Journal of Plant Sciences
2017; 5(5): 130-133
http://www.sciencepublishinggroup.com/j/jps
doi: 10.11648/j.jps.20170505.11
ISSN: 2331-0723 (Print); ISSN: 2331-0731 (Online)

Adaptability Study of Hot Pepper (*Capsicum* spps.) Varieties at Senegal, Southern Ethiopia

Mohammed Awel

Southern Agricultural Research Institute, Jinka Agricultural Research Center, Department of Crop Science Research Case Team, Jinka, Ethiopia

Email address:
mohammedawel27@gmail.com

To cite this article:
Mohammed Awel. Adaptability Study of Hot Pepper (*Capsicum* spps.) Varieties at Senegal, Southern Ethiopia. *Journal of Plant Sciences.* Vol. 5, No. 5, 2017, pp. 130-133. doi: 10.11648/j.jps.20170505.11

Received: June 14, 2017; **Accepted**: June 30, 2017; **Published**: September 4, 2017

Abstract: A field experiment involving three improved hot pepper (Capsicum spps.) varieties and one local check was carried out at Senegal kebelle during the 2015 to 2016 cropping seasons under rain fed conditions to identify the best performing variety to the target areas of South Omo Zone. The hot pepper varieties included in the field experiment were three improved (Mareko Fana, Melka Shote, Melka Awaze) and a local check. The experimental design was a randomized complete block design (RCBD) with three replications. Phenological and growth parameters, fruit yield and yield components were studied. The result showed that plant height was significantly affected by variety while branch number was not significantly influenced by variety. Number of days to flowering and maturity were significantly affected by variety. Total fruit number per plant, mean pod weight and total yield per hectare also showed a significance difference among varieties. The highest total yield per hectare (20 t/ha) was recorded from Mareko Fana where as Melka shote, Melka Awaze and local check show no significance difference among each other Therefore, it can be concluded that use of the improved hot pepper varieties such as Mareko Fana is advisable and could be appropriate for hot pepper production in the test area even though further testing is required to put the recommendation on a strong basis.

Keywords: Fruit Yield, Growth Parameters, Hot Pepper Variety, Phenological Parameters, Yield Components

1. Introduction

Pepper (*Capsicum* spps.) is a new world crop that belongs to the family Solanaceae. The genus *Capsicum* is the world's second most important of the family after tomatoes [1]. Pepper is a dicotyledonous small shrub in suitable climatic conditions, living for a decade or more in the tropical South and Central America [2]. Pepper is grown in many countries of the world and its production for culinary and vegetable uses has been increased from time to time. In Ethiopia today, it is extensively produced and used. It is actually considered as a national spice. Even though no documented information is available, it was introduced to Ethiopia probably by the Portuguese in the 17 century [3].

As a food, pepper has little energy value (25 Kcal/100g) but it is an excellent source of vitamins A (530 IU/100g) and C (128 mg/100g) and a good source of vitamin B2 (0.05mg/100g), potassium (195 mg/100g), phosphorus (22 mg/100g), and calcium (6 mg/100g) [2]. The high nutritive and culinary value of pepper gives them a high demand in the market year round. *Capsicum* spps. are used fresh or dried, whole or ground into powder and alone or in combination with other flavoring agents. According to [4], the world production was 45.25 million tons of which 5.031 million tons was from African countries. In Ethiopia, 14,672.74 and 76,202.62 ha of land was covered by green and red pepper, respectively [5].

The climatic and soil conditions of Ethiopia allow cultivation of a wide range of fruit and vegetable crops. The country has a vast potential for production of fresh fruit and vegetable varieties for domestic and export markets, primarily for the densely populated urban areas such as Addis Ababa, and also for the neighboring foreign markets such as Djibouti, Somalia and the Middle East [6] [7] [8].

Capsicum probably evolved from its ancestral form in Bolivia/Peru area. Mexico has a great diversity of cultivated

forms with a secondary center in Guatemala [9]. *Capsicums* are grown from sea level to 2000 meters above sea level (m.a.s.l), but to 3000 m in South America and Ethiopia [10]. The species are extremely variable, particularly in fruit characteristics, and many of the so-called species are locally adapted cultivars [2]. Chile types usually are classified by fruit characteristics, i.e., pungency, color, shape, flavor, size, and their use [11] [12]. Despite their vast trait differences most chili cultivars commercially cultivated in the world belong to the species, *C. annuum*. The tabasco (*C. frutescens*) and habañero (*C. chinense*), are the best known exceptions [11].

The genus *Capsicum* consists of approximately 22 wild and five domesticated species: *C. annuum, C. baccatum, C. chinense, C. frutescens,* and *C. pubescens* [13]. *Capsicum* pepper refers primarily to *Capsicum annuum* L. and *Capsicum frutescens* L., plants used in the manufacture of selected commercial products known for their pungency and color. *Capsicum annuum* L. is an herbaceous annual plant that reaches a height of one meter and has glabrous or pubescent lanceolate leaves, white flowers, and fruit that vary in length, color, and pungency depending upon the cultivar. Native to America, this plant is vastly cultivated in Spain, Eastern Europe, North Africa, California, and New Mexico. *Capsicums* flourish in warm, sunny conditions, and require 3-5 months with a temperature range of 18-30°C; below 5°C growth is retarded and frost kills plants at any growth stage. A seedbed temperature of 20-28°C is the optimum for germination, which is slowed at 15°C and cease at 35°C [10]. If seeds are planted when soil temperatures are too cool, germination rate is retarded, affecting emergence and growth of the seedlings. Slow growth can prolong seedling exposure to insects, diseases, salt or soil crusting, any of which can kill all the seedlings. Higher yields result when daily air temperature ranges between 18 and 32°C during fruit set [2]. Pepper is adapted to high temperature but in excessively hot and dry weather may produce infertile pollen thereby reducing fruit set. Temperature above 32°C with a fairly low relative humidity may also cause excessive transpiration, resulting in dropping of buds, flowers, and fruits. A drop in temperature below 16°C at flowering may result in poor fruit set and seedless fruits [14].

2. Materials and Methods

2.1. Description of the Study Area

The experiment was conducted on farm at senegal *kebelle* of south omo zone. Senegal is located 703 kms South West of the capital Addis Ababa at E 360 33' 02.7" Longitude and N 050 46' 52.0" Latitude and at an altitude of 2420 meters above sea level. The long term weather data for the area revealed that the maximum and minimum monthly average temperature of the center is 31.55°C and 19.55°C, respectively; whereas, the maximum and minimum monthly average temperature of the growing periods was 23.576°C and 10.622°C, respectively. The long term rainfall data for the area showed that the mean annual rainfall of the area is 1774.67 mm; while the mean monthly rainfall of the area for the growing seasons was 151.7188 mm. Rainfall pattern of the area over the years have been bi-modal with peaks around September and October and spans from February to November. The experiment was conducted during the 2015 to 2016 cropping seasons under rain fed conditions.

2.2. Treatments and Experimental Design

The experiment was executed by using three improved hot pepper varieties and one local check. The field experiment was laid out in a randomized complete block design (RCBD) with three replications. The spacing was 30 cm and 60 cm between plants and rows respectively. The gross plot area was $9m^2$.

2.3. Data Collection

Plant height: The heights (cm) of 15 randomly taken sample plants were measured from the ground level to the highest point at blooming stage.

Number of branches: The number of primary and secondary branches of 15 randomly taken sample plants of at blooming stage was recorded.

Days to 50% flowering: This was recorded when approximately 50% of the plants in a plot formed some flowers that were in bloom.

Days to fruit maturity: This was recorded when approximately 70% of the plants in a plot had fruits that attained physiological maturity.

Number of fruits per plant: The total numbers of physiologically mature fruits per plant were counted over the harvest period on 15 randomly selected plant samples per plot.

Fruit number and weight per plant: 15 samples of plants per plot were taken at each harvest, Mean number and weight of fruits were then calculated to record numbers and weight per plot.

Mean pod weight: This was calculated from fruits of successive harvests from 15 random sample plants, i.e. total pod weight of sample plants divided by the total number of fruits harvested.

Yield: Total weight of matured fruits from the central three rows over the harvest period was recorded to estimate yield per hectare. The weight of a fruit is determined by the total number of fruits per plant. All the data recorded throughout the growing periods were averaged over every harvest in the growing seasons for data analysis and computation.

2.4. Statistical Analysis

Analysis of variance was performed using the GLM procedure of SAS Statistical Software Version 9.0 [15]. Effects were considered significant in all statistical calculations if the P-values were < 0.05. Means were separated using Fisher's Least Significant Difference (LSD) test.

3. Results and Discussion

3.1. Agronomic Characteristics, Yield and Yield Components

3.1.1. Agronomic Characteristics

Significant differences ($p < 0.05$) were observed in plant height among the hot pepper varieties studied (Table 2). The plant height ranged from 49.66 cm in Melka Awaze to 58.33 cm in Mareko Fana. Melka Shote, Melka Awaze and local check had the shortest plants with no significant difference among them. Mareko Fana had the tallest plants with mean height (58.33 cm).

The number of branches per plant shows no significant difference among all hot pepper varieties ($p > 0.05$). Significant ($P < 0.05$) variations were observed among the hot pepper varieties in the number of days plants attain 50% flowering and 70% physiological maturity. Mareko Fana, Melka Shote and Melka Awaze required relatively, compared to local check, the longest time (ranging from 75.66 to 81.33 days) until 50% of the plants to flower. Local check required the shortest time (68.00 days) to flower.

There was a significance difference ($P < 0.05$) in the days required to reach maturity. Local check requires the shortest (131) days to reach maturity. The remaining three varieties were found to be late relatively with a maturity date ranging from 144.66 – 150.33 days with no significance ($P > 0.05$) different among each other. [16] reported 127 to 140 days for maturity of different *Capsicum* species. Lemma and Shimels (unpublished report) also indicated a range of 96 to 99 and 100 to 126 days to flowering and maturity, respectively, for different *capsicum* genotypes including varieties in the present study. In another study too, [17] reported 74 – 97 days and 114- 158 days for flowering and maturity, respectively, of 18 *Capsicum* genotypes grown at Melkassa Research center. The results indicate that the traits are affected by both genotype and environment.

Table 1. *Mean Square Values for Crop Phenology and Growth Parameters of four hot pepper varieties grown at Senegal, in 2015 to 2016.*

Source	DF	PH (cm)	BN	DTF	DTM	TFN/P	MPW (g)	TY(ton/ha)
Replication (R)	2	0.25ns	3.25ns	12.25ns	151.08*	10.58*	4.00ns	2.08ns
Variety (VAR.)	3	47.44*	4.75ns	108.30*	227.63*	15.33*	28.08*	30.75*
Error	6	9.36	3.25	18.47	23.97	1.58	5.00	4.08

PH- plant height, BN-branch number, DTF-days to flowering, DTM-days to maturity, TFN/P- Total fruit number per plant, MPW- mean pod weight, TY- Total yield.

Table 2. *Mean plant height, branch number and days to flower and maturity of four hot pepper varieties grown at Senegal.*

Variety	Plant height (cm)	Branch number	Days to flowering	Days to maturity
Melka shote	51.667a	10.33a	80.00a	150.33a
Melka awaze	49.667b	11.00a	75.66ab	148.33a
Mareko fana	58.333b	12.33a	81.33a	144.66a
Local check	50.333b	9.33a	68.00b	131.00b
LSD (0.05)	6.11	3.6	8.58	9.78
CV (%)	5.82	16.77	5.63	3.4

Means within a column followed by the same letter (s) are not significantly different

3.1.2. Yield and Yield Components

Both total fruit number per plant and mean pod weight showed significant difference ($p < 0.05$) among the hot pepper varieties (Table 3). The highest total fruits per plant were recorded in Mareko Fana with 21.66 followed Melka Shote, Melka Awaze and local check with no significant difference between the later three varieties. The fruit number per plant in this study is in accordance with previous reports by [16], who observed fruits number per plant ranging from 8 to 70 in 16 *Capsicum* accessions. It is clear that environmental and genetic factors regulate the number of fruits. [18], indicated that the total number of fruits per plant depended on the mean daily temperature. They reported that as the mean daily temperature increase the number of fruits per plant also increased. [19], noted that temperature is the primarily factor in the decrease of fruit production as reduced fruit set was due to flower abortion and not due to decreased flower initiation or plant growth. [20], as cited in [2], showed that the poor fruit set at high temperature to be due to excessive transpiration by the plant which could partly be the cause for the differences observed in this experiment.

Total yield per hectare of the hot pepper varieties show a significance difference ($p < 0.05$). Mareko Fana records highest (20 ton/ha) and the remaining three (Melka Shote, Melka Awaze and local check) varieties record minimum ranging from 12.33 to 15 ton/ha with no significance difference (Table 3).

Table 3. *Mean fruit number, fruit weight and yield of four hot pepper varieties at Senegal.*

Variety	TFN/P	MPW (g)	TY(ton/ha)
Melka shote	17.66b	11.33b	15.00b
Melka awaze	17.33b	11.00b	15.00b
Mareko fana	21.66a	17.33a	20.00a
Local check	16.66b	11.33b	12.33b
LSD (0.05)	2.51	4.46	4.03
CV (%)	6.86	17.53	12.96

TFN/P- Total fruit number per plant, MPW- mean pod weight, TY- Total yield. Means within a column followed by the same letter (s) are not significantly different at $P < 0.05$.

Therefore, it can be concluded that use of the improved

banana variety, Mareko Fana is advisable and could be appropriate for banana production in the test area even though further testing is required to put the recommendation on a strong basis.

Using improved varieties of hot pepper could make an important contribution to increase agricultural production and productivity in areas like *senegal* where there is low practice of using improved technologies such as improved crop varieties. To this end, use of improved hot pepper technologies such as improved varieties could be one of the alternatives to improve productivity by small farmers. However, the use of improved hot pepper varieties is not yet studied in the area. Thus, this research work is initiated to investigate the impact of including improved hot pepper varieties on the existing production system is of paramount important.

References

[1] Rubatzky, V. E and M. Yamaguchi, 1997. World vegetables: principles, production and nutritive values, 2nd edition, Chapman and Hall International, Thomson Publishing, New York, 843p.

[2] Bosland, P. W. and E. J. Votava. 2000. Pepper: Vegetable and Spice *Capsicums*. CABI Publishing, New York.

[3] Hafnagel, H. P., 1961. Agriculture in Ethiopia. Food and Agricultural Organization of United Nations (FAO), Rome, Italy.

[4] FAOSTAT. Food and Agriculture Organization of the United Nations. 2015. Production status. (http://www faostat.fao.org.). Accessed on June 2, 2015.

[5] CSA (Central Statistical Agency of Ethiopia). 2014. Agricultural Sample Survey. Report on Area and Production of Major Crops. Volume I, VII and VIII. Statistical Bulletin 578. Addis Ababa, Ethiopia.

[6] Lemma D., H. Edward, B. Terefe, L. Berga and G. Seifu, 1994. Horticultural research: past present and future trends. Proceeding of the second national horticultural workshop of Ethiopia. IAR/FAO, Addis Ababa.

[7] Tilahun, S., 2002. The improvement of the shelf life of vegetables through pre and postharvest treatment. Ph. D. Dissertation presented to the University of Free State. South Africa. 270 p.

[8] Seifu G., 2003. Status of commercial fruit production in Ethiopia. *In* Proceeding of the second horticultural workshop of Ethiopia Ethiopian Agricultural Research organization, Addis Ababa.

[9] Heiser, C. B., 1976. Peppers *Capsicum* (Solanaceae). *In:* N. W. Simmonds (ed.), the evolution of crops plants. Longman Press, London, 265-268.

[10] Weiss, E. A., 2002. Spice Crops. CABI publishing. 190p.

[11] Smith, P. G., B. Villalon, and P. L. Villa, 1987. Horticultural classification of pepper grown in the United States. *Horti. Sci.* 22: 11-13.

[12] Bosland, P. W., 1992. Chiles: a diverse crop. *Hort Technolo.* 2: 6-10.

[13] Bosland, P. W., 1994. Chiles: history, cultivation, and uses. In: G. Charalambous (ed.), Spices, herbs, and edible fungi. Elsevier Publ., New York. 347-366p.

[14] Rice R. P. and Rice L. W. and Tindall H. D. 1990. Fruit and vegetable Production in Warm Climates. Macmillan education ltd. London.

[15] SAS. 2002. Statistical Analysis Systems SAS/STAT user's guide Version 9.0 Cary NC: SAS Institute Inc. USA.

[16] Ado S. G., I. Samarawira and J. D. Olarewaju, 1987. Evaluation of local Accession of pepper *(Capsicum annum)* at Samaru, Nigeria. *Capsicum Newsletter,* 17-18.

[17] Geleta, L., 1998. Genetic Variablity and association for yield, quality and other traits of hot pepper *(Capsicum* spp.). An MSc Thesis presented to the School of Graduate Studies of Alemaya University.

[18] Bakker, J. C. and J. A. M. van Uffelen, 1988. The effect of diurnal temperature regimes on growth and yield of sweet pepper. *Netherlands J. Agri. Sci.* 36: 201-208.

[19] Ericson A. N. and A. H. Markhart, 1997. Development and abortion of flowers in *capsicum annum* exposed to high temperature. *Hort Tecnolo*. 7: 8.

[20] Cochran, H. L., 1964. Changes in pH of the pimiento during maturation. Proc Amer. Soc. Hort. sci., 84: 409-411.