

## Challenges and Benefits of Organic Farming among Farmers in Nembure Division, Embu County-Kenya

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### Abstract

*In appreciating the growing concern on the environmental risks associated with modern agriculture, organic farming has been mooted as an environmentally friendly farming practice. However, organic farming needs to be examined in the view of benefits and challenges associated with it. This paper evaluates the practice of organic farming by examining the challenges and benefits associated with it in Nembure Division of Embu County, Kenya. Descriptive research design was used for the study. Proportionate stratified sampling was used in selecting 37% of organic farmers in the Division. All the twelve agricultural extension officers were purposively selected for the study. Pre-testing of the questionnaires for the organic farmer respondents and the extension officers was done to ensure their validity and reliability. The reliability coefficients obtained for the farmers' and extension officers' questionnaires were 0.79 and 0.82 respectively. Basic descriptive and inferential statistics were used in analysis through a computer package Statistical Package for Social Sciences (SPSS) version 11.5 for windows. High certification fees among 57% of the farmer respondents, labour intensity in double digging (61.7%), conflicting advice on farming techniques (76.7%) and inadequate market incentives for organic produce; constituted the main challenges facing organic farming. Organic farming was found to have helped improve soil fertility and soil-water conservation, thus increasing crop production among 83.3% of farmer respondents. This led to enhanced food security among 90% of the farmer respondents. Sale of surplus meant improved income to 80% of the farmer respondents. The study therefore considered organic farming to be a feasible production system towards sustainable development. The study recommends development of an organic farming policy in Kenya through wide consultation with all stakeholders.*

**Key terms:** Fertilization, Organic Farming, Double Digging.

### Introduction

The negative environmental impacts associated with increasing industrialization of agricultural production and the belief that agricultural problems can be solved by the appropriate use of machines and chemicals has accelerated the development of alternative farming methods (David, 1995; Njoroge, 2000). The initial high yields experienced under conventional agriculture are usually accompanied by adverse side effects sooner or later. The negative side effects include: reduced soil fertility, water pollution and destruction of natural habitat, among others. Lampkin (1994) notes that, developing countries are usually entangled in environmentally unstable production systems which are manifested in severe environmental damage and declining agriculture base, making it even more difficult for real development to take place. This, as Altieri and Anderson (1986) observe, serves to widen the gap between the rich and the poor.

Various reasons ranging from political, economic, socio-cultural and environmental as well as technological have been echoed for advocating and embracing organic farming. Njoroge (1999) and KIOF (1999) are in agreement that organic farming was as a result of failure of green revolution to meet the expectations, especially that of increasing agricultural production. To this end, KOAN (2007) opines that organic farming is a cheap and a sustainable alternative in which farmers can produce without causing health or environmental damages. However, KOAN (2007) while outlining the benefits of organic farming, it has overemphasised the financial benefits at the expense of other aspects which this study has captured. Organic farming has been put forth by many agriculturalists, development practitioners and social scientists as one such alternative for small-scale food producers.

The search for an organic farming as an alternative agricultural production in Kenya started formally in Kenya in early 1980's when the pioneer organic farming training institutions were established. At the same time, a few horticultural companies started growing organic vegetables for export (UNCTAD, 2006). Initial efforts to promote organic agriculture in Kenya were made by rural development non-governmental organizations (NGOs), faith based organizations, individuals and community-based organizations (CBOs), who sought to help rural farmers address the issues of declining agricultural productivity (especially the degradation of soils and the natural resource base), high poverty levels, food insecurity and low incomes, which prevented farmers accessing high cost inputs. The key players in the sector are NGOs including Kenya Institute of Organic Farming (KIOF), based at Juja, Manor House Agricultural Centre in Kitale, the Sustainable Agriculture Centre for Research, Extension and Development in Africa (SACRED-Africa), the Molo based Baraka College as well as the Association for Better Land Husbandry (ABLH) situated in Nairobi.

Compared to conventional farming, the organic farming sector is relatively small but its growth is remarkable (KOAN, 2009). This growth is attributable to the contribution from private sector actively involved in organic produce mainly for export; and the NGOs with special focus in promoting organic farming (Jessica, 2005). Statistics regarding organic farming have not been consolidated which makes it difficult to certainly give the exact acreage under organic farming. However, IFOAM and FiBL (2006), estimate about 0.69% (182,000 Ha) of the total agricultural land in Kenya to be under organic management. By the year 2007, it is estimated that around 30,000 farms had embraced organic farming methods (IFOAM & FiBL, 2006). It's however clear that vegetables and fruits grown organically on large farms have been exported since 1980's. Over time and with the development of organic farming sector, UNCTAD (2006), notes that exports over time, have grown to include products such as dried herbs, essential oils, spices; in addition to products for the cosmetic and pharmaceutical industries (Murage, 2006). Although, most of the new export products are mainly from smallholders, it is difficult to capture and give the contribution of the organic sector mostly occurring in rural areas in Kenya where organic farmers occur sporadically. Thus the contributions of the small holder organic farming to the socio-economic and environmental development were explored by this study.

### ***Statement of the Problem***

Agriculture being the backbone of the Kenya's economy relies heavily on environmental resources. Therefore for Kenya to attain the Sustainable Development Goals and realise vision 2030, environmental conservation must be enhanced through organic farming. Organic farming would contribute greatly to environmental conservation if the challenges and benefits associated with it are well understood. This therefore gave the impetus to the current study.

### ***Objectives of the Study***

The study focused on the following specific objectives:

- i. To find out challenges associated with organic farming in Nembure Division, Embu County.
- ii. To evaluate benefits associated with organic farming in Nembure Division Embu County.

### ***Literature Review***

The proponents of organic farming while strongly highlighting its benefits are not as keen to dissect the challenges facing the organic sector with similar zeal, which may probably influence the adoption of organic farming. This propelled the study to establish challenges inherent in the organic farming practices. Despite the opportunities and bright future for the organic sector, marketing challenges have been a constant headache to organic farmers. According to Shrum (2000), there are no proper marketing strategies which are connecting the producer and buyer and a strategically placed collecting centre. Shrum further argues that organic farming practiced currently in the country centres on crops for distant markets.

KOAN (2009), observes that despite the Africa reputation of producing excellent quality products, the inconsistencies in quality and quantity is the biggest hurdle to get over. That is producing excellent quality one year, and either disappearing the next or failing to make the quality standards. In addition, lack of certification has also greatly hindered the marketing of organic products. Njoroge (1999) notes that, at present there are neither governmental nor privately-enforced standards for the certification of organic products in Kenya. According to IFOAM and FiBL (2006), uncertified organic farming is practiced every country, most particularly in Africa where artificial inputs are both relatively scarce and expensive.

According to Jessica (2005), organic farming has emerged due to problems of food insecurity. Jessica notes that smallholders, more than any other group, are immediately confronted with the problem of food insecurity. In response to the failure of interventionist strategies to increase rural household food security, organic farming has been promoted as a possible solution to food insecurity (Lampkin, 1994; Njoroge, 1999). David (1995) opines that the practice of organic agriculture holds great potential in improving the agricultural system, the wider environment, society, the economy and institutions. Most small-scale farmers are faced with food insecurity and their main objective is to set food on the table every day. Informal indications show that compared to other families, organic producers are more food secure and are able to sell excess produce, enabling them to educate and clothe their children better than other farmers (IFOAM & FiBL, 2006). It was the aim of the study to find out whether these benefits as expressed by Crucefix (1998), David (1995), IFOAM and FiBL (2006) applied to the farmers in Nembure Division.

Despite the potential impact of organic farming to the economy, its contribution to Gross Domestic Product (GDP) is difficult to ascertain, in the East Africa countries as the export councils in the three countries make no distinction between organic exports and non-organic exports. However, in Uganda, the contribution of the organic agriculture sector to overall export competitiveness has been recognized by the Uganda Export Promotion Board through the designation of the "Best Organic Exporter" category among the prize categories of the Presidential Awards for Export Excellence (UNCTAD, 2006). Other surveys have shown a large percentage of consumer interest in organic food were more readily available even to the extent of paying a price premium of 15% or more Njoroge (2000). However, Njoroge (2000) does not state whether the benefits get to the organic farmer producers. This is what the study sought to establish.

## ***Materials and Methods***

### **Research Design**

The study was conducted using a descriptive research design to evaluate organic farming practices, with an aim of finding out the challenges and benefits associated with organic farming. The design was used for the study because it is useful in securing evidence concerning an existing situation as well as identifying standards and norms with which to compare present conditions in order to plan the next step (Good, 1992). The research design allows the researcher to study the variables under investigation without manipulating them, hence making it appropriate for this study.

### **Location of the Study**

Nembure Division is one of the five Divisions in Embu West sub-county in Embu County. The Division is subdivided into three administrative locations and 10 sub-locations. The division's estimated population is 41,590 with a population density of 497 persons per km<sup>2</sup>. The Division lies between 1,000-1,500 m above sea level. It covers an area of 88 km<sup>2</sup>, of which 65 km<sup>2</sup> is arable land (KNBS, 2010). The average annual rainfall ranges from 1,200 to 1,500 mm. Rainfall is bimodal and distributed in March/April (long rains) and October/November (short rains). Soils are fertile and well drained. The Division is classified under the agro-ecological zone UM2, which is mainly a coffee zone (RoK, 1997).

KNBS (2010) statistics indicate that 36.6% of the population in Nembure Division is absolutely poor. Agriculture, in form of small scale food and cash crops (coffee and macadamia) is the main economic activity in the division contributing about 60.1% of the total household income. On average, small scale farmers have 0.8Ha while large scale farms average 3Ha. Notably, women provide for about 80% of the family labour. According to Kenya National Bureau of Statistics (KNBS), Embu District 2010 fact sheet, the total acreage under organic farming is about 50 hectares. However, information on whether the farms were certified for organic production or not, is not available. The performance of the organic farming sub-sector in Embu County is not well documented. Therefore this study formed a basis for developing such information.

### **Population**

The study targeted extension officers representing the informed specialists in Nembure Division of Embu West sub county, Embu County. On the other hand, organic farmers in the Division formed the consumers or users of the organic farming techniques. The targeted farmers were members of community based self help groups in Nembure Division which had been trained on organic farming by Green Belt Movement (GBM) and or KIOF between 2003 and 2010, but were currently registered by GBM.

One hundred and fifty nine organic farmers, alongside twelve extension officers from both government departments (9) and NGOs (3) formed the population of the study.

### Sampling Procedure and Sample Size

According to Kothari (2001), one of the major criteria to use when deciding on a sample size is the extent to which the sample is distributed in the same way as the population. The other consideration is the length of a questionnaire; which in this case was detailed enough to capture adequate information on the objectives of the study. Information on Table 1 shows that out of the 159 organic farmers, a sample size of 60 respondents, representing about 37% of the organic farmers was considered for the study. This was considered adequate since it represented more than the 30% of the population as recommended by Mugenda and Mugenda (1999). Proportionate stratified sampling was then used to select farmers for the study from each stratum. Stratified random sampling was used because it allows all variations in the population to be represented in the sample thus reducing the sampling error. Further, it offers an opportunity for even spatial coverage while taking into consideration the aspect of randomness. However, this technique demands prior information about the population under the study, which in this case the researcher had.

**Table 1: Sampling Matrix**

Village	Number of Organic Farmers in a Group	Sample Size		
		Women	Men	Total
Kivue	32	8	4	12
Kiangui	40	9	6	15
Kau	21	3	5	08
Gacutheri	36	8	6	14
Kiambogo	30	6	5	11
Total	159	34	26	60

**Source:** GBM Manyatta Constituency Office, 2010.

### Instruments

The research instruments used for data collection included structured questionnaires and an observation schedule. The first questionnaire was purposely designed in a way to collect data on the benefits accruing from organic farming and challenges associated with it. The second questionnaire was designed to collect information from extension officers from the ministry of agriculture and non-governmental organizations on organic farming. The data obtained from these sources was used for comparison with data obtained from the farmers and other sources. There was piloting of the research tools in the neighbouring Manyatta Division, especially the questionnaires in order to conform to the reality on the ground without adulterating the research objectives. A sample size of 10 and 3 subjects for organic farmers and extension officers respectively, from the neighbouring Manyatta Division was considered adequate for the study (Mugenda & Mugenda, 1999).

To enhance the validity of the questionnaires, the researcher sought the expert judgment of the faculty members as advised by Borg and Gall (1983). Using Kuder-Richardson (KR) 21 formula, reliability coefficients of 0.79 and 0.82 were obtained for the farmers' and extension officers' questionnaires respectively. The data generated from the field was organized according to the variables and research specific objectives. Data was coded and entered in the computer for analysis using the Statistical Package for Social Sciences (SPSS). As Martin and Acuna (2002) note, SPSS is efficient and handles large amount of data given its wide spectrum of statistical procedures purposefully designed for sciences. The researcher was careful in noting the number of times that views were expressed and the number of respondents holding related views. This helped in drawing conclusions.

### Results and Discussion

#### Challenges Associated with Organic Farming

Organic farming being a relatively new venture has its own fair share of challenges associated with it. However, some challenges cut across the whole organic farming process while others are specific to certain stages in the process. Double digging is a technique that accompanies preparation of raised beds, sunken beds and 5/9 seed holes. Double digging forms a very critical part in organic farming. Farmer respondents had the following challenges as summarized in Table 2.

**Table 2: Challenges Associated with Double Digging**

Challenges	Frequency	Percentage
Demand a lot of labour	37	61.7
Consume a lot of manure and shortage of materials	1	1.7
Labour intensive, water logging and takes up a lot of manure	19	31.7
I don't know	3	5.0
Total	60	100.0

Despite the great benefits accruing from double digging, it remained unpopular among farmers. Majority (61.7%) of the farmer respondents felt that double digging demands a lot of labour. Double digging is one of the practices that make organic farming to be associated with hard work (Njoroge, 2000). Shortage of materials and the consequential demand for relatively large amount of compost manure formed challenges associated with double digging as indicated by a minority (1.7%) of the respondents. Slightly more than a third (31.7%) of the respondents considered labour intensity, water logging and intensive use of compost manure as demerits of double digging. Water logging was common where farmers had sunken beds and long rains followed. Five to nine seed holes were associated with hard work because these holes are used in planting of maize and therefore those with expansive land found it almost impractical to have the holes on even an acre. Five percent of the respondents had no experience with double digging since they had not adopted the technique. Essentially the study established that double digging is a key component of organic farming, its labour intensive which could limit the number of double-dug beds that a farmer can have in a farm.

**Table 3: Challenges of Composting**

Challenges	Frequency	Percentage
Hard work in turning of the compost manure	15	25
Shortage of raw materials	21	35
Bulkiness, shortage of materials and labour	24	40
Total	60	100.0

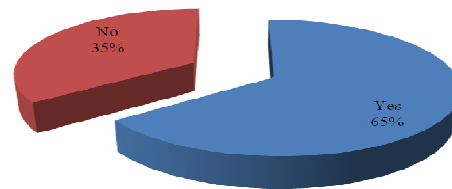
Unlike in double digging where labour demand is high, composting posed a challenge in labour especially in turning. Given that compost requires to be turned at least twice before it's ready for use (KIOF, 1999), it meant more time and labour by the farmer to prepare compost manure. It was an uphill task for the elderly and sickly farmers. Thirty five percent of the respondents considered shortage of materials as a major impediment to successful composting. This happened where green vegetation was to be sourced outside the farm and at times incurring costs in purchase during dry seasons. Those on small farms, found it hard to get all the materials on farm. Forty percent of the respondents had a problem of shortage of materials and labour needed for preparation of compost. A challenge of transportation was encountered where the compost manure was prepared away from the point of use. These twin problems of shortage of labour and raw materials were identified by the study as challenges associated with composting.

In order to find out the challenges associated with management of pests and diseases using EPM approaches, farmer respondents were asked to highlight such challenges and their responses are presented in Table 4.

**Table 4: Challenges in Use of EPM Techniques**

Challenges	Frequency	Percentage
Ineffectiveness, health side effects	18	30
Conflict with promoters of inorganic chemicals, Lack of technical knowhow, ineffectiveness, scarcity of over the counter organic chemicals	42	70
Total	60	100.0

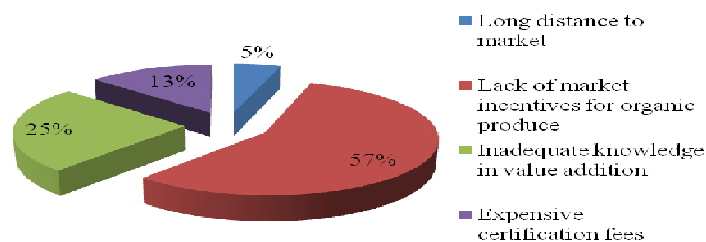
Results in Table 4 indicate that although farmers used EPM methods in pest and disease management, 30% of the farmer respondents felt that these approaches were ineffective. This is because some natural pesticides did not eliminate all the targeted pests or control diseases as expected. Bacterial and viral diseases (especially wilting and blights) on tomatoes and potatoes proved hard to be effectively managed by natural extracts. This forced farmers to resort to inorganic chemicals because they feared loss of their produce to pests and diseases. Consequently, the use of inorganic chemicals compromised the organic quality of their produce. Preparation of the natural extracts from plants especially from mexican marigold and black pepper, caused sneezing and coughing to some people who opted to abandon preparation of the extracts.



**Figure 1:** Proportion of Farmers Aware of Existence of Organic Pesticides in Agrochemical Shops

Seventy percent of the respondents cited conflict with other conventional farmers and some extension officers who did not believe in the natural pesticides. The natural pesticides did not quite have standardized formulations because different farmers gave different views on dosage of similar extracts. This remains a challenge to the organic farmers. Although information on Figure 5 shows that majority (65%) of the farmers are aware of organic chemicals being sold in shops, 70% the respondents did not get an organic pesticide of their choice from the local agrochemical outlets (Table 4). This is because the agrochemical shops did not stock the needed chemicals or they were in low supply. The study found lack of technical knowhow especially on dosage among users of natural pesticides, scarcity of organic pesticides on shops and ineffectiveness of some natural extracts in managing diseases and pests; to be great challenges in working with EPM techniques as an aspect of organic farming.

It's the hope of every farmer to produce enough for own consumption and have surplus for sale in order to benefit from their farming enterprises. In fact, profit derived from such enterprises may serve to encourage expansion of the enterprise. However, this may not always be the case and therefore marketing of organic produce may not be spared of the bottlenecks that hinder development of organic farming sector. Thus, the study sought to find out the challenges encountered in marketing of organic produce. The results obtained are presented in Figure 2.



**Figure 2:** Challenges Related to Marketing

Results in Figure 2 show that lack of market incentives is a major challenges facing marketing of organic produce, as indicated by 57% of the farmer respondents. This probably is due to the low awareness on the benefits of organic produce among consumers in Nembure Division thus demand for organic produce may not be high enough to motivate more production. A quarter of the farmer respondents indicated that they did not have the skills in value addition, which may partly explain the low prices that they fetch for failure to add value to their produce. Thirteen percent of the respondents cited high certification fees to be a great impediment in the marketing of organic produce. The certification of farms and value addition of organic produce greatly influence marketing of organic produce, especially those that need to be marked for export (KOAN, 1999).

The process of organic certification is not only an expensive venture but also tedious and rigorous, therefore putting off most of prospective small scale rural organic farmers. The farmers were not familiar with the requirements of the certification process, which among other things require proper farm record keeping for ease of traceability. Five percent of the farmers found long distance to favourable market as a challenge in marketing their produce. The study established that lack of information, long distance to favourable market, exorbitant fees for certification process as well as low prices offered for organic produce as the main challenges associated with marketing of organic produce.

**Table 5: Farmers Opinion on Issues of Contention in Organic Farming**

Issue(s) of Contention	Frequency	Percentage
Mixed cropping	36	60.0
EPM	8	13.3
None	14	23.3
Mixed cropping and EPM	2	3.3
Total	60	100.0

According to information in Table 5, majority (60%) of the farmer respondents felt that there was conflicting advice from extension officers on the practice of mixed cropping. A minority (3.3%) of the respondents felt that they received conflicting information on aspects of EPM and mixed cropping. Although, organic farming encourages diversity of crops on a farm, farmers were also advised by some extension officers to practice mono-cropping. The farmers were visited by extension officers from both the government and the NGOs. The conflicting advice could be as a result of lack of clear understanding on organic farming by the extension officers from the government departments because none of them had attended a refresher course on organic farming.

### Benefits Associated with Organic Farming

More than four fifths (83.3%) of the farmer respondents had recorded increased farm production since adopting organic farming. Out of this, 76% attributed the increase in farm input to adoption of organic farming techniques such as use of compost manure, use of plant teas for top dressing and continued as well as intensification of tillage practices (double dug beds, sausage gardens and 5/9 seed holes). Twenty four percent of those who had an increase in farm output attributed it to their use of organic fertilization techniques or intensification of tillage techniques. This agrees with the observation made by NEMA (2003).

**Table 6: Reasons for Increased Farm Output**

Reason	Frequency	Percentage
Continued use of organic fertilization techniques	11	22.0
Continued and intensification of tillage techniques	1	2.0
Both of the above	38	76.0
Total	50	100.0

On the other hand, 17% of the farmer respondents felt their farms' output was not any different since starting organic farming. Sixty percent of the farmer respondents with this view attributed the constant farm output to their failure to adopt more, and intensify on organic farming techniques. Under a conventional farming, maize spacing is usually 30cm within a row and 60cm between rows (30cm x60cm), an equivalent of 9 plants in an area of 1.62m<sup>2</sup> translating to 55,555plants /ha. Given the measurement of the holes and the distance between the holes, 9 plants are in an area of 1.44m<sup>2</sup> under the 5/9 seed hole technique. This translates to about 62,500 plants/ha. Therefore the higher number of plants per unit area explains the high input in an organic system. The researcher sought to find out the flow of income since starting organic farming. The responses are as presented in Table 7.

**Table 7: Flow of Income since Starting Organic Farming**

Flow of Income	Frequency	Percentage
There has been an increase of income	48	80
No change in amount of income	10	16.7
Not sure	2	3.3
Reduced income	0	0
Total	60	100.0

Majority (80%) of the farmer respondents had an increased flow of income since starting organic farming. Less than a quarter (16.7%) had not noticed any change in income since starting organic farming. This is because they had not diversified on the organic farming techniques which would have given them more output. A paltry 3.3%, were not sure whether they had recorded an increase or decrease in flow of income since starting organic farming. The increase in income could be attributed to diversification of enterprises such as livestock and crops at individual farm's level. According to Lampack (1994) and KIOF (1999), well established and diversified farm enterprises confer multiple benefits to farmers, among others, an increase in income. The various crops and livestock serve to cushion farmers against loss in case of drought or disease or pest outbreak since different crops and animals withstand differently to such calamities. Therefore, the study found out that there was increased income to those who had diversified and maximized on organic farming techniques.

Further to identifying benefits of organic farming, farmer respondents identified those that accrued from double digging which are listed in Table 8.

**Table 8: Benefits of Using Double Dug Beds**

Benefits	Frequency	Percentage
Healthier crops and Improved moisture retention	3	5.0
Higher crop production	4	6.7
Improved moisture retention, Better Crops' performance, Resilience to pests and diseases; Increased output, weeding was made easier, reduces tillage frequencies, sense of pride	46	76.7
Don't know	7	11.7
Total	60	100.0

Although double digging is unpopular among organic farmers due to its labour intensity, majority (76.7%) of the farmer respondents reported improved moisture retention on farms where double digging was carried out. These farmers had their crops doing well compared to plants growing on other sections of the farm or other farmers' farms where double digging was not being practiced. Such crops developed deeper roots which ensured they had a wider surface area for water absorption. The retained moisture helps plants retain their vigour even during the dry season (KIOF, 1999; Njoroge, 2000). Even for the crops which had been attacked by pests and or diseases, they exhibited a higher resilience. This observation is in agreement with experiments done by KIOF (1999). Since the crops were doing well, the farmers had a better output. Double dug beds give high yield which is ideal for small holder farmers. Given the high input of compost and moisture retention, the beds allow for high plant density. The closed canopy formed by crops acted as ground cover which reduced emergence of weeds. Instances of reduced soil erosion were minimized under the circumstances. Consequently the crops on double dug beds were doing very good. Further, farmers observed that once an area had double dug beds, it stayed for three years before a new bed is prepared thereby reducing the number of times that the section had to be tilled. Therefore in subsequent seasons, less time and labour would be used in tilling that section.

Double beds gave farmers a sense of satisfaction and pride especially when the output was good and crops did well, because other farmers came for advice from them. Few (5%) of the farmer respondents had the benefits of improved moisture retention and healthier crops while 6.7% of the farmer respondents had a higher crop production. However, not all farmer respondents had an encounter with double digging and therefore some (11.7%) of them did not know if there were benefits associated with double digging. This study considered the farmers' production of maize and beans before and after adopting organic farming. The "yes" meant that the respondent was in a position to harvest enough from their farms for food (maize and beans) needs while "no" does not necessarily imply the respondents were short of food, but were exposed to a hunger situation.

A "no" was even recorded for respondents who sold their milk, vegetables and fruits from their farms to buy maize and or beans. The farmers' responses are captured in Table 9.

**Table 9: Food Sufficiency in Maize and Beans Before and After Adopting Organic Farming**

Before Adopting	After Adopting	Frequency	Percentage
Yes	Yes	32	53.3
No	Yes	22	36.7
No	No	6	10
Total	No 6 (10%) Yes 54 (90%)	60	100
No 28 (46.7%) Yes 32 (53.3%)			

Before adoption of organic farming, 46.7% of the farmer respondents were not self-sufficient in maize and beans while 53.3% had enough from their farms to meet the family needs for maize and beans. However, 10% of the respondents did not become self sufficient even after adopting organic farming. This is because they partially adopted organic farming techniques which did not put them at par with those who had widely adopted and intensified on the techniques. Notably, the proportion of respondents who reported an increase in maize and beans production grew by more than a third (36.7%). This means that their farms produced enough for their own use. Therefore, the study found out that organic farming contributed to increasing the output in maize and beans production that formed the staple food (*Kithere*) of the local community.

Fertilization of farms is crucial in an organic farming system. The study intended to find out ways in which farmers benefited by using compost manure or composting as a process. The listed benefits are as presented in Table 10.



**Table 10: Benefits of Composting**

Benefits	Frequency	Percentage
Cheap to make and is less polluting	8	13.3
Cheap, reduces pests incidences, boost production,	12	20
Cheap, free of inorganic chemicals, confers long-lasting benefits and improves soil structure	13	21.7
All of the above	27	45
Total	60	100.0

It is evident that all the farmer respondents reported multiple benefits of composting. Composting being cheap and causing less pollution were listed by 13.3% as the benefits associated with the practice. Forty five percent of the respondents felt that composting produced manure with minimal disease causing microorganisms, caused less pollution and it is cheap to prepare. Compost manure improves soil structure in addition to improving soil fertility. All these combined, increase production (KIOF, 1999). Compost is cheap since it is made from locally available materials such false sunflower, weeds, kitchen ash, kitchen wastes, farmyard manure and or loam soil. Since such raw materials were sourced locally, it became cheaper to prepare compost manure, rather than buy inorganic fertilizers. Kitchen remains and ash, which would otherwise be considered as waste were useful components in composting. Therefore composting helped in reducing wastes to the environment.

Lampkin (1994) describes the dangers associated with residues from inorganic chemicals used in management of pests and diseases as well as fertilization practices. He notes that pesticides, for instance *dithiocarbamate* (fungicide) combine with nitrites to form carcinogenic compounds. Since organic farming largely avoids use of such inorganic chemicals, the study intended to find out what benefits farmers had in avoiding use of inorganic chemicals and embracing EPM. The responses from the farmers are summarized in Table 11.

**Table 11: Benefits of EPM Techniques**

Benefits	Frequency	Percentage
Cheap	3	5.0
Effective	21	35.0
Cheap, effective, likelihood to have better prices and satisfaction in having safer food	36	60.0
Total	60	100.0

Five percent of the farmer respondents indicated that low cost of EPM techniques is a prime benefit of the organic farming. A further 35% felt that in addition to being cheap, EPM techniques were effective in management of pests and diseases. Majority (60%) of them, while acknowledging the aforementioned benefits, they clearly indicated that they had satisfaction in knowing that their families fed on relatively healthy food with less inorganic chemical residues. According to Lampack (1994), consumers can support the organic farming by demanding to know how the produce they are getting has been grown. Much of the residual inorganic chemicals in food are either from fertilization process (as a result of inorganic fertilizers) or a result of spraying of inorganic chemicals.

KIOF (1999) points out that use of synthetic pesticides especially in conventional agriculture include elimination of beneficial natural enemies, high costs and tendency of target pests to develop resistance to such chemicals. Therefore, with the safety assured in the food that consumers have, there is bound to be happiness among consumers when they know whatever they or their families eat is healthy.

Loss of trees on Kenya's land is increasing but the government is in spirited afforestation and reforestation campaign. The absence of trees on farms and the resulting negative impacts are dawning on Kenyans. Since agroforestry is central in organic farming, therefore information was sought from the farmers on the benefits accruing from the agroforestry practice. The responses were as presented in Table 12.

**Table 12: Benefits of Agroforestry**

Benefits	Frequency	Percentage
Provision of wood fuel, fruits, fodder for livestock	4	6.7
Wood fuel, fruits, soil water conservation, fodder, fruits, income	32	53.3
Wood fuel, Medicinal products, income, fruits, income, fodder, bees' forage, soil water conservation, wind speed reduction, climate amelioration, timber for building and construction	6	10
All of the above	18	30
Total	60	100.0

More than half of the respondents benefited greatly from agroforestry component on their farms, where all the farmer respondents confirmed deriving multiple benefits from the system. Majority of the respondents (53.3%) benefited from agroforestry by getting wood fuel, fruits, and fodder for livestock, income from the sale of tree produce, and above all soil water conservation. A further 6.7% felt that provision of wood fuel; fruits and fodder for livestock were the products that they got from agroforestry system. A third of the respondents, were quite elaborate on the benefits accruing from agroforestry. Wood fuel, a significant source of energy for majority of the rural population ranked high as one of the benefits of woody component. Reduction of soil erosion by trees and ground vegetation; provision of forage for bees, climate amelioration, income from sale of tree nurseries and tree products were prominent benefits as stated by the respondents. In addition medicinal products from herbs and barks of trees; timber for building and construction, as well as fruits; were other positive things derived from agroforestry component on individual farms.

A combination of the above benefits replicated on several farms would ensure a well conserved environment where constituent elements complement each other. An attempt to quantify contribution of agroforestry in climate change would quickly run out of scope of the study but one would expect that more trees and other vegetation on farms would mitigate impacts of climate change. This is because they provide carbon sinks for carbon (IV) oxide which is greenhouse gas. The study found out that agroforestry as a practice and its components confer multiple benefits to the farmers in form of food, fodder, wood fuel, timber; as well as to the environment.

### **Conclusions and Recommendations**

The findings of the study show that organic farmers in Nembure Division realized positive benefits in carrying out organic farming which are manifested in the increased production and improved environmental conservation. However, crucial aspects of marketing and certification were challenges that farmers faced in carrying out organic farming. Aggressive marketing and awareness creation can greatly improve the organic farming sector. Consumers play a key role in the future development and growth of organic farming. Some of these challenges can be addressed by an elaborate policy on organic farming. Therefore, if all stakeholders worked in harmony towards the growth and support of organic farming, both the farmers and the environment will greatly benefit from this vital sector. Organic farming holds a great potential which can be exploited as a path towards sustainable development if the challenges identified can be addressed and intensify on the benefits accruing from organic farming.

### **Suggestions for Further Studies**

Based on the findings of the current study, the researcher makes the following suggestions for further study:

- i. There is need to carry out a comparative study on conventional farming in Nembure Division.
- ii. There is need to carry out a study to establish and develop standards for use of organic formulations used in management of pests and diseases in an organic system.

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