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Evaluation of improved hermaphrodite papaya (*Carica papaya* L.) varieties at Arba Minch, Southern Ethiopia

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ABSTRACT

The experiment was conducted to evaluate the adaptability of newly released papaya varieties at Chano Mille research site of Arba Minch Agricultural Research Center during 2019-2020 cropping seasons. The three hermaphrodite papaya varieties namely; Braz-HS1, Koka-HM1 and Meki-HL1 were used for the study and laid-out in a Randomized Complete Block Design in three replications. Data on yield and yield components were collected and analyzed by using analysis of variance (ANOVA) through Statistical Analytics System software. The ANOVA results revealed that there were significant variations among papaya varieties for the studied parameters. Significantly, the highest number of fruits plant⁻¹, number of leaves and fruit yield were obtained from Braz-HS1 papaya variety. The fruit yield of Braz-HS1 variety was 46% higher than that of Koka-HM1. In general, Braz-HS1 papaya variety performed (in terms of number of fruits and fruit yield) better than the rest two varieties. Thus, Braz-HS1 papaya variety could be recommended for the papaya growers in the study area and vicinity with similar agro-ecology.

Keywords: Adaptability, Arba Minch, Fruit yield, Papaya varieties

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Introduction

Papaya (*Carica papaya* L.) is a short-lived perennial plant in the genus *Carica* under the family of *Caricaceae*. It is among the most important fruit crops growing mainly in the tropical and warmest parts of subtropical regions of the world. Papaya fruits are very popular due to their high nutritive, medicinal and other multiple uses such as meat tenderizer (extracted papain), raw materials for cosmetics, soft drinks and food canning industries and it is one of the high value fruit crops (Munoz *et al.*, 2000; Josef, 2008; Mello *et al.*, 2008; Ming *et al.*, 2008; Serrano and Cattaneo, 2010). Moreover, papaya helps the human body to properly digest food and important to control premature aging (Sepiah, 1993; Milind and Gurditta, 2017).

In Ethiopia, papaya is one of the most important fruit crops, which is produced for fresh and processed local consumption as well as for fresh fruit export purpose. Like for other fruits, the demand for papaya is increasing steadily due to rapid population growth and changes in dietary habits, but its productions have not been expanded as the country's potential and market

demand. In recent years, it has also attained great popularity primarily because of its easy cultivation, quick returns (early fruiting as compared to other fruit crops), adaptability to diverse soil and climatic conditions; it occupies significant positions in homestead, smallholder and commercial production for home consumption and income generation.

Currently, papaya covered about 4010 hectares of land with total production of 59,205 tons in Ethiopia during 2018-2019 cropping season (CSA, 2019). According to CSA (2019) data, it was also indicated that the distribution of papaya across the country was only 3.34% as compared to other fruit crops despite its importance. The productivity of papaya in the country is 14 tha⁻¹ (CSA, 2019) which is very low as compared to the world average yield (30 t ha⁻¹) (FAOSTAT, 2019). Southern Nations, Nationalities and Peoples' (SNNP) regional state shared 40, 47 and 60% in number of smallholders, area coverage and total production of papaya, respectively as compared to the country (CSA, 2019). This indicates that the region has huge potential for papaya

production. Arba Minch, the fruit paradise, is one of the districts found in SNNP regional state where different fruit crops are dominantly produced for income generation (Tuma, 2007). However, the total area covered by papaya and its productivity is very low as compared to the potential that the country and Arba Minch have.

Lack of improved papaya varieties and low accessibility of the existing improved varieties are among the major papaya production constraints in Arba Minch, in particular and in Ethiopia, in general. Therefore, this study was conducted to evaluate the adaptability of newly released papaya varieties at Arba Minch, Southern Ethiopia to increase the accessibility of available improved papaya varieties for growers.

Materials and Methods

Descriptions of the study area

This study was conducted at Chano Mille research site of Arba Minch Agricultural Research Center for two years (2019-2020). It is situated at 5° 59' to 6°4'N and 37° 31' to 37° 36'E at an altitude of 1220 m.a.s.l. The site received mean annual rainfall of 713 mm with minimum and maximum temperature of 17 and 31°C, respectively in the two consecutive years (2019-2020).

Experimental treatments and design

The three newly released papaya varieties namely; Braz-HS1 (CMF078-L56), Koka-HM1 (KK103-L446) and Meki-HL1 (MK121-L516) were used for this study. Melkassa Agricultural Research Center (MARC) released these varieties in 2015 cropping season owing to their distinct characters such as fruit size, flesh aroma and color, fiber, skin thickness, pulp TSS (°Brix) and fruit yield (MoA, 2015). The experimental treatments were arranged in Randomized Complete Block Design in three replications. The seedlings of the three varieties were brought from MARC and planted at the spacing of 2.5 m between rows and plants in a plot size of 10 m x 7.5 m. All other agronomic management practices (supplementary irrigation, weeding, etc.) were

applied uniformly to all varieties as per the recommendation for the crop (MoA, 2015).

Data collection and analysis

Data were collected for six traits namely; fruit weight (FW), fruit diameter (FD), fruit length (FL), number of fruits plant⁻¹ (NFP), number of leaves plant⁻¹ (NL) and fruit yield throughout the years. All the collected data were subjected to analysis of variance by using the procedures outlined by Gomez and Gomez (1984) through SAS software version 9.2 (SAS, 2008). Mean separation was done by using Least Significant Difference (LSD) to compare significant treatment means at 5% level of significance.

Results and Discussion

The analysis of variance results revealed that all the traits considered in this study showed significant differences among the varieties (Table 1). Accordingly, the maximum number of fruits per plant and number of leaves plant⁻¹ were observed in Braz-HS1 variety whereas Koka-HM1 and Meki-HL1 exhibited the least in the two traits without significant difference among each other. The highest fruit weight was obtained from Meki-HL1 variety that is statistically similar with Koka-HM1 variety while fruit weight of Braz-HS1 was significantly minimum (Table 2). The highest fruit yield was obtained from Braz-HS1 variety while the lowest fruit yield was harvested from Koka-HM1 variety. This might be due to the genetic difference of the variety that can show its performance in a given area. It was also reported that the inherent characters of the varieties, space availability, nutrient availability and weather condition of the specific area (MoA, 2015; Wegayehu *et al.*, 2016; Ayele *et al.*, 2017) influenced the performance of papaya varieties in terms of yield and yield components. The fruit yield of Braz-HS1 was more than six fold of the current papaya productivity in both the region and country. Therefore, production of Braz-HS1 papaya variety could increase the productivity of papaya in the study area if all appropriate agronomic practices were applied.

Table 1. Analysis of variance for the traits considered in this study.

Source of variation	Degrees of freedom	Mean Squares					
		NL	NFP	FW	FD	FL	Yield
Variety	2	133.58*	67.78*	44205.34*	25.33*	8.087*	1825.18**
Replication	3	7.60	42.49	13950.70	3.83	1.810	46.76
Error	6	21.47	14.68	10652.90	5.90	1.640	46.77
Grand mean		32.58	28.33	411.23	21.42	17.080	67.97
LSD (0.05)		8.02	6.63	178.58	4.20	2.210	11.83
CV (%)		14.20	13.50	25.09	11.30	7.500	10.10

FW: fruit weight; FD: fruit diameter; FL: fruit length; NFP: number of fruits plant⁻¹; NL: number of leaves plant⁻¹.

Table 2. Mean values of yield and yield components of the three papaya varieties evaluated at Arba Minch, Southern Ethiopia.

Varieties	Parameters					
	NL	NFP	FW (g)	FD (cm)	FL (cm)	Yield (t ha ⁻¹)
Braz-HS1 (CMFo78-L56)	39.25a	31.50a	401.94b	18.75b	15.50b	91.30a
Koka-HM1 (KK103-L446)	29.50b	29.80ab	585.13ab	23.65a	18.25a	49.31c
Meki-HL1 (MK121-L516)	29.50b	23.67b	711.63a	21.85ab	17.50ab	63.34b
LSD (0.05)	8.02	6.63	178.58	4.20	2.21	11.83
CV (%)	14.20	13.50	25.09	11.30	7.50	10.10

FW: fruit weight; FD: fruit diameter; FL: fruit length; NFP: number of fruits plant⁻¹; NL: number of leaves plant⁻¹.

Means in each column followed by the same letter(s) were not significantly different at 5% significance level.

Conclusion and Recommendation

Papaya is one of the most economically important fruit crops grown in Gamo zone mainly by smallholder farmers. This study showed that there was significant variation among the papaya varieties evaluated at Arba Minch, Southern Ethiopia. Among the evaluated varieties, the highest fruit yield was obtained from Braz-HS1 variety as compared to other varieties. Therefore, this variety could be recommended for wider production in the study area and vicinity with similar agro-ecology.

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