

Full Length Research Paper

Yield improvement in hot pepper through demonstration of improved variety (Melkashote) with improved production technologies under irrigation scheme, Abergelle, Tigray, Ethiopia

Hintsa Meresa*, Tsegay Gebreselassie, Fantay Belay, Haftu Kelelew and Atsbha Gebreslassie

Abergelle Agricultural Research Center, P. O. Box 44 Abi-Adi, Tigray, Ethiopia.

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The demonstration was conducted in 2014/15 production season at Tanqua-Abergelle district, particularly at Hadash-Tekhli (Zembaw) irrigation scheme at farmers' land. The scheme has high irrigation potential for horticultural crops production. But, improved technologies have not yet been demonstrated. Therefore, the objective of this research was to demonstrate improved variety of pepper with improved management practice into the irrigation scheme. The improved pepper variety (Melkashote) and local cultivar, 'Tsalet' were used in the demonstration. The mean fresh fruit yield obtained from the improved pepper variety was higher (13.87 t/ha) than the local cultivar (10.16 t/ha). This shows 36.5% fresh pepper fruits yield increment over local cultivar, implying yield productivity per unit area can be increased by using the improved pepper variety. In addition, the improved pepper variety (Melkashote) required 115 days to mature whereas the local cultivar matured in 129 days. This shows the improved pepper variety was earlier in maturity than the local cultivar. In terms of monetary value, an average gross income of 202,859.60 Birr/ha or US\$ 96,46.33 per hectare was generated from the improved pepper variety while from the local cultivar was 114,277.50 Birr/ha or US\$ 5,434.10 per hectare. This implies the farmers were able to generate more income from the improved pepper fresh yield over the local cultivar. Besides, based on farmers' perception results, except the attributes of fruit size, most of the respondents had favored the improved pepper variety (Melkashote) in its productivity, fruit length, fruit color, maturity, insect and disease resistance, marketability, fruit quality and taste than the local cultivar (Tsalet). Hence, the farmers decided to grow the variety in the next production season. Therefore, further popularization and scaling out activities should be done by the research center and office of agriculture and rural development of the district.

Key words: Farmers' perception, maturity, Melkashote, Tsalet, yield.

INTRODUCTION

Pepper fruit (*Capsicum* species) is one of the most important vegetable crops. *Capsicum* species popularly known as pepper is the world's second most important crop after tomato (Yoon et al., 1989). According to

Bosland (1994) the genus *Capsicum* belongs to the family Solanaceae. Cobley and Steele (1976) reported that apparently between 5200 and 3400 B.C, the native of Americans were growing *Capsicum*, which places it

among the oldest cultivated crops. Adamu et al. (1994) reported that Nigeria is the largest producer of pepper in Africa, accounting for about 50% of the African production. The plant is an herbaceous annuals usually growing from 45 to 65 cm tall.

It is a relish in most African diets. It serves as a spice and is rich in vitamin C (Espig, 1991). Pepper is a short-lived herb normally grown as annual. Peppers are adapted to high temperatures, but excessively hot weather may produce infertile pollen and reduce fruit set. Temperatures above 32°C may also cause excessive transpiration resulting in dropping of buds, flowers and fruits. A drop in temperature to 16°C at flowering may result in poor fruit or seedless fruit. Plants are tolerant of slightly acid soils but a pH of 5.5 to 6.6 is preferable.

Like other vegetable crops, pepper has many advantages. Pepper has always been regarded as the king of spices. Highly treasured and a precious commodity it was used in the past for trading exchanged like money. Consumption of pepper accounts for about 20% of the average vegetable consumption per person per day in Nigeria (Erinle, 1989; Alegbejo, 2002). It is used in the preparation of soup and stew, which are among the major essential compliments of staple based on cereals and root crops and also forms remedies for toothache and sore throat (Bosland, 1994; Leung and Foster, 1996). The capsaicin extract from sweet pepper is used in pharmaceuticals as a counter irritant balm (Purseglove, 1997). In Japan and China, it is used topically in an ointment form to treat myalgia (But, 1997) and in Germany; it is approved as a topical ointment for the relief of painful spasm. Capsicum is regarded as a neuropathetic pain reliever; therefore it is used in the treatment of diabetic neuropathy and also in the management of surgical neuropathic pain in cancer patient (Messiaen, 1992).

Abergelle Agricultural Research Center had carried out pepper adaptation trials to evaluate the yield potential of pepper varieties and cultivars in farmer's field in Adiha irrigation scheme. As a result, potential and promising high yielding improved pepper varieties were identified and an average fresh fruit yield of 12.87 and 9.93 t/ha were obtained from Melkashote and Marakofana, respectively. Therefore, demonstration of one of the best performed improved pepper variety with its improved production technologies is found to be important in Tanqua-Abergelle district particularly at Hadash-Tekhli (Zembaw) irrigation scheme. This research was conducted to:

1. Demonstrate the improved pepper variety (Melkashate) and its management practices; and
2. Collect farmer's perception about the performance of

improved pepper variety versus local cultivar.

MATERIALS AND METHODS

Description of the study area

The demonstration trial was conducted in Tanqua-Abergelle district, particularly at Hadash-Tekhli (Zembaw) irrigation scheme at farmers' land during 2015 production season. The district is located in central zone of Tigray which is 120 km to the West of Mekelle. It is located at Latitude 13° 14' 06"N and longitude 38°58'50" E. It has area coverage of 144,564 ha and the average land holding per house hold is estimated to be 1.84 ha. It is agro-ecologically characterized as hot warm sub-moist low land (SM_I-4b) below 1500 m.a.s.l, however; altitude ranges between 937 and 2370 m.a.s.l. The mean annual rainfall and temperature ranges between 400 and 600 mm and 21 to 41°C, respectively. It has 20 kebelles of which 19 are rural kebelles. Major soil type of the district is sandy soil followed by clay and clay loam. Mixed farming system is dominantly practiced in the district. Major crops grown in the district are; sorghum, maize and pulses (cowpea, ground nut, sesame). The district is also well known for its large number of livestock resources (sheep and goats) and poultry (TADOoARD, 2015).

Farmers research group (FRG) establishment

This demonstration was carried out through the participation of farmers. Farmers Research Group (FRG) was established based on their interest and willingness. It was demonstrated in 10 m x 10 m plot size with 12 farmers and the total land area covered was 0.12 ha. Before execution of the demonstration, training was given to the farmers about FRG concepts, pepper production and managements, seed production techniques and maintenance. Pepper seeds were provided to the farmers by the research centre. They evaluated the performance of the crop according to their time of schedule from transplanting up to harvesting. During participatory monitoring and evaluation, FRG members were evaluating the performance of the improved pepper variety (Melkashote) versus local cultivar both for its yield and farmers' perception on the attributes of the improved variety.

Plant establishment

Pepper seed at a rate of 600 g/ha was used. In nursery site, the seeds were planted in well prepared seed bed and mulched with grass. Around 45 to 55 days after sowing or 3 to 4 true leaf stages, 12 to 15 cm tall, healthy and vigorous seedlings were transplanted to farmers' field. The seedlings were planted in spacing of 70 and 30 cm between rows and plants. After transplanting, fertilizers were applied at a rate of 200 kg/ha DAP and 100 Kg/ha urea in split form (50% during planting and 50% after one and half month).

Data collection and analysis

Sowing date, transplanting date, days to 50% maturity, marketable yield, nearby market price and farmers' perception data were

*Corresponding author. E-mail: hintsa1982@gmail.com.

Table 1. Descriptive statistical results of households' demographic characteristics.

Variable	N	Minimum	Maximum	Mean	Std. deviation
Age of household head (in years)	12	28.00	56.00	38.17	9.44
Family size of household head (head count)	12	3.00	7.00	5.00	1.41
Education status of the household head (Last grade completed)	12	2.00	8.00	5.75	1.82

Source: Computed from survey data (2015). N = population.

Table 2. Distribution of household head's sex, marital status and their main occupation.

Variable	Frequency	Proportion (%)
Sex of the household head		
Male	11	91.7
Female	1	8.3
Marital status of the household head		
Married	12	100
Main occupation of the household head		
Farming	9	75
Farming and student	2	16.6
Farming and trading	1	8.3

Source: Computed from survey data (2015).

collected. Five kilograms of ripened pepper fruit samples were taken to evaluate the improved pepper variety (Melkashote) versus the local cultivar. The data collected were analyzed using IBM SPSS statistics version 20.0 and Microsoft excel.

RESULTS AND DISCUSSION

Demographic characteristics of the households

The mean age of the household heads was 38.17 ± 9.44 while the minimum and maximum ages were 28 and 56, respectively. This implies all the participated farm households in the demonstration of improved pepper versus local cultivar were at the working ages and could handle the difficult nature of irrigation activities. The average family size of the households was 5 ± 1.41 heads per household and the minimum and maximum households' family size was 3 and 10, respectively. This indicates the participated farm households were able to hire and engage their families in the irrigation activities. The minimum and maximum educational status or last grade completed of the households were 2 and 8, respectively while the average educational status or last grade completed of the households was 5.75 ± 1.82 (Table 1). This implies most of the participated farm households were about grade 5 which can easily adopt the demonstrated technology, management practices and seed production techniques.

From the overall participated households, majority (91.7%) were male. All the participated farmers were

married (100%). Majority (75%) of participated farm households' main occupation was farming, 16.6% farming and schooling and 8.3% was involved in farming and trading (Table 2).

Pepper fresh fruit yield and days to maturity

The mean fresh fruit yield obtained from the improved pepper variety was higher (13.87 t/ha) than the local cultivar (10.16 t/ha). This shows 36.5% fresh pepper fruits yield increment over local cultivar, implying yield productivity per unit area can be increased by using the improved pepper variety. A maximum of fresh yield (18.1 t/ha) was also recorded from Melkashote while the maximum fresh yield from the local cultivar was 14.2 t/ha. In addition, on average the improved pepper variety (Melkashote) required 115 days to mature whereas the local cultivar matured in 129 days during the demonstration period (Table 3). This implies the improved variety matured earlier than the local cultivar. Hence, the farmers decided to grow the variety in the next production season.

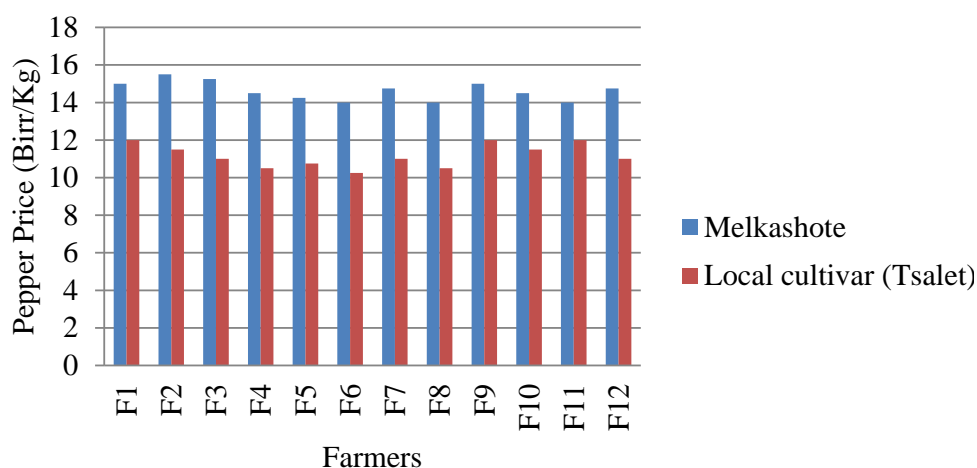
Market prices and gross income generated from sales of fresh pepper fruits

Price of fresh fruits of the improved pepper variety had better price than the local cultivar. This implies

Table 3. Mean fresh yield and maturity date of improved pepper variety versus local cultivar.

Farmer's number	Melkashote		Local cultivar	
	Days to 50% maturity	Total fresh yield (t/ha)	Days to 50% maturity	Total fresh yield (t/ha)
F ₁	115	11.4	129	7.8
F ₂	115	15.8	129	9.5
F ₃	115	17.6	129	12.5
F ₄	115	14.3	129	10.4
F ₅	115	15.4	129	11.8
F ₆	115	18.1	129	14.2
F ₇	115	14.2	129	10.5
F ₈	115	10.7	129	10
F ₉	115	10.1	129	7.2
F ₁₀	115	10.9	129	8.8
F ₁₁	115	13.8	129	10.7
F ₁₂	115	14.1	129	8.5
Mean	115	13.87	129	10.16

Source: Computed from survey data (2015); t/ha = ton per hectare; F = farmer 1...12.

**Figure 1.** Price of fresh pepper fruits sold by the farmers in the nearby market improved versus local cultivar.

Source: Computed from survey data (2015).

melkashote pepper fruit has got great market demand than the local cultivar (Figure 1).

Mean price of fresh fruits of the improved pepper variety sold by the farmers was 14.63 Birr¹/Kg or US\$ 0.78/Kg while the local cultivar was 11.25 Birr/Kg or US\$ 0.53/Kg (Figure 2). This implies melkashote pepper fruit had better price over the local cultivar.

Mean gross income generated from the improved pepper variety sold by the farmers was 202,859.60 Birr/ha or US\$ 96,46.33 per hectare while the local cultivar was 114,277.50 Birr/ha or US\$ 5,434.10 per hectare (Figure 3). This implies the farmers were able to generate more income from melkashote pepper fruit sold in the market over the local cultivar.

Farmers' perception on the attributes of pepper

Farmers' perception were collected on the attributes of productivity, fruit weight, fruit size, fruit length, fruit color, maturity, insect and disease resistance, marketability, fruit quality, taste and shelf-life. Based on farmers' perception results, except the attributes of fruit size, most of the respondents had favored the improved pepper variety (Melkashote) in its productivity, fruit length, fruit color, maturity, insect and disease resistance, marketability, fruit quality and taste than the local cultivar (Tsalet). However, about 41.7 and 66.7% of the respondents reported that there is no change in fruit weight and shelf-life, respectively between the improved

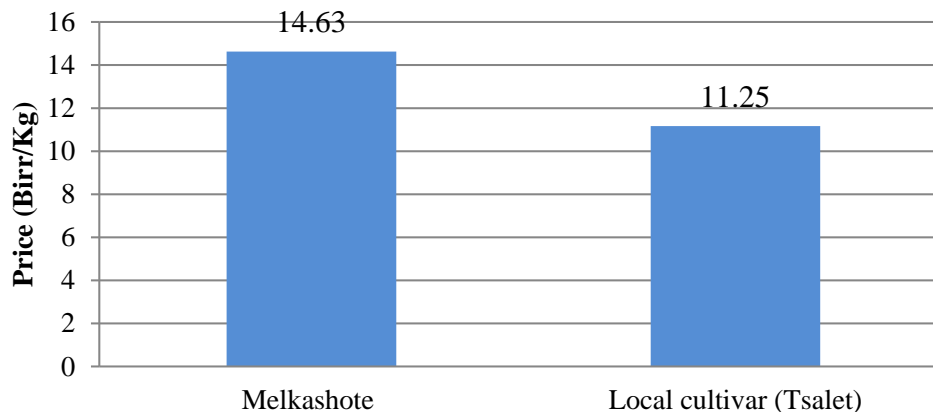


Figure 2. Mean price of fresh pepper fruits sold in the nearby market, improved versus local cultivar; 1 = Ethiopian Currency.

Source: Computed from survey data (2015).

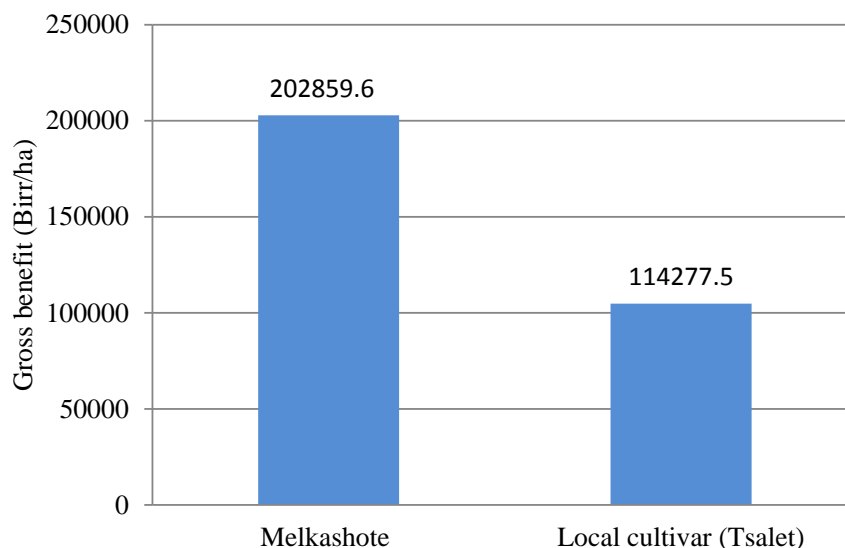


Figure 3. Mean gross income generated from fresh pepper fruits, improved versus local cultivar.

Source: Computed from survey data (2015).

hot pepper variety and the local cultivar. Equal number of respondents reported that fruit size (41.7%) of the improved pepper is good and poor (Table 4). Generally, most of the respondents had good perception based on the attributes of the improved hot pepper variety as compared to the local cultivar. Hence, the farmers decided to grow the variety in the next production season.

CONCLUSION AND RECOMMENDATIONS

As the study result shows, the improved pepper variety had better yield advantage over the local cultivar; hence

the farmers were able to maximize more benefit or gross income. Besides, the improved pepper variety matured earlier than the local cultivar and awareness of the farmers on nursery management, transplanting, fertilizer application and other cultural practice of pepper increased. Hence, the farmers favored the improved pepper variety and decided to grow it in the next production season. Therefore, it can be recommended that: farmers should produce high yielding and early maturing improved hot pepper variety (Melkashote) instead of producing low yielding local pepper cultivar. Therefore, further popularization and scaling out activities should be done by the research center and office of agriculture and rural development of the district.

Table 4. Farmers perception on attributes of improved hot pepper variety versus local cultivar.

S/N	Attribute	N	Perception level [*]		
			Poor (%)	No change (%)	Good (%)
1	Productivity	12	0	0	100
2	Fruit weight	12	25	41.7	33.3
3	Fruit size	12	41.7	16.6	41.7
4	Fruit length	12	0	0	100
5	Fruit color	12	0	0	100
6	Maturity	12	0	41.7	58.3
7	Insect resistant	12	16.7	33.3	50
8	Disease resistant	12	16.7	33.3	50
9	Marketability	12	0	16.7	83.3
10	Fruit quality	12	0	0	100
11	Taste	12	0	0	100
12	Shelf-life	12	0	66.7	33.3

Source: Computed from survey data (2015); * Poor = 1; No change = 2; Good = 3.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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