



## Participatory Variety Selection of Hot Pepper Varieties at Halaba and Negelle Arsi Districts, Southern Ethiopia

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**Abstract:** In Ethiopia hot pepper is one of the important vegetable crops produced for home consumption, local markets and international markets. The price of hot pepper in both green pod and dry pod was being increased due to various factors. Selection of best variety for green pod and also for dry pod purpose is mandatory before production. Hence, participatory variety selection was conducted at Halaba and Negelle Arsi districts of the Southern Ethiopia during 2020/2021 cropping season. Five varieties (Melka Oli, Melka Awaze, Melka Shote, Melka Zala, and Melka Dera) were evaluated for green pod purpose and four varieties Melka Awaze, Melka Shote, Melka Zala, Mareko Fana, and local variety were used for dry pod evaluation purpose at both sites. The Researchers' data and farmers preferences toward the varieties were collected and analyzed using SAS software and pair wise ranking, respectively. From the farmers' evaluation results Melka Dera followed by Melka Shote selected for green pod and Mareko Fana for dry pod purpose. Researchers' evaluation results also showed that Mareko Fana was higher in yield and yield components as compared to other varieties evaluated for dry pod purpose. Therefore, based on the results obtained it is better and recommended to produce Melka Dera and Melka Shote for green pod and Mareko Fana for dry pod for the farmers of Halaba and Negelle Arsi districts and other similar agro-ecologies. However, for comprehensive results the participatory variety evaluation should be repeated using irrigation and all possible hot pepper varieties for both green pod and dry pod purposes.

**Keywords:** Hot pepper dry pod, hot pepper green pod, variety, participatory.

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## 1. INTRODUCTION

Hot pepper (*Capsicum* species) is one of the import plants from the family Solanaceae (Kumar *et al.*, 2011). Globally there are about 1,600 different varieties of pepper throughout the world categorized in to five main domesticated species such as *C. annum* L., *C. frutescens* L. *C. Chinenses*, *C. baccatum* L., and *C. pubescens* R. (Bosland and Votaya, 2000). Hot pepper believed to be originated in Andes of South America and Central America (Mexico) from where Spanish

and Portuguese explorers spread it around the world (Salter, 1985; Walter, 1986). Hot pepper produced, traded and widely consumed globally in various industries such as food and pharmaceuticals (Caporaso *et al.*, 2013). Hot pepper is one of the high value vegetable crops. The contribution of hot pepper in food industry widely discussed so far. According to Geleta (1998), the fruits are consumed as fresh, dried or processed, as table vegetables and as spices or condiments. Beside, nutritional value of hot pepper

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reported as it is a rich source of vitamin (Vitamin A, Vitamin C and Vitamin E) and minerals (Poulos, 1993). On the other hand, the medicinal values of hot pepper strongly linked with the traditional as well as the modern medicine systems. Hot pepper used to treat asthma, coughs, arthritis and sore throats (Bosland and Votaya, 2000). Hot pepper also used in processing industries as a coloring agent and raw material for the export markets in the form of oleoresin (Bosland and Votaya, 2000). Because of these nutritive and medicinal contributions, the demand for the hot pepper enhanced from year to year.

However in order to ensure global supply of the hot pepper products both in quality and quantity, improving its production is the main job which involves the use of high yielding and disease resistant varieties. Variety is one of the most important factors to be considered during crop production and productivity. Therefore, it is important to evaluate and select the best hot pepper varieties for yield, quality, disease resistance, and market preference. Hence, the current work was initiated to evaluate and select best hot pepper varieties for higher yield and yield components.

## 2. MATERIAL AND METHODS

### 2.1 Description of the Study Area

The current experiment was conducted at Halaba and Negelle Arsi districts of the Southern Ethiopia during 2020/2021 cropping season under rain fed condition. Halaba district is known for its major hot pepper producing potential. It is located 314 km south of Addis Ababa and 85 km southwest of Hawassa City. It lies between 07° 20'34.5" to 07° 20'21.9"N latitude and 38° 06'30.0" to 38° 06'31.1"E longitude with an altitude of 1808 m.a.s.l. Hot pepper producing village from the mid-altitude agro-ecology was selected for the experiment. The site receives annual rainfall that varies from 857 to 1085 mm, and the annual mean temperatures vary from 13 °C to 20 °C. The site also has a bimodal rainfall where the small rains are between March and April while the main rains are from July to September. The major crops grown in the Halaba district include maize, wheat, hot pepper, haricot bean, sorghum, and millet (Ayale, 2016). The second experimental site, a village from Negelle Arsi district, is located at 7°05'N and 39°29'E at the elevation of 1895 m.a.s.l. The area receives a mean annual rainfall of 964 mm with minimum and maximum temperature of 12.94 and 27.34°C, respectively (Lemma *et al.*, 2022).

### 2.2 Varieties Evaluated for Evaluation Purpose

These hot pepper varieties were evaluated for green pod and/or for dry pod purposes.

1. Melka Awaze evaluated for both green and dry pod
2. Melka Shote evaluated for both green and dry pod
3. Mareko Fana evaluated for dry pod
4. Melka Zala evaluated for both green and dry pod
5. Melka Dera evaluated for green pod
6. Melka Oli evaluated for green pod
7. Local variety used for comparing varieties for dry pod.

### 2.3 Field Establishment and Management

This participatory variety selection experiment comprised replicated and non-replicated systems. The no-replicated and replicated plot areas were 10metre\*10metre and 2.8metre\*3metre, respectively. The non-replicated plots were used for field evaluation by selected farmers and experts while data were collected, analyzed and evaluated from the replicated for analysis. The replicated experiment was arranged in a randomized complete block design (RCBD) with three replications where the treatments were randomly assigned to each plot. Transplanting was conducted using row spacing of 70cm and plant spacing of 30cm and space between replications and plots were 1.5m and 1m, respectively. Plants in the middle rows of the net plot were used as the sampling unit for data analysis. All field management activities were done as required as per recommendations.

### 2.4 Farmers' Selection and Participatory Evaluation of the Varieties

Hot pepper producing 40 farmers (20 farmers from each site) which include 9 Female and 31 Male farmers were considered for the participatory variety evaluation and selection. Besides, 4 experts (2 Female and 2 male) were also from both sites participated in the variety selection. First, farmers and crop production experts set their preference criteria for the green pod and dry pod purposes. Disease resistance, pod size, pod shape, pod uniformity, market preference, yield were criteria set by participated farmers hence hot pepper varieties for green pod and dry pod were evaluated using these evaluation criteria set by farmers and analyzed using pair wise and matrix ranking.

### 2.5 Data Collection and Analysis

Dry pod yield data were collected from the replicated experiment plots and subjected to analysis of variance using SAS package (SAS 9.4). The least significance differences (LSD) were made to compare the treatments following the procedures of Gomez

and Gomez (1984). Farmers’ perception data were analyzed using SPSS software.

### 3. RESULTS AND DISCUSSION

#### 3.1 Farmers’ Evaluation

##### Farmers’ Preference of the Hot Pepper Varieties for Green Pod Purpose at Halaba and Negelle Arsi during 2020/2021 cropping season

Farmers’ perception for the performances of the hot pepper varieties was recorded both at Halaba and Negelle Arsi. A total of thirty three (33) farmers were participated and actively evaluated the varieties based on their six criteria. Farmers evaluated the

disease tolerance, yield performance, pod quality, and marketability of the pods. As shown below (Table 1), Melka Dera variety was better in disease resistance as noted by the participating farmers and Melka Shote and Melka Zala varieties were not preference by farmers with respect to the disease condition. Even though, Melka Dera variety was second in terms of yield following Melka Shote during the present study, a variety choice conducted not only for its yield but also considering other criteria like quality and market preference. Hence, the overall farmers’ choice for green pod purpose belongs to Melka Dera followed by Melka shote and Melka Oli, respectively (Table 1).

**Table 1: Farmers’ preferences for hot pepper varieties for green pod purpose at Halaba and Negelle Arsi (n=33) during 2020/2021 cropping season**

Preference Criteria	Hot pepper varieties				
	Melka Oli	Melka Awaze	Melka Shote	Melka Zala	Melka Dera
Disease resistance	7	6	4	5	11
High yielder	7	6	9	3	8
pod size (medium)	2	7	8	6	10
Pod shape (straight)	5	6	5	5	12
Pod uniformity	10	4	4	5	10
Market preference	6	5	8	4	9
Total preference	37	34	38	28	60
Rank	3	4	2	5	1

Based on the criteria set by the farmers, each farmer compared the varieties each other using pair-wise ranking as shown below (Table 2). The result showed that Melka Dera was the most preferred varieties followed by Melka Shote and Melka Oli (Table 2). The farmers gave lowest rank for Melka Zala due to its low yield and market preference as

compared to the other varieties. Therefore, in their hot pepper production strategies for green pod purposes, the vegetable production and extension departments of the respective testing locations should consider Melka Dera and Melka Shote varieties for future production and marketing.

**Table 2: Pair wise ranking on the overall preference of farmers toward different hot pepper varieties for green pod purpose at Halaba and Negelle Arsi during 2020/2021 cropping season**

	Melka Oli	Melka Awaze	Melka Shote	Melka Zala	Melka Dera	Total score
Melka Oli						2
Melka Awaze	Melka Oli					1
Melka Shote	Melka Shote	Melka Shote				3
Melka Zala	Melka Oli	Melka Awaze	Melka Shote			0
Melka Dera	Melka Dera	Melka Dera	Melka Dera	Melka Dera		4

*Total score 0= the lower rank, total score 4=the higher rank*

##### Farmers’ Preference of the Hot Pepper Varieties for Dry Pod Purpose at Halaba and Negelle Arsi during the 2020/2021 Cropping Season

Four varieties and one locally available variety of the hot pepper were evaluated for dry pod purpose based on earliness, disease resistance, dry pod yield, pod size, pod color, pod uniformity and marketability criteria. The result of the farmers’ preference showed that Mareko Fana variety was

better because of pod size, pod color, and marketability and followed by the local variety (Table 3). The rest hot pepper varieties Melka Awaze, Melka Shote, and Melka Zala were not preferred by most farmers during the evaluation for dry pod (Table 3). Farmers’ evaluation result was similar with that of the researchers’ result which showed as Mareko Fana hot pepper variety was the superior variety for dry pod.

**Table 3: Farmer’s preference of hot pepper varieties for dry pod purpose at Halaba and Negelle Arsi (n=15)**

Preference Criteria	Hot pepper varieties evaluated for dry pod purpose				
	Melka Awaze	Melka Shote	Mareko Fana	Melka Zala	Local variety
Earliness	0	0	8	0	7
Disease resistance	4	4	2	3	2
High yielder	3	2	4	2	4
pod size (large)	0	0	7	2	6
pod color	0	0	8	0	7
Pod uniformity	3	4	3	3	2
Market preference	0	0	7	2	6
Total preference	10	10	39	12	34
Overall mean	1.4	1.4	5.5	1.7	4.8
Rank	4	4	1	3	2

Moreover, evaluation of the hot pepper varieties using par-wise ranking showed that Mareko Fana variety became the higher in rank followed by the local variety (Table 4). The lower rank was given to the Melka Shote variety. The larger the pod size, the attractiveness of the pod color and the higher domestic market demand made the Mareko Fana variety the best among the rest varieties tested for dry pod purpose. The current finding is similar with the findings of Tesheshigo *et al.*, (2019) who recommended Mareko Fana over other varieties due to higher number of pod per plant (36.6) higher

marketable yield (6.18-6.34t/ha). Moreover, the driving force that enhances the acceptances of the Mareko Fana hot pepper variety might be due to the better shelf life after harvest as there were reports that supported the results. For instance, during their postharvest study Samira and Woldetsadik (2013) reported that the shelf life of hot pepper was improved and the quality characteristics were maintained better in Mareko Fana than in the other varieties when harvested at mature green stage and stored under evaporative cooled storage.



**Figure 1: Participatory Hot pepper variety evaluation at afield condition, Negelle Arsi district**

**Table 4: Pair wise ranking on the overall preference of farmers toward different hot pepper varieties for dry pod purpose at Halaba and Negelle Arsi during 2020/2021 cropping season**

	Melka Awaze	Melka Shote	Mareko Fana	Melka Zala	Local	Total score
Melka Awaze						1
Melka Shote	Melka Awaze					0
Mareko Fana	Mareko Fana	Mareko Fana				4
Melka Zala	Melka Zala	Melka Zala	Mareko Fana			2
Local	Local	Local	Mareko Fana	Local		3

### 3.2 Researchers' Evaluation

#### Growth, Yield Components and Yield of Hot Pepper Varieties for Dry Pod Purpose

The analysis of variance (ANOVA) showed both highly significant differences ( $p < 0.01$ ) and non-significant difference ( $p > 0.05$ ) among hot pepper varieties evaluated for dry pod purpose with respect plant height, branch number per plant, pod number per plant, pod diameter, pod length, marketable yield per hectare, and total yield per hectare (Table 5). No significant difference observed in plant height and branch number per plant, however, the higher significant pod number per plant (34.1) was obtained from Melka Shote compared to the other varieties including the local variety and the lower significant

pod number per plant was obtained from Melka Zala (15.93). Mareko Fana variety, the oldest and the most important hot pepper variety for domestic consumption, was superior and statistically equivalent with that of local variety in pod diameter, marketable yield per hectare, and total yield per hectare (Table 5). The results of the present significant variations among hot pepper varieties is similar with the findings of the other authors' investigations in the country (Daniel and Abrham, 2020; Teferi *et al.*, (2015). Besides, Tesheshigo *et al.*, (2019) also reported as Mareko Fana was superior in yield and yield components compared to other varieties.

**Table 5: Overall mean performance of hot pepper varieties for dry pod purpose evaluated during 2020/2021**

Varieties	Plant height (cm)	Branch numbers per plant	Pod number per plant	Pod Diameter (cm)	Pod Length (cm)	Marketable yield per hectare (t)	Total Yield per hectare (t)
Local	56.57	8.00	18.80 <sup>abc</sup>	1.65 <sup>a</sup>	9.91 <sup>a</sup>	2.71 <sup>a</sup>	3.02 <sup>a</sup>
Melka Awaze	53.02	10.67	27.57 <sup>abc</sup>	1.11 <sup>b</sup>	6.47 <sup>c</sup>	2.20 <sup>b</sup>	2.47 <sup>abc</sup>
Mareko Fana	54.83	7.53	20.00 <sup>abc</sup>	1.7 <sup>a</sup>	8.20 <sup>abc</sup>	2.75 <sup>a</sup>	3.06 <sup>a</sup>
Melka Shote	48.87	10.53	34.10 <sup>a</sup>	0.79 <sup>b</sup>	7.49 <sup>bc</sup>	2.09 <sup>b</sup>	2.34 <sup>c</sup>
Melka Zala	52.09	9.87	15.93 <sup>c</sup>	1.07 <sup>b</sup>	8.05 <sup>abc</sup>	1.97 <sup>b</sup>	2.20 <sup>c</sup>
LSD <sub>0.05</sub>	ns	ns	15.83	0.36	2.00	0.38	0.63
CV (%)	15.91	18.02	36.11	15.08	13.24	8.66	12.65

## 4. SUMMARY AND CONCLUSION

Since hot pepper is important for domestic consumption and export purposes in both green pod and dry pod produce, each producer should learn and identify the best variety with good yield and quality. Besides, agricultural offices' experts should have the knowledge of the importance of the variety with production practices as well. From the present finding, farmers participated and evaluated hot pepper varieties for green pod and dry pod purposes. They chose Melka Dera variety for green pod followed by the Melka Shote variety as compared to the other varieties. Mareko Fana variety was selected for dry pod purpose by the participated farmers. Farmers choice for dry pod purpose was similar with result of the researchers' finding which showed Mareko Fana the high yield variety as compared to the other varieties. Therefore, growers in the study area and other similar areas can use Melka Dera and Melka Shote for green pod and Mareko Fana for dry pod hot pepper production. However, for comprehensive results the participatory variety evaluation should be repeated using irrigation and all possible hot pepper varieties for both green pod and dry pod purposes.

### Limitations of the Study

The present study was conducted during the rainy season and evaluation using different irrigation approaches left. We didn't consider all possible hot pepper varieties for evaluation during the study phase and further consideration by including the other improved varieties also advantageous.

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**Conflict of Interest:** The authors declare that they have no competing interests

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