Evaluation of Hot Pepper Varieties (*Capsicum species*) for yield related traits, Quality and yield in Burie District, West Gojjam Zone, Ethiopia

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Hot pepper is one of the major vegetables and spice crop produced in west Gojjam in Burie District that serve as the source of income particularly for small holders in many parts of the study area. The study was conducted at two locations Alefa and Zalima kebeles. The aim of study was to evaluate the effect of growing environment on the performance of hot pepper varieties and the interaction effect of location with varieties on yield and yield related characters. The treatment Randomized Complete Block Design with three replications. The result of the study revealed that almost all of the parameters considered were significantly affected by the varieties but not significantly affected by the treatments. Therefore, farmers in the study area recommended to use some varieties accordingly Mareko Fana, Bako Local and Melka Eshet (with 6.34, 5.43 and 4.69 t/ha, respectively) could be used for better yield than the rest of hot pepper varieties evaluated during the study period.

**Keyword:** Pepper, variety, location, yield, capsicum, quality,

**INTRODUCTION**

*Capsicum* has been known since the beginning of civilization in the Western Hemisphere. The genus Capsicum is a member of the Solanaceae family consists of approximately 22 wild species and five domesticated species. The five domesticated species include C. annum L., C. frutescens L., C. Chinenses., C. baccatum L., and C. pubescens (Bosland and Votava, 2000). Despite their vast trait differences most cultivars of peppers commercially cultivated in the world belongs to the species C. annum L. (Bosland, 1992). In Ethiopia, pepper grows under warm and humid weather conditions and the best fruit is obtained in a temperature 21-27 °C during the daytime and 15-20°C at night (IAR, 1996). It is extensively grown in most parts of the country, with the major production areas concentrated at altitude of 1100 to 1800 m.a.s.l. (MoARD, 2009). Hot pepper is one of the major vegetable crops produced in Ethiopia and the country is one of a few developing countries that have been producing paprika and *capsicum* oleoresins for export market. Because of its wide use in Ethiopian diet, the hot pepper is an important traditional crop mainly valued for its pungency and color. The crop is also one of the important spices that serve as the source of income particularly for smallholder producers in many parts of rural areas.

According to EEPA (2003), in the major pepper producing regions in the country, that is, Amhara, Southern Nations and Nationality People’s Regional State (SNNPR) and Oromia pepper generated an income of 122.80 million Birr for farmers in 2000/01. This value jumped to 509.44 million Birr for smallholder farmers in 2004/05. This indicates that hot pepper serves as one of the important sources of income to smallholder farmers and as exchange earning commodity in the country (Beyene and Phillips, 2007). Capsicum production especially the green one grew worldwide from 11 million in 1990 to 23.2 million metric tons in 2003 and 28 million metric tons in 2009 (FAO, 2009). Of this, China was the largest producer, accounting for about 50 percent, Mexico and Turkey each accounted another 7 percent, followed by Indonesia, Spain, the United States and Nigeria together accounting for 15 percent of world production. It is estimated that more than 1.8 million hectares of green peppers are grown in the world. The production of dry pepper in the world during the same period was lower, which was about 3 million metric...
tons from total area of about 1.9 million hectares. In Ethiopia, pepper is cultivated in many parts of the country and it is an important source of cash earning for smallholder producers both in green and dry forms. According to FAO (2009) report, the estimated production of peppers were 220,791 ton 97, 712 ha in green form and 118,514 t of dry pepper from an area of 300,000 ha.

Though Ethiopia is considered a source of pepper diversity, much work has not been done concerning about hot pepper cultivars improvement. Only two cultivars, namely Marekofana and Bako local were released in 1996 and are being extensively produced in the commercial farms and at household level. Currently, new hot pepper varieties like Melkashet, Melkaweze Melka zala and Melka shote have been released by Melkasa research centre.

The main constraints that contributed for low productivity of pepper in Ethiopia are: Shortage of improved varieties, Lack of proper and adequate inputs, Traditional production methods and Lack of research out puts on production techniques. According to Bure Agricultural office (2015) report, the present situation indicates that in study area there is shortage of improved hot pepper varieties but there is one variety named “Marekofana” by local growers.

The dry yield of this variety is very low (1.1 ton per hectare) compared to national average yield. There has also been no research on evaluation of hot pepper which enables the growers to select the best performing varieties in the study area. Better adaptable and well performing variety (varieties) with improved cultural practices could be a possibility to boost quality and marketable production of the crop. Therefore, evaluations of selected varieties are one of the considerations to ease the existing problems of obtaining the desired varieties, Beyene and Phillips (2007).

Objective of the Study

To evaluate the performance of different hot pepper varieties.

MATERIAL AND METHODS

Description of the Study Area

The study was conducted at two locations, Alefa and Zalima kebeles under Burie district. It is located at about 436 km from Addis Ababa, 169 km from the capital city of Amhara Region, Bahir Dar and at 10° 42’41”N rainfall 1750 ml, the mean minimum and maximum temperatures are 17°C- 27°C respectively and the soil type of the site is clay loam soil to vertisols.

Experimental Materials

The five hot pepper varieties which were collected from different Agricultural Research Centers were evaluated under two locations, that is, at Alefa kebele and Zalima kebele experimental sites. The five varieties of hot pepper were obtained from Melkassa and Bako Agricultural research centers. The varieties used were Mareko Fana, Melka Eshet, Melka Awaze, Bako-Lokal and Melka Shote. Seeds were sown in April, 2016 on a seed bed size of 1x10m. The seed bed was covered with a dry grass for 20 days. Then, beds were covered by raised shade to protect the seedling from strong sun shine and heavy rainfall until the plants were ready for transplanting. Watering was done based on climatic conditions with a fine watering can, and was hand weeded. Farmyard manure was added up on the recommended before the seed sown in to the seedbed.

Experimental Design

The study was conducted at two locations and five varieties were arranged in split plot in a Randomized Complete Block Design (RCBD) with three replications at each location to lay out the treatments (Raghavaro, 1983). The two locations were considered as a main plot while the five varieties were as a sub-plot. The plot size at each location was 1.5 m x 3.5 m (with a total plot size of 5.25 m²). Transplanting to the actual field was done when the seedlings attained 20 to 25 cm height and or at 55 days after sown. The Seedlings were spaced 30 cm between plants and 70 cm between rows. 200 kg/ha DAP as a side dressing during the transplanting operation and 100 kg/ha for UREA, half of it during the transplanting and half of it 15 days after transplanting was applied. All agronomic differences are attributed to the availability of optimum managements were adopted following previous climatic condition in greenhouse compared to conditions recommendations (EARO, 2004).

There were five rows per plot and five plants per row with a total of 25 plants per plot. Hand weeding was done frequently as per the emergence of the weeds. The testing locations represent major hot pepper producing areas of the study area having typical tropical and sub-tropical climate. Hence, the varieties were expected to express their full genetic potentials for the characters under consideration.

Data Collected

Data were collected from the middle five plants from central rows excluding the border rows and the rest of all response variables were recorded from the average of those five selected sample plants per plot at each location, as indicated below.

Data Analysis

For each measured response variables analysis of variance (ANOVA) mean separation procedure was carried out. The classical fixed effect analysis of variance model that includes the main effects of locations, varieties
together with interaction effects of locations and varieties were used. The ANOVA model used for the analysis was: 

$$Y_{ij} = \mu + V_i + L_j + (V \times L)_{ij} + e_{ij}$$

Where, \(Y_{ij}\) the mean value of the response variable of the \(i^{th}\) variety at the \(j^{th}\) location and the right hand side of the equation gives the grand mean value (\(\mu\)) and the respective main and interaction effects of varieties and locations. \(e_{ij}\) is a random error term due to those uncontrolled factors.

After fitting ANOVA model for those significant interactions or main effects a mean assumption procedure using LSD mean methods were carried out at required levels of probability. Simple correlation analysis between different characters was also computed to observe associations between characters. In order to assess the associations between those measured response variables a Pearson correlation procedure was carried out. All the statistical analysis was carried out using SAS-9.2 and Minitab 17 statistical package.

RESULT AND DISCUSSION

The analysis of variance indicated significant difference among different tested hot pepper varieties and there was no interaction effect with respect to vegetative growth, yield and quality parameters. Hence, the results are presented and discussed here under.

GROWTH PARAMETERS

Plant Height (cm)

Highly significant difference was observed between varieties at (p<0.01); while there was non-significant (p>0.01) interaction effect between varieties and location based on the selected parameters. The tallest plant height was recorded from Marko Fana variety at Alefa location (69.33 cm) followed by Baco local (62.93 cm) variety at the same location and the shortest plant height was recorded from Melka Awaze (50.08 cm) variety at Zalima location (Table 1). The result contradicts with the findings of Melaku et al. (2015) which reported the highest plant height observed in Melka Awaze and the lowest in treatment Mareko Fana variety tested five varieties in one location.

Increase in plant height could mainly be due to better availability of soil nutrients in the growing areas, especially Nitrogen and Phosphorus which have enhancing effect on the vegetative growth of plants by increasing cell division and elongation and the varietal variability to absorb the nutrients from the soil (Vos and Frinking, 1997), El-Tohamy et al. (2006). The result of this study confirms the finding of (Gonzalez et al. 2004) who reported that organic manure and inorganic fertilizer supplied most of the essential nutrients at growth stage resulting in increase of growth variables including plant height.

Days to 50% Flowering

The number of days to fifty percent flowering showed a significant (p<0.01) difference between varieties but there was recorded non-significant deference across location at (p>0.01). Accordingly, the shortest days to fifty percent flowering is recorded from Melka Eshet variety (71 days) at Alefa experimental site while the longest days to fifty percent flowering is attained from Melka Awaze variety (84 days) at Zalima experimental site (Table 1).

This result is similar to the work of (Silesh Dessalegn, 2011) that Melka Shote was an intermediate duration of days to set flowers. Earliness or lateness in the days to 50% flowering might have been due to their inherited characters, early acclimatization to the growing area to enhance their growth and developments and/ or due to the transplanting disturbance since it is subjected to loss of feeder roots during uplifting, and consumed their energy to repair damaged organs and thus the process demanded them more time to resume shoot growth. Moreover, the earliness or lateness in days to flowering could also be affected by high temperature of the growing area (that reaches about 32°C during flowering) that may enhance the flowering nature of the crop. This result, therefore confirmed the findings of(Sam-Aggrey and Bereke-Tsehai (1985) that reported earliness or tardiness in flowering of pepper plants could be affected by the growing environment as well as the planting methods.

Number of Flowers Per Plant

The number of flowers per plant showed highly significant (P<0.01) difference between varieties but the same character showed non-significant (P>0.01) difference across location at comparatively, the highest number of flowers was recorded from Melka Awaze (89.60) at Alefa experimental site. While the lowest number of flowers was recorded from Melka Eshet variety (41.40) at Zalima experimental site (table 1).

This result contradicts with the result of (Silesh Dessalegn, 2011) under Jimma condition that there was very highly significant difference between varieties and location. Moreover, the primary cause of poor flowering and fruit set as well as marketable yield loss could be due to diseases, wind and heavy rain during flowering in decreasing effective pollination that resulting in loss of potential fruit, frost causes flower and fruit damage and loss of yield. This result is in agreement with the work of Sreelanthakumary and Rajamony (2004) who indicated that, the inhibitory effect of high temperature should be considered during the flowering period.
Table 1. Mean values of different tested characteristics as affected by the interaction between location and varieties in 2008/09

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Plant height (cm)</th>
<th>Days to 50% flowering</th>
<th>Number of flowers per plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alefa</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zalima</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melka</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shote</td>
<td>52.53b 51.35a</td>
<td>77.33ab 79.167b</td>
<td>68.60c 58.7c</td>
</tr>
<tr>
<td>Melka</td>
<td>51.23b 50.08b</td>
<td>82.00a 84.00a</td>
<td>89.60a 79.70a</td>
</tr>
<tr>
<td>Awaze</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bako</td>
<td>62.93a 61.95a</td>
<td>74.00c 76.00c</td>
<td>79.20b 69.20b</td>
</tr>
<tr>
<td>Local</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melka</td>
<td>51.4b 50.23b</td>
<td>71.00c 73.50d</td>
<td>51.40d 41.40d</td>
</tr>
<tr>
<td>Eshet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marko</td>
<td>69.33a 64.867a</td>
<td>76.00 c 78.00 cb</td>
<td>51.53d 41.57d</td>
</tr>
<tr>
<td>Fana</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CV%</td>
<td>11.3</td>
<td>2.4</td>
<td>4.6</td>
</tr>
</tbody>
</table>

Values in each column sharing same letter are not significantly affected at (α = 0.01)

Days to First Harvest

According to data analysis, days to first harvest showed highly significant (P<0.01) difference between varieties and across location. The shortest day to first harvest was recorded from Melka Eshet variety (132.33 days) at Alefa site. While the longest days taken for first harvest was attained from Melka Awaze (157.67 days) at the same location (Table 2).

The variations in days to first harvest (maturity) could be due to the differences in due to the genetic make-up of the varieties. For best growth and fruit maturity and quality, it should be grown in an area with a temperature of (21-29°C day) and (15-20°C night) and soil pH of 6.5-7.5.

Canopy Diameter (cm)

Highly significant variation (P<0.01) was observed in canopy diameter between varieties. While non-significant (P>0.01) interaction between varieties and location was recorded. The widest canopy diameter was recorded from Melka Eshet (24.37 cm) at Alefa experimental site, where as the smallest diameter was recorded from Melka Awaze (17.77 cm) at Zalima experimental site (Table 2).

These variations in canopy diameter between varieties might be due to their inherited traits, the growing environments, soil type, and rainfall and soil pH. This variation on the other hand, may determine the yielding potential of the crop, since, varieties with wider canopy diameter could produce more fruit (pods) than varieties with narrow canopy due to increased number of secondary and tertiary branches which are the locations for fruit bud formation. (Aliyu et al., 2002) used the crown diameter as the main variable to identify the quality of strawberry transplants.

Number of Primary Branches Per Plant

Highly significant (P<0.01) difference was observed between tested varieties. While non-significant (P>0.01) difference was recorded between varieties and location. The highest number of branches recorded from Melka Shote (6.2) at Alefa and (5.60) at Zalima followed by Bako Local (4.93). The lowest number of primary branches per plant was observed Melka Awaze (3.47) at Zalima experimental site (Table 3). This result is in line with the work of (Sileshi Dessalegn, 2011) reported the highest number of primary branches attained from Mareko Fana (9.33), Bako Local (9.15), Melka Shote (9.30) at JUCAVM experimental field.

Table 2. Mean values of different tested characteristics as affected by the interaction between location and varieties in 2008/09

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Days to first harvest</th>
<th>Canopy diameter</th>
<th>Number of primary branch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alefa</td>
<td>146.33b 146.167b</td>
<td>19.71b 19.39a</td>
<td>6.20a 5.60a</td>
</tr>
<tr>
<td>Zalima</td>
<td>157.67a 156.333a</td>
<td>18.21b 17.77c</td>
<td>4.09a 3.47b</td>
</tr>
<tr>
<td>Melka</td>
<td>142.00c 142.00c</td>
<td>23.34a 23.54a</td>
<td>4.93a 4.33b</td>
</tr>
<tr>
<td>Shote</td>
<td>132.33d 136.167d</td>
<td>24.37a 22.71a</td>
<td>4.76a 4.20bda</td>
</tr>
<tr>
<td>Bako</td>
<td>151.33d 149.66b</td>
<td>20.06d 18.03cb</td>
<td>4.85a 4.17bda</td>
</tr>
<tr>
<td>Local</td>
<td>1.3</td>
<td>9.6</td>
<td>31.8</td>
</tr>
</tbody>
</table>

Values in each column sharing same letter are not significantly affected at (α = 0.01)

YIELD AND YIELD RELATED PARAMETERS

Number of Pod Per Plant

There was highly significant difference (P>0.01) between varieties in number of pods per plant. But there was non-significant difference (P<0.01) attained between varieties and location. The highest number of pods was counted from Mareko Fana variety (36.6) at Alefa experimental site while the lowest number of pods was recorded from Melka Eshet variety (19.30) at Zalima experimental site (Table 3).

This result in line to (Melaku et al., 2007) local variety had the highest number of fruits (88.3) even if the size is smaller compared with the other varieties, while the least number of fruits per plant was recorded from variety Melka Awze (28.00). The variations in fruit yield might be due to the influence of the growing environment’s temperature, associated traits like canopy diameter that could limit the number of branches. Because, as a number of primaries, secondary and tertiary branches increased, there could be a possibility of increasing the number of fruits producing...
buds for fruit production. Moreover, the variations in fruit development among varieties, could also be due to the temperature stress of the growing environment and the capability of each varieties to withstand the stress specially on the reproductive development, which is more sensitive to high temperature stress (day and night temperature) than vegetative development. (Sato and Peel, 2005) also reported that, the reduction of fruit set under moderately elevated temperature stress was mostly due to a reduction in pollen release and viability in tomato plant (Lycopersicum esculentum Mill.).

**Average Number of Seeds per Pod**

Highly significant difference was attained (P>0.01) between varieties in average seed number per pod, but there was non-significant (P<0.01) difference recorded between varieties and location in the same character. The highest seed number per pod was counted from Melka Eshet (146) at both Alefa and Zalim experimental sites. While the lowest seed number per pod was counted from Melka Shote (57) variety in both experimental sites (Table 3).

This result is in line with (Marcelis and Baan Hofman-Eijer, 1997 and Lemma, 1998) who pointed that seed number per pod is one factor that determine pod size. They observed a linear increase in individual fruit size and weight with seed number. Furthermore, this report is consistent with that of (Russo, 2003) who observed positive relationship between seed number and pod size, where fruit weight increased linearly with seed number in sweet pepper. Pepper plants that exhibited high vegetative growth due to effects of treatments have gained high leaf area, increased photosynthetic capacity and assimilate partitioning that resulted large pod size and hence in greater seed number per pod and large pod size.

**Seed Weight**

There was highly significant (P>0.01) difference between varieties and significant (P<0.01) difference between the interaction of varieties and location on seed weight parameter. Accordingly, the highest seed weight attained from Melka Eshet (1.09 g/plot) while the lowest seed weight was recorded from Melka Shote (0.24 g/plot) (Table 3).

This might be attributed to the genetic makeup of varieties and/or the agro ecological factors including, soil type and its nutrient contents, temperature, availability of irrigation or rain water in the growing area based on the study period. Because, pods with higher seed weight can be considered as those receiving higher percentage of assimilate, which also indicate that a good combination of number of seeds and seed weight per pod could improve pod quality through increase of seed weight and pod size. (Bosland and Votava, 2000) indicated that, in some cultivars of Chili seed can contain up to 60% of the dry weight of the fruit which makes it an important economic part of the crop.

**Table 3. Mean values of different tested characteristics as affected by the interaction between location and varieties in 2008/09**

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Number of pods per plant</th>
<th>Average number of seeds per pod (g/plot)</th>
<th>Seed weight (g/plot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alefa</td>
<td>31.07(^a)</td>
<td>57.00(^a)</td>
<td>0.62(^a)</td>
</tr>
<tr>
<td>Zalima</td>
<td>25.56(^b)</td>
<td>57.33(^c)</td>
<td>0.43(^d)</td>
</tr>
<tr>
<td>Melka Shote</td>
<td>31.87(^a)</td>
<td>65.60(^d)</td>
<td>0.63(^c)</td>
</tr>
<tr>
<td>Melka Awaze</td>
<td>26.36(^a)</td>
<td>106.50(^c)</td>
<td>0.918(^a)</td>
</tr>
<tr>
<td>Bako Local</td>
<td>33.80(^a)</td>
<td>146.80(^a)</td>
<td>0.918(^a)</td>
</tr>
<tr>
<td>Melka Eshet</td>
<td>19.30(^b)</td>
<td>1.09(^a)</td>
<td>0.918(^a)</td>
</tr>
<tr>
<td>Mareko Fana</td>
<td>36.60(^a)</td>
<td>140.00(^b)</td>
<td>0.918(^a)</td>
</tr>
<tr>
<td>CV%</td>
<td>28.1</td>
<td>3.5</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Values in each column sharing same letter are not significantly different (\(\alpha = 0.01\))

** Marketable Yield**

Highly significant (P>0.01) and non-significant (P<0.01) difference was observed between varieties and the interaction of varieties and location respectively in marketable yield. Relatively, the highest marketable yield was recorded from variety Marko Fana (6.34 ton/ha) and (6.18 ton/ha) at Alefa and Zalim experimental sites respectively. On the other hand, the lowest marketable yield was attained from variety Melka shote (2.08 ton/ha) and (2.39 ton/ha) at Zalima and Alefa experimental sites respectively (Table 4).

This result is in conformity with the work of Melkassa Agriculture Research Center (2005) in which the highest marketable yield was recorded in Mareko Fana variety. The recorded variations of varieties in marketable yield could be due to their differences in genetic make-up and/or agro ecological adaptations compared to the locations in which they had evaluated, which is in line with the findings of Fekadu and Dandena (2006) who reported that the magnitude of genetic variability and heritability are necessary in systematic improvement of hot pepper for fruit yield and related traits.

**Unmarketable Yield**

Highly significant (P>0.01) and non-significant (P<0.01) variation was recorded between varieties and between varieties and location respectively in unmarketable yield. According to the result the result highest unmarketable yield was attained from Marko Fana variety (0.24 ton/ha) at Alefa experimental site but the lowest unmarketable yield was recorded from Melka Eshet (0.02 ton/ha) at Alefa and Zalima experimental site (Table 4).
The result is in line with the finding of (Sileshe D., 2011) where the highest unmarketable yield was obtained from Mareko Fana (0.52) at Jimma research site. This unmarketable yield was recorded through subjective judgment based on hrunken shaped fruits, small sized, and discolored fruits that were estimated to be due to the differences in the inherent characters of the varieties, those lacked uniformity when drying, and or due to physiological disorders (bleaching) during the fruit set or due to the climatic conditions of the growing environment during harvesting.

**Total Dry Fruit Field**

Highly significant (P>0.01) difference was attained between varieties. While non- significant (P>0.01) difference was recorded between varieties and location in total dry fruit yield. The highest dry fruit yield was recorded from Marko Fana (6.59 ton/ha) and (6.33 ton/ha) at Zalima and Alefa experimental sites respectively. While the lowest dry fruit yield was recorded from Melka Eshet (2.49 ton/ha) and (2.30 ton/ha) at Zalima and Alefa experimental sites respectively (Table 4).

Table 4. Mean values of different tested characteristics as affected by the interaction between location and varieties in 2008/09

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Marketable yield ton/ha</th>
<th>Unmarketable yield ton/ha</th>
<th>Total dry pod yield ton/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melka Shote</td>
<td>2.39&lt;sup&gt;c&lt;/sup&gt;</td>
<td>2.23&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.09&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Melka Awaze</td>
<td>3.32&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.16&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.13&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Bako Local</td>
<td>5.43&lt;sup&gt;a&lt;/sup&gt;</td>
<td>5.27&lt;sup&gt;ba&lt;/sup&gt;</td>
<td>0.17&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Melka Eshet</td>
<td>4.69&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>4.53&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.02&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Marko Fana</td>
<td>6.34&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.185&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.24&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>CV%</td>
<td>30.55062</td>
<td>29.92320</td>
<td>18.47709</td>
</tr>
</tbody>
</table>

Values in each column sharing same letter are not significantly affected at (α = 0.01)

**QUALITY PARAMETERS**

**Pod Length**

Non- significant (P<0.01) difference was recorded between varieties and also in the same way, there was non-significant (P<0.01) difference between varieties and location. The longest pod length was recorded from Melka Eshet (8.93 cm) and (8.77 cm) at Zalima and Alefa experimental sites respectively while the shortest pod length was attained from Bako Local (7.51 cm) and (7.79) at Alefa and Zalima experimental site respectively (table 5).

The result contradicts with that of Melkasa Agriculture Research Center (2005) which reported that the long fruit length recorded from Marko Fana variety. The variations were most probably being attributed to their inherited traits or the growing environment. This could be due to the climatic conditions (i.e. the temperature, the soil type, the altitude) difference in which the crop was evaluated.

**Pod Diameter**

According to data analysis, pod diameter was highly significant (P>0.01) difference between varieties but, there was non-significant difference among varieties and location. Relatively, the longest pod diameter was obtained from Mareko Fana variety (2.42 cm) both at Zalima and Alefa experimental sites and the shortest pod diameter was recorded from Melka Awaze (0.8 cm) at both experimental sites.

The variations in fruit diameter could be due to the difference in varieties inherited characteristics and or due to environmental conditions of the growing areas. This result is in line with (Melkasa Agriculture Research Center (2005) which showed that variety Mareko Fana had a fruit diameter of 2 cm. The pod width difference among varieties could be due to different dry matter partitioning ability of plants and the soil fertility status of the growing locations. Larger and wider hot pepper pods are considered to be the best in quality and have better demand for fresh as well as dry pod use in Ethiopian markets (Beyene and Phillips, 2007). Therefore, subjectively this quality attribute, along with pod length and pericarp thickness could be of better preference to consumers over thinner and shorter pods.

Table 5. Pod length and diameter

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Pod length (cm)</th>
<th>Pod diameter (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melka Shote</td>
<td>8.77&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.93&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Melka Awaze</td>
<td>8.33&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.09&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Bako Local</td>
<td>7.51&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.79&lt;sup&gt;a, b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Melka Eshet</td>
<td>8.72&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.52&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Marko Fana</td>
<td>8.44&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8.33&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>CV%</td>
<td>18.4</td>
<td>5.2</td>
</tr>
</tbody>
</table>

Values in each column sharing same letter are not significantly affected at (α = 0.01)

**CONCLUSIONS**

Hot pepper is one of the major vegetables and spice crop produced in west Gojam specifically in Burie District, that serve as the source of income particularly for small holders in many parts of the study area. The result of the study revealed that almost all of the parameters considered were significantly affected by the varieties but not significantly affected by the treatments or their interaction effects.
Highly significant difference were observed between varieties at (p>0.01) in plant height, days to 50% flowering, number of flowers per plant, days to first harvest, canopy diameter, number of branches per plant, number of pods per plant, average seed number per pod, seed weight per pod, marketable yield, unmarketable yield, total dry pod yield, pod length and pod diameter.

Non- significant interaction effect were attained between varieties and location based on the selected parameters such as plant height, days to 50% flowering, number of flowers per plant, days to first harvest, canopy diameter, number of branches per plant, number of pods per plant, average seed number per pod, seed weight per pod, marketable yield, unmarketable yield, total dry pod yield, pod length and pod diameter. Simple linear correlation analysis showed that marketable yield was significant, positive and strong association with plant height, seed per plant, seed weight, unmarketable yield, total dry fruit yield, number of fruits per plant and fruit diameter. The positive and significant correlation coefficient (r values) between marketable yields and its components, and growth parameters indicate that yield is greatly influenced by above mentioned parameters.

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REFERENCES


Raghavaro, D., 1983. Page 255, a numerical presentations, where the three locations were whole plots and four nitrogen levels were sub-plots.


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