertilizers in a balance with environment, have maximum output in human food , conserve the biodiversity in it and the surrounding environment, be suitable to run social activities on it, be specialized in a production and can include packing and processing and selling food too (Løes, 2014).

c) Organic farming impacts (output)

1. *Soil health and soil rehabilitation:* Organic farming gives a soil with higher humus and biota, higher soil water holding capacity and better aggregates in compare with conventional system. Sometimes these two farming systems are not that different in mineral contents but the organic ones are less contaminated with heavy metals, herbicides and pesticides residues (Maeder *et al.*, 2002). Furthermore organic farming have significant potential to accumulate soil carbon (Gattinger *et al.*, 2012); hence organic farming has good tools for soil rehabilitation (Poor soil enrichments and bioremediation of contaminated soil) (Maeder et al. 2002).
2. *Plant nutrition and health:* Foods from organic sources have better minerals content (Table1) and proteins quality. Higher flavonoids production (better autoimmune against pest and diseases) (Worthington, 2001). This also true for feeds stock (Haas et al., 2007)
3. *Water quality and water reservation:* Organic farming system has better quality of water that is less contaminated with pesticides and herbicides (Up to 97 % reduction). Less NO_2 especially in underground water. Less PO_4 so more water freshness (Pimentel et al., 2005). Soil moisture and water resources conservation is a major advantage of such system even with old traditional water harvesting technologies particularly under drought conditions (Pimentel et al., 2005).
4. Conservation, abundance and richness of taxa by prohibition of inorganic herbicides, pesticides and chemical inorganic fertilizers. Preservation of mixed farming. Sympathetic management of non crop habitats. The impacts of organic farming in pastoral and upland agriculture are limited (Maeder *et al.*, 2002). Step wise studies are needs to fill the gap of knowledge in appraisal the role of organic farming in Biodiversity (Hole *et al*., 2005).
5. *Environmental issues:* The most famous issue is less CO_2 uses and emission as the soil serves as major C sink. However soils managed by organic farming not only may emit less carbon dioxide (CO_2), but also nitrous oxide (N_2O), and methane (CH_4) compared to conventional system (Lorenz and Lal, 2016)
6. *Human health:* The healthier soil produce healthy crops, lead to health of animal and people. Better immunity and less allergic problems. Less carcinogenic because of less pesticides residues (EPRS, 2016). Heart health improvement is recognized because organic food has more salicylic acid in stressful natural growing plants (117 ppb compare to 20 ppb in conventional) (Willer.and kilcher, 2009). Better nutrients and antioxidants (EPRS, 2016). The biggest precaution comes from the contest is the contamination with human and animals feces that infected by bacterial and viral diseases but this issues will be declared later in this context. When it comes to livestock organic milk and meat has a higher omega3 compare to conventional system. Addition health values is the prevention of antibiotics in organic farming minimize the risk of antibiotic resistance (EPRS, 2016).

d) Processing and marketing

Products processed in organic scheme have no artificial food additives or coloring and careful clean

handling and packing. For organic animals products free of diseases and parasites is a major task and has to be managed carefully (Lund and Algers, 2003). Organic market is limited by high prices added values. Price is the major perceived barrier to purchase organic products (Aschemann-Witzel and Zielke, 2015).

e) Converting to organic farming

At least Three years are needed for such conversion. Gap land is needed between organic farm and conventional system. Well trained labors are needed for modern organic farm practices and post harvesting and food processing (Acs *et al.*, 2007). Up to 20% reduction in productivity and has to be well planned to fill the gap in food production and profit. Also the organic farming needs more labors and the low labors income is one of the major constrains in such conversion (Acs *et al.*, 2007).Therefore in planning to conversion labors income has to be considered (Acs *et al*., 2007) Governmental and/or non-governmental financial support like civil society organization and small farmers' cooperation societies is required to cover this transit period (Aschemann-Witzel and Zielke, 2015).

f) Limitation (precautions) of organic farming

There is a debate that the organic products have more attachment to biological contaminants, therefore the organic food more contaminated. Nevertheless this phrase is absolutely wrong because the organic food developed more resistant mutagenic against biological diseases (EPRS, 2016). The alarm of existence of more mycotoxins especially alfalatoxins is also another thing has to lookout but the cited literature did not show that the organic is more contaminated (EPRS, 2016), and if the there is more contamination with compost from animals origin this means the immaturity of this compost or the manure age is less than 60 days (TECA, 2015).

The organic farm is less in the production to about 20% in compare to conventional system which lead to less food Security especially in the developing countries where there the lack in food production (Mohamed Osman, 2010). Another has to be considered that organic farming consumes less inputs and energy up to 35-55% (Pimentel *et al.,* 2005). Although this less productivity also give less economic return but the added values to organic products will fulfill and maximize the profit of such products (Løes, 2014).

III. Organic Farming in Sudan

a) Experience: modern organic farming vs. traditional models

There are little small modern organic farms for vegetables in and surrounding Khartoum state. Many of fruits producers for export seeking to get organic certificates (e.g. mangos and melons). The lack of official body giving organic certificates limited this experience to expand. In addition profit losses of the adding values of organic products.

The traditional models classically all are organic. The most famous model is rain-fed agriculture in small scale and in a large arable soil (Gadarif, Blue Nile, and Western Sudan). Also the irrigated narrow shallow in River Nile banks In Khartoum state, River Nile state and Northern state. In additional Flood Plain it is seasonally varied depending on the flooding of River Nile and its branches using it for cultivation and fishing (Zaroug, 2006). The forest natural products (Gum Arabic, Nabk , Gudiam, tabaldi, tamrinedus (Aradiab) in poor and rich Savanna sector) is very important system (Abdel-Rahman, 2011) that give cash crops such as gum Arabic and serve for a wide range of public as food and drink stuff (Abdel-Rahman, 2011).

Natural fodder grazing animals' products (dairy, meats and eggs) in many states (Zaroug, 2006). Even if the production is organic using pesticides for post harvesting preservation (Sesame) (Papadakis *et al.*, 2006), and artificial additives in food processing (esp. in meat) minimized the added values of organic processing products especially in exportation. More studies are needed to maximize the values of these traditional systems and getting the benefit of the added values of organic products and proper competitive processing for marketing.

b) Limitation of organic farming expanding in Sudan

There are many organic inputs existing in the local Sudanese market. Some are locally produced and some are introduced with varied quality especially in term of bio-organic fertilizers (Elhassan *et al.*, 2010). On the other hand, 7% of registered pesticides are biopesticides is about 18 trading mark, but about 5-6 active ingredients mostly are bacterial origin. The problem the farmer preferable is price wise and he used it in conventional system with other chemical fertilizers and pesticides (Hamad A. M.A, personal communication, 2017).

The traditional organic outputs (e.g. the forest natural products as mentioned before) most of the time is underestimated (Jens et al., 2002) because of bad packing, processing and handling and sometimes added artificial additives or colors. Furthermore, there is no good labeled system and most of the goods treated and managed traditionally and even getting worse (Osman, 2010).

The lack of regulation, rules and guidelines for organic farming, the administrative control gap, inspection gap, extension gap, the food gap and lastly the profit or benefit limitation weak the expanding in the organic farm marketing (Mohammed, 2010).

The suspected farmers and consumers, and the receptor market for products (locally and outside) is exist but the lack of leading or organizing body in such direction is key lock for the organic products.

c) *Problem shooting (false practices)*

The market is open and there are many immature and incompatible types of compost without any control (Elhassan *et al.*, 2010]). Water availability is major limiting factor in agriculture in Sudan (Malik, 2010). So, the late rainfall or lack of energy for irrigation systems let those who added organic fertilizers suffer from the dryness (burning of organic matter); therefore, the application of organic fertilizers is very limited especially in rain fed system (Osman and Ali., 2010). Contaminated water and handling is a major issue to solve to upgrade all agricultural systems including organic products. Manure misuses, immature young manure can refer to the poor trained farmer (Osman, 2010). Waste treatment in Sudan still in childhood and the added values of treated sludge as organic fertilizers is almost zero. Urban agriculture is another big catastrophe where extensive fertilization and pesticides are used to cover the gap of food without any visible control. Even to those are honest and having save organic products they lack the official body who can release the organic certificates.

d) *Future prospects*

Modern organic farming system is not a nightmare but it is a dream need a little organized effort in inspection; agricultural advices in extension pursues for the farmers and the producers. Raising the public awareness in this issue is the hottest spot and the role of recent official and social media cannot be ignored (). Animal insertion in urban agriculture (e.g. chicken and goats) animals' health and welfare is other left hand to upraise the organic farming. It concludes that in a phrase of farmers' motivations and formal regulations.

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Table 1: Nutrients Content of Organic Vs. Conventional Crops. (Worthington, 2001)

Vitamin C	+27	Iron	+21
Proteins	+12	Manganese	+28
Essential amino acids	+35	Copper	+34
Calcium	+56	Nitrate	-15
Potassium	+13	Phosphorus	+16
Magnesium	+49	Iodine	+50