

Assessment of Production Potentials and Constraints of Mango (*Mangifera indica*) at Bati, Oromiya Zone, Ethiopia

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Abstract

Production potentials and constraints of mango were assessed at Bati wereda, Oromiya zone, Ethiopia in 2013 using data from sixty randomly selected mango producers in the area. Data were collected using questionnaire and focus group discussion. The result revealed that most of the producers belonged to the age group of 41-50 (28.3%) and 31-40 (26.7%). 95% of the producers were male and the rest 5% were female. Analysis of production system revealed that 90% of the respondents do not use fertilizer; the only 10% of the respondents do use organic fertilizer. All of the respondents use irrigation water; however the source, quantity and quality differ from farm to farm. 85% of the respondents replied that they did not control diseases except birds during the time of fruit maturation. Most of the respondents (95%) did not practice pruning. The orchards branch is so large and weak to support the fruit. Fifty percent of the respondent replied that they harvest the fruit at peak maturity but 33.33% of the respondents replied that the fruit harvest before peak maturity and only 16.67% response that the fruit harvest after peak maturity. The majority of the respondents (46.67) replied that all the listed factors (irrigation water scarcity, pest and disease and technology limitation) can influence the production of mango. The majority of the respondents (66.67) replied that hand picking method of harvesting produce and maintains good quality of fruit and protects the fruit from mechanical damage. Most of the respondents (30%) replied that all the listed (birds, wind, wounding, maturity stage and micro organisms) are major causes of mango production loss. 26.67%, 23.33%, 6.67%, 8.33% and 5% of the respondents response that birds, wind, wounding, microorganisms and maturity stage are the main causes of loss on mango respectively. Most of the respondents (45.00%) replied that major lost of mango occurs during harvesting and before harvesting. The majority (35) of the respondents use both pack animal and human back and shoulder to transport their produce. Most of the respondents (96.67%) sell their products at nearby local market.

Key words: Mango, orchard, potentials, constraints, postharvest

1. Introduction

Mango (*Mangifera indica*) is a fleshy stone fruit belonging to the genus *Mangifera*, consisting of numerous tropical fruiting trees in the flowering plant family Anacardiaceae. The mango is native to the south Asia from where it was distributed worldwide to become one of the most cultivated fruit in the tropics. Mango (*Mangifera indica*) is produce in most frost free tropical and sub tropical climates, more than 85 countries in the world cultivate mango. The total production area of mango in the world is around 3.69 million hectares. The total amount of mango production in the world is around 35 million tons by the year 2009 [1].

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The amount of mango production in Africa during 2009 is 13.6 million tones. Nigeria is the leading country followed by Egypt [1]. In Ethiopia mango produced mainly in west and east of Oromia, SNNPR, Benshangul and Amhara [2]. Mango production in Ethiopia is in fluctuated conditions, because of occurrence of diseases, lack of proper management and also weather conditions [3]. In Bati there is a large amount of mango plantation. The plantation exists in different areas but cultivation methods are different. There is no recorded document about the size of cultivation areas and amounts of productions. There is a great opportunity in the production of mango; however there are also limitations, which are not assessed yet. So, the aim of my research is to evaluate or assess the opportunities and challenges of mango production in Oromiya Zone, Ethiopia with reference to Bati Wereda.

2. Research methodology

2.1 Description of the study area

The study was conducted at Bati Wereda, Oromiya zone, North East Ethiopia in 2013. The Wereda has a latitude and longitude of 11°11'N 40° 1E with elevation of 1502 masl. Its annual temperature range from 22-32⁰c and rainfall ranges from 600-900mm. the agroclimatic classification of the area is 81% kola and 19% woina dega. The total population of the Wereda is 155,093 of which 78515 are males and 76578 are females.

The main crops commonly cultivated in the Wereda are sorghum, teff, sesam, ground nut. Vegetables and fruits like cabbage, tomato, mango, avocado, orange and papaya are also cultivated in the area. The livelihood of the people is depending on both crop production and animal husbandry.

2.2 Sampling and data collection

In the Wereda, there is 23 kebeles from which two kebeles were selected based on their potential (due to presence of mango orchards). The total respondent of the survey was 60 from the two kebeles, from which 30 respondents in each kebele. Data was collected from both primary and secondary source. The primary data was collected through formal questioner and observation. The secondary data was collected from different books, wereda agricultural office and kebele development agents.

2.3 Data analysis

The data entered and analyzed using appropriate software (SPSS version 17). Frequencies and pie charts were used to display results of findings for categorical variables. In addition, qualitative data was analyzed through discussions.

3. Result and discussion

3.1 Socio-economic characteristics of respondents

Majority of the respondents involved in mango production fall with the age range of 41-50 (28.33%) followed by the age range of 31-40 (26.67%). The least age range involved in this practice is 61.70 (10 %) (Table 1).

Table 1. Age range of the respondents

Age	No of respondents	%
21-30	11	18.33
31-40	16	26.67
41-50	17	28.33
51-60	10	16.67
61-70	6	10.00
Total	60	100

There is gender disparity in mango production. Overwhelming percentages (95%) of the respondents were male. While the remaining percentages (5%) are females, majority of who were widows who probably look over the orchards from their deceased husbands. A greater populations of those engaged in mango production were married and those 5% were unmarried. This is an indication of the significance role played by this enterprise in the economic life of families. It could even be that married people were attracted in to it as a way of supporting their expanding families. Interesting thing is that mango retail marketing in the area seems to be exclusively a female affair. With respect to education attainment majority, (80%) had no formal education. 15% of the respondents had primary education and least (5%) had secondary education. All of the female respondents had no education (Table 2).

Table 2. Sex and educational status of the respondents

Educational status	Male		Female	
	No	%	No	%
Illiterate	45	75	3	5
Primary education	9	15	0	0
Secondary education	3	5	0	0

3.2 Farm characteristics

Most of the respondents had mango orchards age 20 years and above. The producers did not pay a special attention to the orchards. Most of the producers used the crop as a boundary market. They also inter crop other fruit orchards like citrus. Majority of the producers have 10 mango trees (Table 3).

Table 3 No. of Mango trees range per respondents

No of trees	No. of respondents	%
1-10	36	60
11-20	12	20
21-30	9	15
31-40	2	3.33
41-50	1	1.67

4.3 Mango production practices

4.3.1 Spacing

Most of the respondents did not give attention to spacing. Orchards growth were not well spaced, some orchards are nearer to each other and the others are very far from one orchard to the others, according to the oldness of the trees most of the respondents replied that had no knowledge about spacing by that time (Table 3). In Bati mango and other fruit production area, mango orchards have 50 years and above. In the area there is no space consideration and other recommended practices. The orchards are very large, hence space play significant role for all activities, absence of proper spacing create difficulties for production. 10% of respondents who established new mango orchards practice proper spacing. They assisted by development agents. This creates good management activities and easy for overlook. However, tree spacing appears to be an important consideration in mango production [4].

4.3.2 Irrigation

All of the respondents replied that they use irrigation. However, the amount of water and the source is different. The greatest percentages (75%) of the respondents use river water. The remaining use pond water. The yield is greater in river water irrigation than pond water irrigated crops. The quantity and quality of water available is on factors that determine the yield in that area (Table 4). Most (50%) of the respondents replied that they irrigate the crop two times a week. 35% of the respondents irrigate once a week. The rest of the respondents irrigate according to the situation of the soil condition. (table 5) this result is supported by finding of [5] who found that frequency and amount of irrigation need depends on soil type, property, climate & others. Most (75%) of the respondents who use river water for irrigation replied that the access is very good but 25% who use pond water replied that the access is poor (table 4).

4.3.3 Fertilizer

The greatest number (90%) of the respondents did not apply neither inorganic nor organic fertilizer on their farmland. The remaining 10% apply organic fertilizer and rare amount of inorganic fertilizer. The organic fertilizer applies in irregular base and the inorganic fertilizer applies in rare amount and not applies with irrigation (table 4).

4.3.4 Pest and diseases control

85% of the respondents replied that they did not control diseases and most of the producer control birds during the fruit matured. Other pests are present on mango orchards but the producers not aware for control those pests and diseases. Some of the respondents replied that they report the problem for agricultural office and measures taken to control the pest and diseases (table 4).

4.3.5 Wind break and pruning

Most (85%) of the respondents did not established wind break around the orchards, but they used the mango orchards as a wind break. Greatest damage occur during fruiting is caused by wind. Many fruit are dropped in to ground before they matured by the wind 15% of the respondents established wind break, from those 5% reduces fruit drop by 30% and the rest of 10% respondents established new orchards with wind break replied that the standing of the orchard is strait and well grown. (Table 4). Most (95%) of the respondents did not practice pruning (Table 4). The orchards branch is so large and weak to support the fruit. The fruit are far from the trunk and create problem during harvesting and management activities. However, pruning in mango has been recommended [6]

Table 4 mango production practices adopted by farmers in the survey area

Production	No of respondents	%
Fertilizer application		
Never	54	90
Irregular (organic)	6	10
Irrigation water source		
River water	45	75
Pond water	15	25
irrigation frequency		
Once a week	30	50
Twice a week	21	35
Depend on the condition	9	15
Pruning		
Never	57	95
Irregular	3	5
Pest and diseases control		
Pest control bird	Never	5
	Do	95
Diseases control	Never	85
	Do	15
Wind break		
Never	51	85
Do	9	15

4.3.6 Harvesting

Harvesting time is similar in the area. All of the producers harvest the produce at summer season, especially from June 1 July 30. Fifty percent of the respondent replied that they harvest the fruit at peak maturity but 33.33% of the respondents replied that the fruit harvest before peak maturity and only 16.67% response that the fruit harvest after peak maturity (table 5). Harvesting the fruit after peak maturity result in shorten shelf life and fruit deteriorated quickly. This result is supported by finding of [7] who found that loss of fruit is increase dramatically after harvest as the fruit maturity increased.

Table 5. Harvesting stage of mango

Stage of harvest	N _o of respondents	%
Harvesting fully ripe fruit	35	58.33
Harvesting partially ripen fruit	15	25
Harvesting un ripen fruit	10	16.67

4.3.7 *Methods of harvesting*

The majorities of the respondents (66.67%) replied that hand picking method of harvesting produce and maintain good quality of fruit and protect the fruit from mechanical damage (Table 6). They use ladder for reaching the Brach. The rest of the respondents use scissors and stick like structure for harvesting 25% and 8.33% respectively. Hand picking can produce the fruit with stem and reduce fruit bruising and damage but stick structure result in fruit dropping and leave the fruit without stem which facilitate fruit bruise and mechanical damage.

Table 6 methods of harvesting used of mango fruit

Methods of harvesting	N _o of respondents	%
Hand picking	40	66.67
Cut by scissor	15	22.5
Using stick	5	8.33
Total	60	100

4.4 *Production constraints of mango*

The majority of the respondents (46.67) replied that all the listed factors (irrigation water scarcity, pest and disease and technology limitation) can influence the production of mango. Nevertheless, 25%, 20% and 8.33 of the respondents' response that irrigation water scarcity, pest and disease, limited technology are the main factors that reduce mango production.

Table 7. Constraints that reduce mango production

Factor	N _o respondents	%
Irrigation water scarcity	15	25
Pest and disease	12	20
Limited tech.	5	8.33
All the above	28	46.67

4.5 *Major causes of mango products loss*

Most of the respondents (30%) replied that all the listed (birds, wind, wounding, maturity stage and micro organisms) are major causes of mango production loss. 26.67%, 23.33%, 6.67%, 8.33% and 5% of the respondents

response that birds, wind, wounding, microorganisms and maturity stage are the main causes of loss on mango respectively. From those birds are more challengeable cause during maturity stage and wind is so problematic starting from fruiting to harvesting stage of the produce.

Table 8 causes of mango produce losses

Causes	No of respondents	%
Bird	16	26.67
Wind	14	23.33
Wounding	4	6.67
Microorganism	5	8.33
Physiological aging	3	5.00
All of the above	18	30
Total	60	100

4.6 Stage of losses of mango

Most of the respondents (45.00%) replied that major lost of mango occurs during harvesting and before harvesting time, because of harvesting methods and maturity stage and also wind and birds. 20% of loss during harvesting and 25% of before harvesting stage. 13% during transporting and 13.33% during stage. 20% of the respondents replied that the loss occurs during the above all stages (Table 9).

Table 9. Stage of loss occurrence

Time	No of respondents	%
Before harvesting	15	25
Harvesting	12	20
Transport	13	21.67
Storage	8	13.33
All of the above	12	20
Total	60	100

4.7 Packing materials

Majority of the respondents use basket to transport the fruit from field to local market. The surface of the basket is rough, it causes physical damage, and it is a cause of contamination because it is difficult to clean the surface. The can is smooth but there is no aeration, it fastens the ripeness of the fruit. 2% of the respondents replied that they use plastic box for packing (Table 10). This is more advantageous than the other packing materials because of its smooth surface and it is also well aerated. It reduces contamination, bruising and other related conditions. According

to [8], the packing material varies according to marketing, it being carton, plastic or wooden box. According to [9], 25-30% of fruit loss is due to poor packing.

Table 10. Packing materials for mango fruit

Material for packing	N _o of respondents	%
Basket	28	46.67
Can	13	21.67
Plastic box	12	20
Wooden box	7	16.67
Total	60	100.01

4.8 Transportation system

The majority (35) of the respondents use both pack animal and human back and shoulder to transport their produce. 25%, 23.33%, 13.33, 3.33% of the respondents use packs animals human pack and shoulder, animal drawn cart and car for transportation of their products. (Table 11).

Table 11. Transportation system

Transportation	N _o of respondents	%
Human back both pack animal	21	35
Pack animal	15	25
Human back	14	23.33
Cart	8	13.33
Car	2	3.33
Total	60	99.99

4.9 Market

Most of the respondents (96.67%) sell their products at nearby local market. Most of the time the producers sell their produce for consumers and sometimes for retailers. These respondents replied that market fluctuation faced them. There are two reasons for this. One reason is maturity stage and harvesting time of mango fruit is similar within the area. This condition increase the supply at that time and the demand is less compare to that of the supply. In this situation the price of the fruit become less and less.

The other reason is mango fruit supply from southern Ethiopia it decreases the value of local mango production because this import mango price is cheaper and the consumers will buy the cheapest product related to cost. The

least (3.37%) of the respondents replied that they sell their commodity on the farm. Market fluctuation did not face them. They did not worry about transportation. They sell their produce by fewer prices than other produces.

4. Conclusions and Recommendations

Fruit production in general mango production in particular is in its infant stage in the study area. Temperature, irrigation water supply, edaphic factors and location of the area is suitable for mango production. However, Prevalence of wind and birds are the most limiting factors. Farmer awareness about spacing of orchards, pruning, fertilizer application, access of new varieties and pest and disease control is very low. In order to increase the production of mango, many actions have to be taken. Training about agronomic practices such as proper spacing, time of pruning, methods and time of fertilizer application, identification of pest and disease and control mechanism, methods and time of harvesting, kind of packing materials used, are vital to increase the productivity of mango. Distribution of pest and disease resistance and early maturing varieties is another method to increase production potential. Facilities like road, canal and transportation system should be improved for further dimension and to reduce the loss.

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References

- [1]FAO, 2009. Utilization of tropical foods: fruit and leaves. Food and nutrition paper, via delle terme dicaracalla, 00100 rome, Italy.
- [2]Desta H, (2005). Export potential of Ethiopia processed fruit and vegetables, export promotion department.
- [3]CSA, (2009).Central statistical authority. Agricultural sample survey: report on area and production for major crops, statistical bulletin 427. Addis abeba, Ethiopia.
- [4]Olaniyan, A.O,2004. General information about mango and citrus production in Nigeria. Oec. 2004, 10PP.
- [5]Dr. Altaf, A.S, 2011. Irrigation mode for better mango fruit in pepper magazine in 21st February 2011.
- [6]Van Ee, s, 1999. Fruit growing in the tropics 2nd Ed. Agrodok-series No 5, Agromisa foundation, 88PP.
- [7]Rosals, C.A, 2005. Skin color and pigment change during ripening and related post harvest management of fruit. National Inc, USA. PP 321-345.
- [8]Kader, A.E, 1992. The role of post harvest management in assuring quality and safety of avocado and mango, national journal, USA.PP. 400-423.
- [9]Rodrigue, T.F, 1997. Horticultural crop handling and management, AGT editors, mexico.PP. 176-190