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Full Length Research Paper

Organic farming and sustainable development in Ethiopia

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The main objective of this paper was to find out the feasibility of organic farming as a part of sustainable development in Ethiopia. The average total cost of chemical fertilizers and biofertilizers used for one hectare of land per year for various crops was calculated to be US$ 150 and US$ 40 respectively while for chemical pesticides and biopesticides, it was US$ 100 and US$ 25 respectively. The total estimated cost of crop production per hectare per year for organic farming was US$ 190 (1634 Ethiopian Birr) and for inorganic farming, it was US$ 320 (2752 Ethiopian Birr). The cost of production for organic farming was about 40.6 % less than that for inorganic farming. The calculations were also done for estimation of total nutrients and other substances required for organic farming for the whole country. In organic farming, the important nutrients required for total agricultural land of country were found as compost/ vermicompost 3.25 x 10^{10} ton, poultry manure 3.2 x 10^{9} ton, FYM (Farm Yard Manure) 9.7 x 10^{7} ton and biopesticides 1.6 x 10^{10} ton. The present status of organic components available in the country was compost/vermicompost 1.6 x 10^{11} ton, poultry manure 8.5 x 10^{9} ton, FYM 1.8 x 10^{10} ton and biopesticides in abundant quantity. As the resources are in abundance for organic farming, hence-forth might be a good opportunity for diverting from inorganic farming to organic farming system and as a result, sustainable development could be achieved in the country.

Key words: Inorganic farming, organic farming, sustainable development.

INTRODUCTION

Ethiopia is a land-locked country known as 'Horn of Africa'. It has diversed topography, encompassing mountains over 4000 m above mean sea level, high plateaus, deep gorges cut by rivers and arid lowlands. The mean annual rainfall is highest (above 2700 mm) in the southwestern highlands and lowest in the northeastern lowlands (100 mm) (Ininda and Befekadu, 1987). The mean temperature ranges from a highest of 45°C (April – September) in the afar depression to 0°C or even lower during night in the highlands (November - February) (Ward and Yeshannew, 1990). Understanding the nature of the Ethiopian climate, it is important to know the pattern of food production and environmental sustain-ability. There are mainly four seasons in Ethiopia namely Kiremt, Tsedey, Bega and Belg (NMSA, 1998).

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These seasons determine the seasonal farming activities such as land preparation, sowing and planting, weeding and harvesting. "Kiremt" is (June- August) the main rainy season in (Kassahun and Bokretsion, 1999) and most of the crops are sown during this season. The "Tsedey" (September - November) is the spring season and is very good for food production and also for health point of view. The "Bega" (December - February) is the dry, windy and sunny season in most highlands of Ethiopia. Farmers harvest their Meher crops during this dry period. The "Belg" (March - May) season is the small rainy period and 5 -10% of crops are produced during this season but in some areas up-to 50% of local food is produced (Kassahun and Bokretsion, 1999) from this season.

Ethiopia is basically an agricultural and pastoral country. About 85% population depends on agriculture for their livelihood. In Ethiopia, there are mainly three farming systems - mixed farming of the highlands (both crops

Table 1. A statistical data of Ethiopia during 2005-2006.

Items	Description
Total population (million)	76.5
Male/Female ratio (%)	51/49
Population growth rate (annual %)	2.7
Adult literacy rate (%)	41.5
Life expectancy (years)	45.5
Rural population (million)	56.9
Urban population (million)	15.4
Population density (km^2)	62
Livestock (million)	78 million (35 million cattle, 25 million sheep, and 18 million goats)
Export (%)	75 (Crops and livestock)
GDP (%)	45 (Agriculture and livestock)
Land area (hectare)	108.5 million hectares-Arable Land 45%, of which; Irrigated 3%; Forests, woodlands and savannas 25%; Other 30%

Source: United Nations Development Programme (Last Updated: February 03, 2006).

and livestock production are integrated), pastoralism in the lowlands and the root crop based farming system (EEA/EEPRI, 2002). Commercial agriculture using the river basins, such as the Awash Basin, is a recent phenomenon (Harris et al, 1998).

Ethiopia is one of the least developed countries in the world and its economy is based mainly on agriculture (Bekalo and Bangay, 2001). It accounts for more than 75 percent of total exports and about 45 percent of its GDP (gross domestic product) (UNDP, 1992). Coffee alone makes up to more than 87 percent of the total agricultural exports (UNDP, 1992). The UNDP has put Ethiopia at 170^{th} rank out of the 175 countries in terms of its development index on HRD (Human Resources Development) scale (HDR, 2004; UNDP, 1992).

The country currently faces a number of environmental challenges resulting directly or indirectly from human activities due to agricultural practices, rapid population growth and the consequent increase in the exploitation of natural resources (Unwin, 1997). The challenges range from land degradation to environmental pollution due to the misguided application of chemicals in agriculture for domestic purposes or for the manufacture of industrial products. The use of agrochemicals by small and marginal farmers is rapidly increasing; and this is in addition to the substantial amounts already deployed on the few large-scale farms, particularly cotton farms (Philippe et al., 2000).

The misuse/overuse of pesticides and fertilizers are damaging human health and polluting the surrounding environment and thus violating the sustainability of ecosystem (Karp et al., 1995). So, environmentally sound farming system is the vision for the society to cope up the problems of chemical based farming system (UNCTAD, 1995). There are several evidences in the literature which are forcing the steps towards organic farming (Buys, 1993). There are also certain cases in literature regarding organic farming of some crops like coffee, cocoa and tea (IFOAM, 1996).

By looking these environmental problems due to this chemical based farming, the government of Ethiopia issued a new policy guideline on Rural Development in World Summit on Sustainable Development, Johannes-burg, South Africa, and 26th August - 4th September 2002. It included the rehabilitation as an essential factor for increasing soil productivity.

The basic aim of this paper is to evaluate the signifycance of organic farming in Ethiopia and its relevance in context to utilize its present natural resources. Thus, ultimately goal of this study is towards the new revolution for sustainable development in this country.

MATERIAL AND METHODS

Survey

The present investigations were conducted at country sites around: Gonder, Jimma, Moyas, Harar and Diredawa towns. These selected sites represented different agro-ecological zones across Ethiopia. Survey was conducted during 2005 - 2006 and 100 farmers were interviewed in each study area using specific questionnaire regarding land use patterns, types of crops growing throughout the year, environmental awareness about significance of organic farming and impact of agrochemicals used for inorganic farming practices among local peoples and availability of organic fertilizers and pesticides. Some secondary data like total geographical area of the country, total population, population growth rate, population density, population distribution in urban and rural sectors, literacy rate, M/F ratio, types and total population of livestock, percent export of the country in terms of agricultural and livestock products and GDP rate of the country were collected from UNDP data source as shown in Table 1.

Farming systems of the country

Study was done about the farming systems in villages situated

Table 2. Different types of crops grown round the year in Ethiopia.

Types	Crops
Cereals	Tef, barley, maize, wheat, sorghum, oats and finger millets
Pulses	Horse bean, field pea, haricot bean, chickpea, grass pea and lentil
Oil crops	Niger seed, linseed, sunflower, rapeseed, groundnut, safflower and sesame
Fruits-vegetables	Citrus, papaya, banana, avocado, mango, cabbage, tomato, hot peppers, pumpkin, onions and garlic
Root and tuber crops	Enset, Irish, sweet and indigenous potatoes, taro, yams, carrot
Cash crops	Coffee, tea, cotton, tobacco, spices, sugar cane and chat

Table 3. Quantity of farming inputs (for inorganic and organic based farming system) in Ethiopia (hectare/year).

Input	Inorganic farming (kg/ha)	Organic farming (Ton/ha)	Cost/hectare (US$)
Chemical fertilizers			
N	100	-	NPK total cost 150
P	50	-	
K	100	-	
Biofertilizers			
Compost/vermicopost Poultry manure	-	5	Total cost
FYM	-	5	40
	-	10	
		30	
Chemical pesticides			
Insecticides and disease controlling substances	70	-	100
Biopesticides			
Insecticides and disease controlling substances (kg)	-	50	25

around five towns round the year to observe their farming pattern; whether it is inorganic based or using natural types of resources with special reference to different seasonal crops. Information was also gathered about various stages of crops grown in Ethiopia as mentioned in Table 2.

Inputs in farming systems

Inputs applied by the farmers in their farming systems were analyzed on the bases of average quantity of major nutrients and pesticides used in organic and inorganic farming. The average total cost (per hectare) of production was calculated for different farming systems from field preparation till the harvesting and yield. The cost comparison for these two different types of farming practices adopted by the farmers was as given in Table 3 and Table 4.

Potential impacts of organic farming

Attempts were made on the potential effects of organic farming on human health, water bodies, livestock, air, soil fertility and biodiversity. All the important impacts of this study were grouped into four categories and these categories included social, economical, agricultural and environment impacts.

Elements for sustainable developments

Studies were based on the actual farm observations for the requirement of different types of nutrients and pesticides for different crops per hectare and average values were taken for calculations of important elements for organic farming and sustainable development for a country like Ethiopia. Our main approach was on the study of natural resources (organic pesticides and organic fertilizers) available in the country, which could support the organic matter based farming system without compromising the total crop production. Measurements were for the total arable land available in Ethiopia for agricultural practices with the help of UNDP data. Then the calculations were made on the basis of total avail-ability of compost/vermicompost, poultry manure, FYM and biopesticides in the country from different sources. Individual amount of compost / vermicompost, poultry manure, FYM and biopesticides was calculated required for the organic farming for the whole agricultural land of Ethiopia. Then assumptions were made for the possibility of sustainable development and organic farming with the present available natural resources (compost/vermicompost, poultry manure, FYM and biopesticides) of the country.

RESULTS AND DISCUSSION

The study was done during 2005 - 2006 in the country site villages of around Gonder, Jimma, Moyas, Harar and Diredawa towns as these locations were covering the four directions of Ethiopia as shown in Figure 1. The total land area of country is 108.5 million hectares and out of this, 45% is arable land out of which only 3% is irrigated, 25% forest, woodlands and savannas and 30% is waste-

Table 4. Average cost (per ha/year) and its comparison for inorganic and organic farming system in Ethiopia.

Activity	Inorganic farming (US$)	Organic farming (US$)
Seedbed preparation	20	10
Fertilizers	50	40
Seeding	10	5
Irrigation	50	50
Thinning	20	10
Weed and Pest management	100	25
Harvesting	50	30
Supervison	20	20
Total cost	**320 (Birr 2752)**	**190 (Birr-1634)**

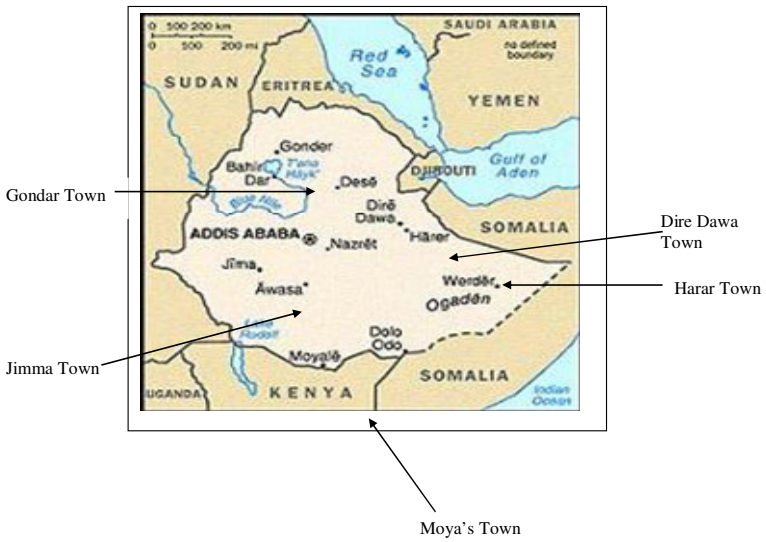

Figure 1. Map of the study sites.

land. Total land available for agriculture in Ethiopia is 3.25 million hectare. From Table 1, it was found that crops and livestock accounts for more than 75% of their total exports and contributes a good percentage towards GDP (45%) of the country.

It was found from Table 2, that the important crops growing in Ethiopia were cereals (tef, barley, maize, wheat, sorghum, oats and finger millets), pulses (horse bean, field pea, haricot bean, chickpea, grass pea and lentil), oil crops (Niger seed, linseed, safflower, rapeseed, groundnut, safflower and sesame), root and fibers crops (nnset, Irish, sweet potato, potatoes, taro, yams and carrots), fruits-vegetables (citrus, papaya, banana, avo-cado, mango, cabbage, tomato, hot peppers, pumpkin, onions and garlic) and cash crops (coffee, tea, cotton, tobacco, spices, sugar cane and chat). The livestock and different types of crops were the important source of income for farmers.

As shown in Table 3, the important farming inputs are NPK fertilizers, herbicides, compost/vermicompost, poultry manure, FYM, chemical pesticides and biopesticides. The total amount required (ha/year) for N, P, and K are 100, 50 and 100 kg, respectively and the total cost of NPK is US$ 100. Biofertilizers required (ha/year) includes compost/vermicompost of 5 ton, poultry manure 5 ton and FYM is of 30 ton and the total cost of biofertilizers is US$ 40.The amount of chemical insecticides (ha/year) required is about 70 kg and its cost is US$ 100. Similarly biopesticides requirement (ha/year) is of 50 kg and its cost is US$ 25 as shown in Table 3.

It is evident from Table 4 that different activities for crop production are field/seedbed preparation, fertilizers, seeding, irrigation, thinning, weed and pest management, harvesting and supervision and the cost of these activeties for chemical farming are US$ 20, US$ 50, US$ 10, US$ 50, US$ 20, US$ 100, US$ 50 and US$ 20 respectively and for organic farming these were US$ 10, US$ 40, US$ 5, US$ 50, US$ 10, US$ 25, US$ 30 and US$ 20 respectively for per ha/year. It was also clear from Table 4 that the total cost of chemical farming for per

Table 5. Elements available/required for sustainable development in context to Ethiopian farming system (ton/year).

Components	Quantity available (ton/year)	Quantity required (ton/year)
Compost/vermicompost	1.6×10^{11}	3.25×10^{10}
Poultry manure	8.5×10^{9}	3.2×10^{9}
FYM	1.8×10^{10}	9.7×10^{7}
Biopesticides	Abundant	1.6×10^{10}

ha/year in Ethiopia was US$ 320 and that was equivalent to 2752 birr (Ethiopian currency) and for organic farming (ha/year) this cost was US$ 190 (1634 birr). From the cost comparison of chemical farming and organic farming, it was found that chemical farming was 40.6% more costly.

Table 5 indicates that the important elements for sustainable development in a country like Ethiopia for organic farming are compost/vermicompost, poultry manure, FYM and biopesticides. The amount required for 3.25 million hectares (total agricultural land) per year for compost/vermicompost, poultry manure, FYM and biopesticides are 3.25×10^{10} ton, 3.2×10^{9} ton, 9.7×10^{7} ton and 1.6×10^{10} ton respectively. The total amounts available per year in country for each category were 1.6×10^{11} ton of compost/vermicompost, 8.5×10^{9} ton of poultry manure, 1.8×10^{10} ton of FYM and biopesticides are in abundance. On the basis of data mentioned in Table 5, it could depict that the amount of essential elements for sustainable development in Ethiopia are in sufficient amount.

There are some assumptions of this study regarding the organic farming for its social and economical impacts, agricultural and environmental impacts. According to the belief, the social impacts included better health conditions, more employment generation, decreasing rural migration, storage for longer period, eco-friendly work environment and better education opportunities. The important economical impacts may be organic farming will be 40.6% cheaper than chemical farming and hence income security in peasant, reduction of cash investment, more return, low risk and self-sufficient and stronger rural economy. Impact on agriculture can be conservation of germplasm, balanced food-quality, soil fertility and microbial activities, tolerance against pest/diseases, self-dependent and stable production system and the possible impacts on environment may be in terms of reduction of soil pollution, maintenance of soil nutrients and soil microorganisms, control on soil erosion, protection of biodiversity, check on air and water pollution and sustainable production.

Conclusion

Ethiopia is a country of farmers and 85% of its population is engaged in farming activities. From the ongoing research, it is clear that the scope of organic farming is bright in this country and it is about 40.6% more economical than inorganic farming. Organic farming will help the farmers to maintain the similar returns with less input. It is also environmental friendly and at the same time, maintains the soil fertility and its integrity. This farming system will also help farmers on control over their means of production and greater independence. Finally, it can be concluded that organic farming is the way towards sustainable development for a developing country like Ethiopia. The Ethiopian government may also capture international market of organic products and hence earn more foreign exchange by exporting organic products to even develop countries like USA, Japan, European countries and other neighboring countries.

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