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ON

Organic Farming Practice for Sustainable Agriculture

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Organic Farming Practice for Sustainable Agriculture[1]

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Abstract

Agriculture is the most important component to meet up our food requirement. Various agricultural practices are adopted worldwide. Now in Bangladesh, organic farming is the best way to make agriculture more sustainable. Govt. and NGOs are giving emphasis on organic farming practice and encouraging the farmers for adoption this practice. Organic farming is an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity. Sustainable agriculture is the act of farming using principles of ecology, the study of relationships between organisms and their environment. Sustainable agriculture maintains our environment in a balanced way. Pesticide using tendency gradually increases due to produce more HYV crop for increasing population. As a result, soil and environment become more polluted. To overcome this problem, different crops are cultivated in organic way including brinjal, tomato, rice etc. These crops yield better in combination with organic and inorganic method. Mulching, crop rotation, composting, green manuring etc are different methods of organic farming. Different experiments are conducted using organic fertilizer. These experiment showed that, fruit size, diameter, yield are higher in organic methods than inorganic methods. Combined technique of organic and inorganic cultivation can fulfill the sustainable agriculture.

Key words: Organic fertilizer, Yield

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CHAPTER I

INTRODUCTION

Agriculture is the basic support for living of dominance of the population in the world. Different agricultural practices are adopted worldwide. These practices include organic farming. “Organic farming is an agricultural classification that promotes environmentally, socially and economically sound production of food, fiber, timber etc. In this system, maintenance of soil fertility is considered as the key to successful production. “It avoids the use of chemo-synthetic fertilizers, pesticides. It also includes social considerations” (IFOAM, 2005)

Organic farming (OF) is one such technology that can reduce the detrimental impacts of agrochemicals, and is considered by many scientists to be the best form of agriculture 1960 s (Hossain, 2001). The people all over the world are expressing great concern over the indiscriminate use of chemicals. Therefore, importance is now focused on the use of organic and other by-products of agriculture and industries (Mishra, 2005). Scientific researchers have shown that the reduction or non-use of synthetic chemicals can lessen environmental hazards and possible adverse effects. In contrast to synthetic fertilizers, organic fertilizers could develop the physical, chemical and biological properties of soil, and its use is important in sustaining soil productivity in the long term (Rahman, 2007). Organic farming may be a good choice as an economical method that can trim down rural poverty and curb pollution. It is also the need in the present day perspective of a serious threat to our ecology and environment (Patil et al., 2010). The farming method is the best means to make sure the air, water and soil uncontaminated leaving the environment safe for the present and future generations (Peter, 2004). For a sound future, organic farming offers a dynamic interaction between soils, plants, humans, ecosystem, environment (IFOAM, 1996). Organic farming is the best approach in terms of maximizing cost-effectiveness and minimizing pollution (Christian et al., 2005).

According to Veeress (2004), organic farming is both a philosophy and a system of agriculture which contains all agricultural systems that promote the environmentally, socially and economically sound production of food and fiber. The organic production combines best environmental practices, preservation of natural resources, animal welfare standards while

confirming no use of genetic engineering, pesticides, additives, or fertilizers; each stage of the organic food production being controlled and certified (Chryssohoidis and Krystallis, 2005).

Organic inputs alone will not meet the nutritional needs of crops because they contain a comparatively less quantity of nutrients compared to inorganic fertilizers, the need to integrate the two forms in order to achieve better crop yields. The interaction between organic matter and inorganic fertilizers may lead to either an increase or decrease in nutrients in soil depending on the nutrient and plant material in question (Francis and Wart, 2009).

On the other hand, sustainable agriculture refers to agriculture where the agro-eco-systems function on self-sustaining basis of nutrient supply and crop protection in order to stabilize the crop yields. Sustainable agriculture involves practices such as organic farming, biological and natural control of pests, an emphasis a watershed approach to conserving the soil and water, the buildup of micro flora in close harmony with beneficial soil - inhabitants and complete desisting the use of synthetic chemicals.

Many researchers also suggested that organic agriculture is effective in poorer countries and it can provide socio-economic and ecologically sustainable development. It can overcome the harmful impacts of the green revolution (IFOAM, 2008)

Due to increasing the use of chemical fertilizer and insecticide natural hazards occur frequently worldwide. Men have to depend on food that has the greater residual effect of these pesticides and fertilizers. The environment is badly affected. Soil fertility reduces. To overcome these problems practicing organic farming could be the best option.

The objectives are as follows

The present review findings have been directed with the following specific objectives:

- To review the status of organic farming practice in the world with emphasis on Bangladesh.
- To ascertain the different practice of organic farming in Bangladesh.
- To evaluate the effect of organic farming practice on some crops.

CHAPTER II

MATERIALS AND METHODS

This seminar paper is exclusively a review paper. It has been prepared by reviewing the various articles published in different Books, Proceedings, Abstracts, Review papers, Journals, Online Resources, MS thesis and PhD Dissertations etc. available in the library of Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh. Valuable suggestions from honorable major professor and other resource personnel were taken into account to enrich the paper. After collecting necessary information, it was compiled and arranged chronologically for the fulfillment of the objectives.

CHAPTER III

REVIEW AND DISCUSSION OF THE FINDINGS

3.1Current world status of organic agriculture

According to the latest FiBL/IFOAM survey (2016) on certified organic agriculture, there are 42.3 million hectares of organic agricultural land (including in-conversion areas) in 160 countries. In terms of area, Oceania (12.1 million hectares) covers the top amount of land, followed by, Europe (7.8 million hectares), and Latin America (6.4 million hectares). Development of the organic industries in Australia, New Zealand and the Pacific Islands has been strongly influenced by quick growing overseas demand. On the other hand, Australia, Argentina, and the United States have the most organic land area. At present, 0.9 percent of the world's agricultural land is organic. Growth is strongest in Europe. The countries with the largest increases are Argentina, Turkey, and Spain (Willer and Kilcher, 2011)**.**

Figure1. Land under organic management by region.

(Source: FiBL / IFOAM, 2006)

Present status of organic farming land in the world

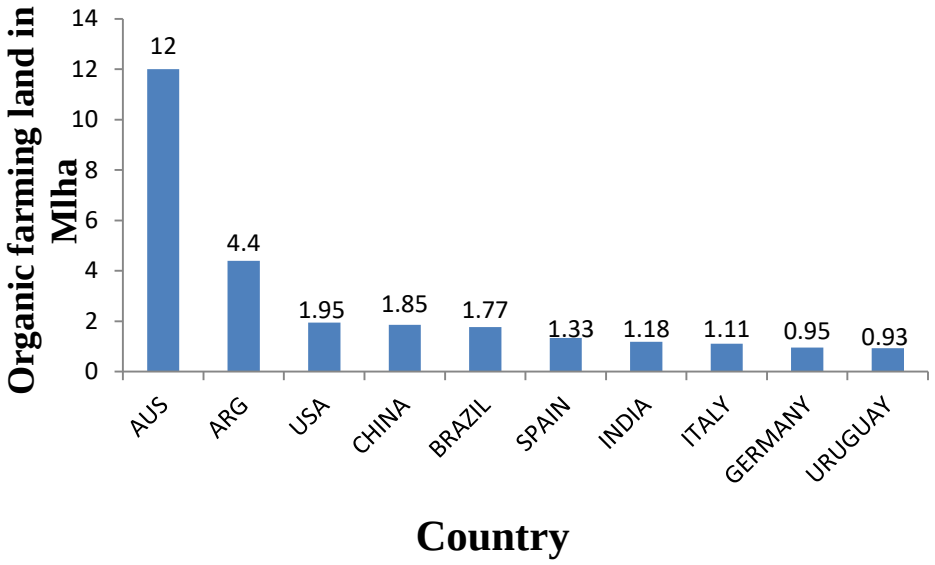

Figure2. The ten countries with the most organic agricultural land.

(Source: FiBL and IFOAM, 2010)

3.2Organic farming status of Bangladesh

Bangladesh had long tradition of organic practices but it is termed as default by nature. Organic farming as a movement in Bangladesh was initiated by the non-government organizations (NGOs). More than 200 NGOs are trying to spread out the concept of sustainable agriculture. Three groups of rice farmers have been interviewed from different location of Bangladesh belong to Proshika, Farmers voice and traditional from three diverse locations namely, Jhenidah (South-western), Barishal (Southern) and Tangail (Central) district. The entire group started organic 2006-2007 and most of the farmers have passed five years. The soil was treated with 7-8t/ha compost or cow dung and homemade organic fertilizers like vermicompost and quick compost. To control insect piercing was practices and some botanicals are often use. The results of T Aman rice are given below.

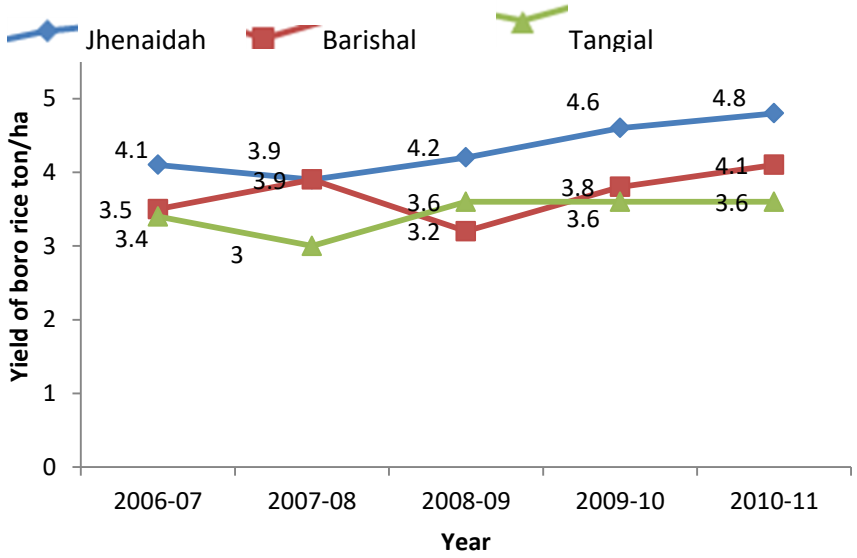

Figure3.Production of Boro Rice under organic practice.

(Source: Uddin and Halim, 2012)

It was revealed that boro rice have been increased over the year irrespective of the location.

Through FGD and secondary information some experiences on growing organic vegetables are cited below.

Morgina (Jhenadah) and Malek (Tangail) shared the experiences on vegetables production. Morgina started organic vegetables production since 2004, she also started vermicompost on 2001. Malek started on 2001 after getting training from Proshika with his other friends. Both are commonly grow cucurbits (Bottle gourd, Bitter gourd, cucumber pumpkin etc.) brinjal, amaranth and spinach with the locally cultivar. According to their statements initially they faces massive barrier from their family and neighbors. They opined after getting first year production and consumption all were supported the activities. Even they sell their product fast compared other conventional growers although they did not received extra benefit from their sale. Both the farmers protected their crop by applying fermented formulation of Neem leaf, Mehagoni fruit, Bishkatli at a week interval.Farmers of Bangladesh use huge chemical inputs for getting the more production. Therefore, government and 14 NGOs have been inspiring and training farmers to introduce organic farming. About 440,000 farmers were given season long and practical

training in IPM during that period. With the joint effort of government and NGOs, Bangladesh became the 2nd country in Asia under organic management (177,700 hectares – 2% of total area) (IFOAM, 2006). In Bangladesh, NGOs are helping more than govt. to adopt organic farming in Bangladesh. Observing the benefits of cultivating organic crops by the NGO farmers, a small number of non NGO conventional farmers have started to cultivate organic crops. Among the few private companies that have started to invest in organic farming, Kazi and Kazi Ltd. is a leader. They have established an organic tea garden at Tetulia, in the Panchagarh district. This tea is certified by the SGS organic production standard in accordance with the EU Regulation 2092/91, and it is marketed as "Meena Tea" (Tea International 2005). This company also produces fresh organic vegetables and herbs for sale in their supermarket, "Meena Bazar," in Dhaka city. Proshika and Nayakrishi farmers adapted their land into organic from 12 to 15 years while BARI contact farmers from 7 years, Kazi tea – 5 years. DAE farmers are using less quantity of chemicals from 4 to 7 years.

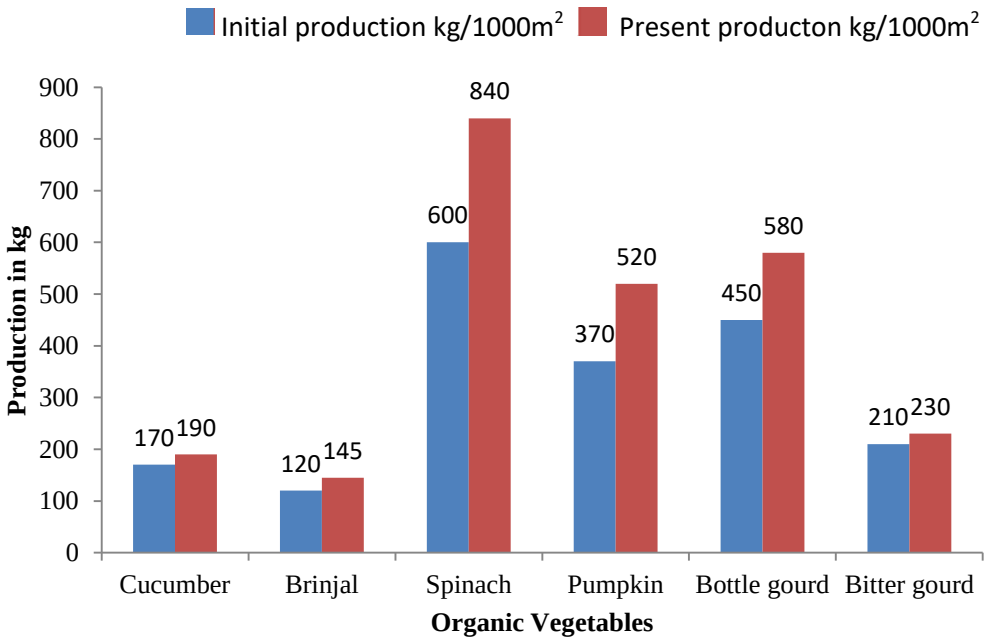

Figure4.Average yield of different vegetables to organic growers.

(Source: Uddin and Halim, 2012)

3.3Organic and eco-friendly practices in Bangladesh:

The progress of organic agriculture in Bangladesh is very slow. Yet we have been able to convert only 1,162 ha of area so far, which is a mere 0.01 percent of the cultivated area (Paul and Henning, 2011). Though government policy is always to promote "grow more food", several eco-friendly projects have been implemented through the Department of Agricultural Extension (DAE) with support from different aid agencies since 1980's. But still there is no standard; inspection and certification system exists in the country. Organic growers, promoters and sellers are working scattered. Due to lack of standards, organic products cannot compete or enter into the world market and also failed to get confidence of internal consumers. However, in Bangladesh, eco-friendly agriculture is practiced from three different levels: NGO, private and government

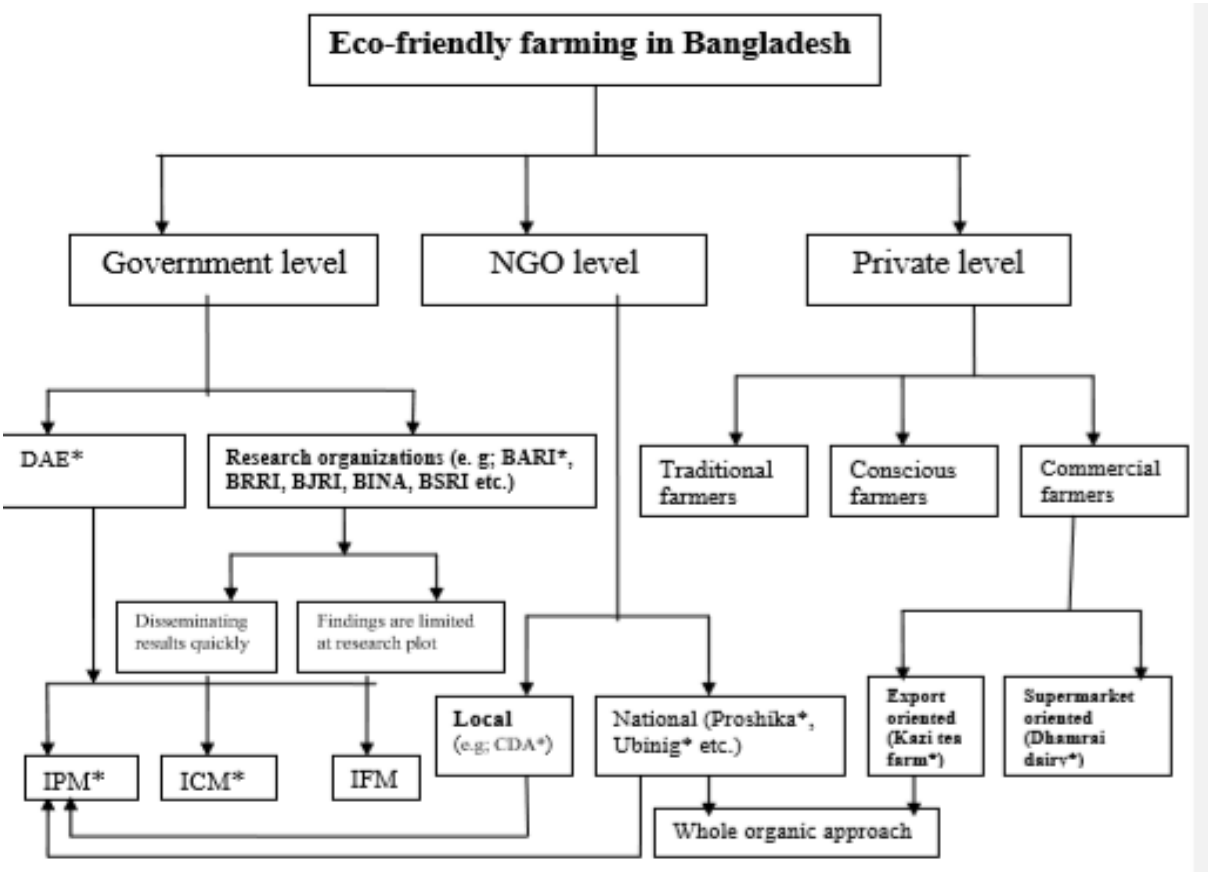

Figure 5.Organizational structure of eco-friendly farming in Bangladesh.

(Source: Hoque, 2012)

3.2Organic farming through different farming practices in Bangladesh:

3.2.1insect management through resistant variety:

Brinjal shoot and fruit borer is a public insect in Bangladesh but now BSFB resistan variety is available. In case of shoot infestation, the varieties/lines Katabegun WS, and Marich begun were found to be tolerant while the varieties/lines Amjuri, Borka, Dharola, Kajla, and Uttara were found to be moderately tolerant.

Table 1. Shoot and Fruit borer resistance brinjal varieties in Bangladesh.

Types of infection	Level of resistance	Varieties
Shoot infestation	Moderately tolerant	Amjuri, Borka, Dharola, Kajla, Uttara
	Tolerant	Katabagun, Marich Bagun
Fruit infestation	Moderately tolerant	Amjuri , ISD 006
	Tolerant	Thamba, Katabegun WS

(Source: Ahmad et al. 2008)

In case of fruit infestation, the varieties/lines Thamba and Katabegun WS were found to be tolerant while the varieties/lines Amjuri and ISD 006 were found to be moderately tolerant.

3.2.2homestead farming

Vegetable and fruits are grown in the homestead. There are two million homestead in Bangladesh and average farm size is 0.05 ha. Women play vital role to produce vegetables and fruits from the ancient time and ensured the household food and nutrition security cucurbits, chilli, brinjal and papaya are common for vegetables and mango, banana, ripe papaya, carambula, wood apple, ber, olive, jackfruit for fruits. Organized certification may ensure organic product large extend.

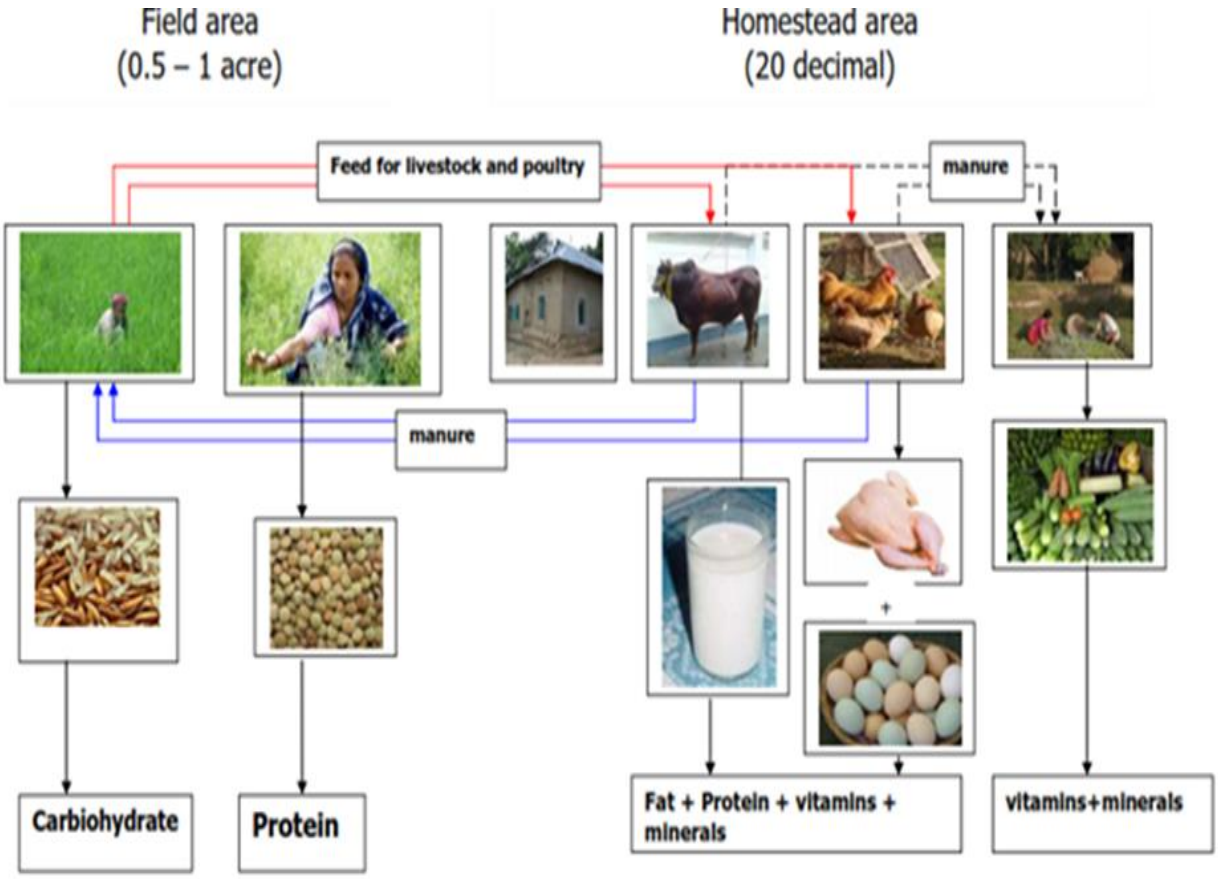

Figure6.Organic product by homestead farming.

(Source: Hoque, 2012)

3.2.3 biological control

Brinjal fruit and shoot borer, Leucinodes orbonalis Guenee (Lepidoptera: Pyralidae) is a vicious and first ranked insect pest constraint of eggplant production in almost eggplant growing areas of the world (Mainali et al., 2013). In table 3, showed that Trichogramma had 11 species, Bracon13 had 3 species and others had 2 species. Bollworm is controlled by Trichogramma, Bracon, Chelonus, and Chrysoperla. Pod borer can be controlled by Trichogramma, Bracon, Chelonus and Chrysoperla.

Table2. Some Species and number of bio-control agent.

Bio-Control Agents	No of species	Pest
Trichogramma	11	Bollworms and Borers
Bracon	3	Bollworm and Pod borer
Chelonus	2	Bollworm and fruit borer
Chrysoperla	2	Sucking pest ,bollworm
Neochetina	2	Weed
Encarsia	2	White Fly, Scale insect

(Source: Sharma et al., 2014)

3.2.4 Different approaches of organic farming

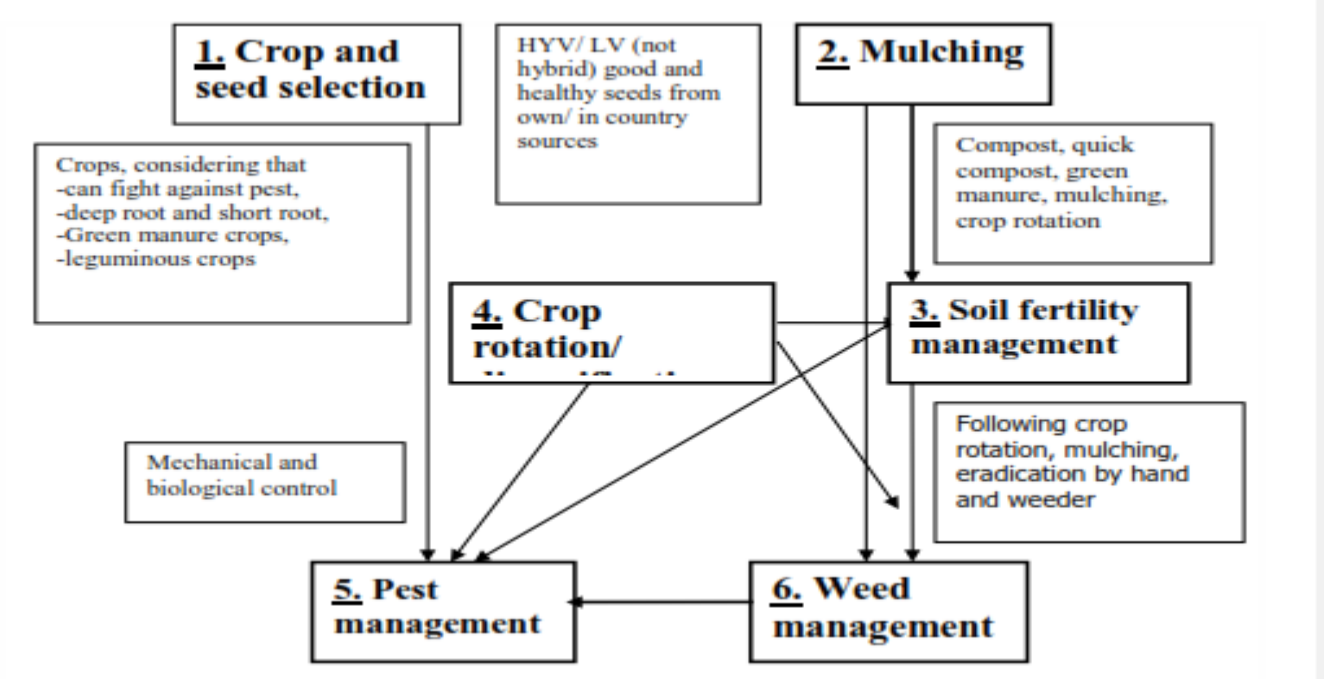

Figure7. Main crop production practices of Proshika and UBINIG.

(Source: Hoque et al., 2012)

Diversity in crop production:

In some standards, diversity in crop production or crop rotation is included in the soil fertility management; while in some other standards, it is considered as a separate section. IFOAM states that soil management is the foundation of organic production. Therefore, organic growing systems care for the soil and surrounding ecosystems and provide support for a diverse species that shall be ensured by minimum crop rotation and/or variety of plantings. Minimum standards for perennial crops shall be set the certifying body. EU regulation and Indian organic classification also follows the same rule (IFOAM, 2005a).

Rotations

Growing the same crops in year after year reduces soil fertility and encourages a build- up of pests, diseases and weeds in the soil. So different types of crops should be moved to a different area of land each year. For vegetables a 3 to 4 year rotation is better as a minimum. Crop rotation brings the time where the fertility of the soil is being built up.

Crop rotation helps a variety of natural predators to survive on the farm by providing habitats and sources of food for them. A typical 4 year rotation includes a cycle with maize and beans, a root crop and cereals with either of the following;

1. Bush (a fallow period where no crops are grown).
2. A legume crop where a green manure, which is a plant grown mainly for the benefit of the soil, is grown

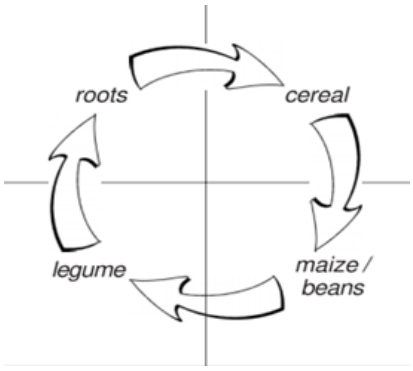

Figure8. A simple rotation that includes a legume

(Source: HDRA, 2008)

Soil fertility and fertilization:

Among all production practices, soil fertility management differs noticeably from one standard to another. According to basic IFOAM standard, nutrient losses from the farm should be minimized. Nutrients should be used in such a way and at appropriate times and places to optimize their effect. Material of microbial, plant or animal origin shall form the basis of the fertility program (IFOAM, 2002). Limitations could be on the basis of location, timing, methods, treatments, or inputs applied. Mineral fertilizers shall only be used (if necessary for maintaining long-term fertility) together with other techniques such as organic matter additions, green

manures, rotations and nitrogen fixation by plants. Mineral fertilizers (that are included in the positive list) shall be applied in the form in which they are naturally composed and extracted and shall not be rendered more soluble by chemical treatment. Chilean nitrate along with all synthetic nitrogenous fertilizers, are prohibited (IFOAM, 2005a).

Manure and compost

Composting is not required in IFOAM standard, but it is mentioned that private standards may have considerably stricter requirements of composting, its origin, quality and quantity (IFOAM, 2005a). EU has limitations on the origin of manure. Conventional manure may be used if it originates from 'extensive animal husbandry' and composted conventional manure may be used unless it comes from 'factory farming'. Japanese standard requires all manure must be composted (EU Regulation, 2007). The US Standard has requirements for composting of manure regardless of origin. The standard regulates how manure is used in organic production to prevent microbial contamination. If farmer uses manure during the growing season, it must be thoroughly composted using a high temperature process (131- 1700 F) for at least 3 days if he use it in static aerated piles; 15 days, for a frequently – turned window system. Application may not occur within 90 days of harvest for fruits and vegetables. Whose edible portion does not touch the ground or receive ground splash. For those crops whose edible portion does contact the soil or soil particles, applications may not be made within 120 days of harvest. Worm-composted manure (vermicompost), dried manure, guano, manure tea and compost tea have the same restriction as uncomposted manure (Kuepper, 2007).

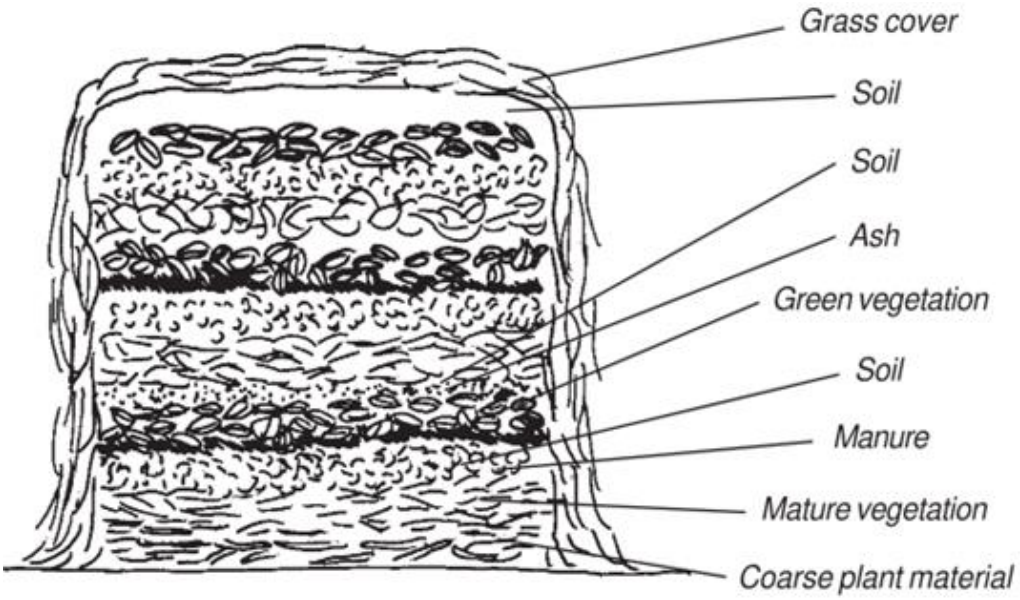

Figure 9.The layers of a compost heap.

(Source: HDRA, 2008)

Compost has many advantages over chemical fertilizers. These provide nutrients for plants but do not improve soil structure. They usually only improve yields in the season in which they are applied. Because compost feeds soil life and improves soil structure, the beneficial effects are long lasting.

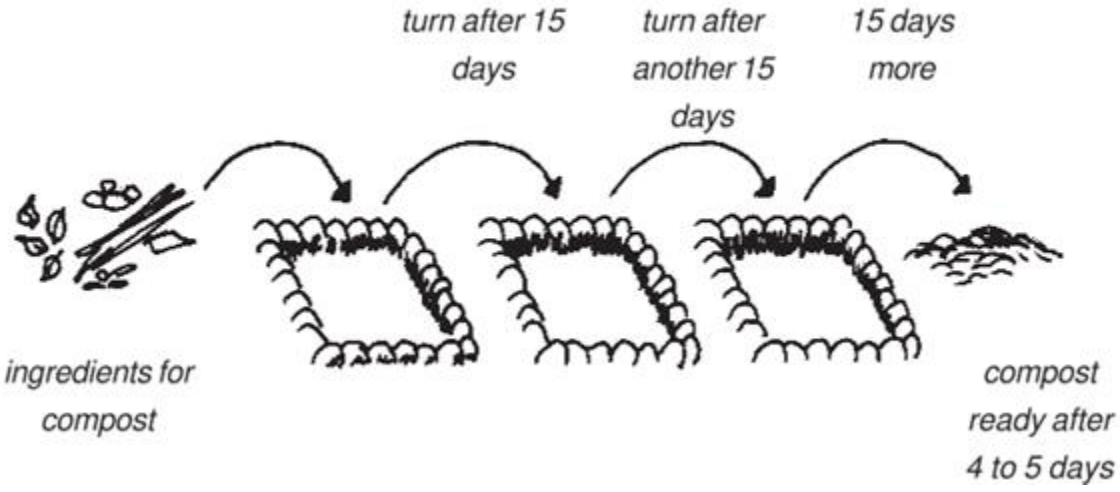

Figure10. Peat composting

(Source: HDRA, 2008)

Pest, disease, weed and growth management:

Organic farming systems apply biological and cultural ways to prevent undesirable losses from pests, diseases and weeds. According to IFOAM rule, these problems are managed by the knowledgeable application of one, or a combination of the measures: “Choice of species and varieties that are well locally adapted to the environment, crop rotation programs, Physical or mechanical cultivation, protection of natural enemies, predators, creating ecological or environmental buffer zones, diversified ecosystems. Intercropping, thermal weeding, seed bed preparation, acceptable biodynamic preparations from stone meal, farmyard manure or plants/household manure, mulching and mowing, grazing of animals, mechanical controls such as traps, barriers, light and sound” (IFOAM, 2005a).

3.3.1The nutrient content of the commonly used organic fertilizer

The nutrient content of the commonly used organic fertilizer in the country is shown in Table 3 (Islam, 2006).

Table3. Nutrient concentrations in commonly used organic fertilizers of Bangladesh.

Organic fertilizers	Nutrient content%		
	N	P	K
Cow dung	0.5-1.5	0.4-0.8	0.5-1.9
Poultry manure	1.6	1.5	0.85
Compost	0.4-0.8	0.3-0.6	0.7-1.0
Farmyard manure	0.5-1.5	0.4-0.8	0.51-1.9
Water hyacinth compost	3.0	2.0	3.0
Bioslurry(cow dung)	1.29	2.80	0.75
Bioslurry(poultry litter)	2.73	3.30	0.80
Rice straw	0.52	0.25	1.20
Wheat straw	0.63	0.28	0.80
Maize stove	0.45	0.30	0.70
Sugarcane trash	0.35	0.25	0.80
Tobacco stems	0.42	0.25	1.10

(Source: Islam, 2006)

Grameen Shakti (2006) conducted an observational field trial in Grey Floodplain soils in Manikganj to study the effects of cow dung and poultry litter bioslurry on cabbage, brinjal an tomato during the Rabi (winter) season of 2005-06. Treatment combinations were: Control (native fertility), 100% RD (recommended dose), and 50% RD + CD bio slurry (2t/ha), 50% RD+PL bio slurry (2t/ha), 10% RD+ CD bio slurry (2t/ha) and 10% RD+ PL bio slurry (2t/ha). Sun dried bio slurry was added at the rate of 2 tons/ha in two installments- first installment was applied along with chemical fertilizers at the time of planting and the second installment as top dressed after 30 days of planting. All the crops responded dramatically to added bio slurry. The results of the field trials are summarized in Table 4

Table4. Effect of bio-slurry on the yield of cabbage, *brinjal* and tomato

Treatment(T/ha)	Cabbage(T/ha)	Brinjal(T/ha)	Tomato(T/ha)
Control(native fertility)	10.00	5.00	6.50
100%RD	56.50	26.30	24.00
50%RD+CD bio slurry	58.60	24.00	25.00
50%RD+PL bio slurry	60.00	25.00	27.00
10%RD+CD bio slurry	44.00	15.00	16.00
10%RD+PL bio slurry	48.00	17.00	18.50

CD-Cowdung,PL-Poultry liter,RD-Recommended dose for cabbage-N_{150} P_{60} K_{120} S_{30} kg/ha,RD for Brinjal-N_{150} P_{60} K_{120} S_{30} kg/ha, RD for Tomato-N_{150} P_{60} K_{120} S_{30}

(Source: Islam, 2006)

A field experiment was conducted at the Horticultural Farm of Bangladesh Agricultural University (BAU), Mymensingh during the period from December 2004 to April 2005 to evaluate the effect of manures and fertilizers on the yield of brinjal. There were five treatments consisting of organic, inorganic and combined sources of nutrients, of which the combined treatment (60 % organic +40% inorganic) showed the best performances. The maximum branching (20.1) with the highest number fruits/plant (15), fruit length (14.1 cm) and fruit diameter (4.3 cm) were found combined application of manures and fertilizers. The highest yield (45.5 t ha^{-1}) was also obtained from the combined application of organic and inorganic sources of nutrients.

Table5. Effect of organic and chemical fertilizer on growth, yield and yield contributing characters of *brinjal*

Treatment	No. of branches per plant	Length of fruit(cm)	Diameter of the fruit(cm)	No. of fruit per plant	Fruit weight per plant(kg)	Fruit yield(t/ha)
T1=Cowdung	15	10.01	2.52	11	1.49	36.65
T2=Mustard oil cake	17	12.05	2.96	13	1.72	40
T3=Poultry manure	18	13.42	3.09	14	1.88	42
T4=Chemical fertilizer	16	11.03	2.77	12	1.53	39
T5=Organic+inorganic	20	14.11	4.3	15	1.97	45.5

(Modified)

(Source: Ullah *et al.*, 2008)

The effects of biogas slurry (it used to be called "gobargas" slurry due to "gobar" or dung being a predominant feedstock for biogas plants) on the yields of a number of crops were studied (Maskey, 1978). The table below summaries the yields of these crops.

Table6. Effects of biogas slurry on paddy, tomato, cauliflower, French bean, wheat and maize.

Crops	**Yield t/ha**	
	Without slurry	**With slurry**
Paddy	2.7	3.0
Tomato	15.0	17.8
Cauliflower	4.6	5.6
French Bean	0.3	1.0
Wheat	1.2	1.8
Maize	1.7	2.7

(Source: Maskey, 2014)

A field experiment supported by a laboratory analysis was conducted to evaluate the performance The experiment was laid out in a Randomized Complete Block Design (RCBD) with 3 replications and comprised of six treatments *viz.*, T0 - Control, T1 - Recommended fertilizer Dose (RFD), T2 – 60% RFD + Poultry Manure (PM), T3 - 60% RFD + Poultry slurry, T4 - 60% RFD + Cow-dung (CD), T5 - 60% RFD + Cow-dung slurry. of bio-slurry on the production of tomato on floodplain soil during November 2011 to April 2012.

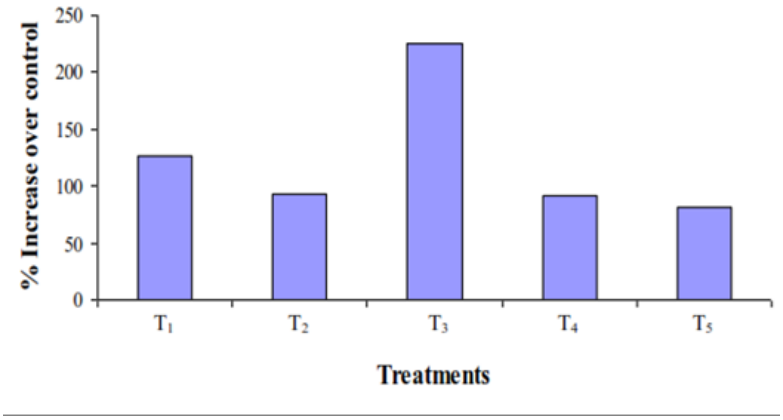

Figure11. Showing growth of tomato in different treatments in graph.

(Source: BAU, 2012)

T_0: Control

T_1: 100% RFD

T_2: 60% RFD + Poultry Manure (PM)

T_3: 60% RFD + Poultry Bio-slurry

T_4: 60% RFD + Cow-dung (CD)

T5: 60% RFD + cowdung bioslurry

Figure12.Growth of tomato in different parameters.

(Source:BAU, 2012)

An experiment was carried out at Bangladesh Academy for Rural Development (BARD) demonstration field to assess the effectiveness of organic waste compost made from household and cafeteria refuse on insect-pest suppression and yield of brinjal during the period of May-September, 2012.

Table7. Effect of compost and fertilizer on the yield of *brinjal*

Level of fertilizers	**Average weight per fruit(gm)**	**Yield (M.ton/ha)**
T1=4t compost/ha	44.83	9.63
T2=8t compost	47.78	21.24
T3=50% NPK+8t compost	48.61	21.61
T4=100% NPK	47.8	18.77

(Source: Munshi, 2014)

CONCLUSION

In the world, maximum organic farming are practiced in Europe about 2.9 mlha and in Asia it is about 2.9 mlha .Organic farming land is highest in Australia. In Bangladesh, About 200 NGOs are trying to spread out the organic farming practice among farmers. Government and NGOs have been encouraging and training to introduce organic farming in Bangladesh.

On the basis of above discussion, organic farming practice is performed by farmers such as homestead farming, use of resistant variety, biological control that increases the productivity. Organic agriculture is environmentally safe and eco-friendly.It has been observed different farming approaches.

All the organic manures used significantly enhance growth, yield and fruit quality of crop. Organic fertilizers can avoid or reduce the deleterious effects attributed to the use of chemical fertilizer. From the above discussion it may be concluded that in crop production combined application of organic and inorganic sources of nutrients can be more productive and this will also sustain the fertility and productivity of soil.

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