

Varietal Evaluation of Jalapeno Pepper (*Capsicum annum L.*) in Low Country Intermediate Zone of Sri Lanka

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ABSTRACT

Jalapeno peppers (*Capsicum annum L.*) are grown in Sri Lanka for export market. An experiment was conducted to evaluate six new jalapeno varieties with one locally cultivated variety, for their morphological, vegetative, reproductive, fruit quality and yield parameters. The experiment was arranged in a Randomized Complete Block Design with three replicates. Variety Tajin showed the highest values for fruit diameter (27.3 mm), diameter at net formation (29.3 mm), yield per plant (414.0 g), fruit weight (14.7 g) and also showed high values at fruit length (64.3 mm) and pericarp thickness (3.8 mm). Grande, Coyame and Ixtapa varieties exhibited high values in fruit length, fruit diameter, yield per plant, fruit weight and fruit diameter at net formation. Therefore, Tajin, Grande, Coyame and Ixtapa varieties could be recommended for cultivation in future as they have shown superior characteristics over the recommended variety Mitla.

KEYWORDS: *Capsicum annum L.*, Jalapeno pepper, varietal evaluation, yield.

INTRODUCTION

Chilli pepper (*Capsicum annum L.*) is classified into family *Solanaceae* and genus *Capsicum*. Peppers are native to Central and South America. Portuguese traders introduced them to India, Indonesia, and other parts of Asia during the 16th century. The crop quickly adapted to the wide range of agro-ecological zones found in Asia (Anon, 2002).

Jalapeno pepper is a popular chilli pepper species in the world. The origin of Jalapeno was the town of Jalapar in the state of Veracruz in Mexico. At present, Mexico has 16,000 ha under Jalapeno cultivation and most of the production is from New Mexico and Western Texas States (Anon, 2009).

Jalapeno plant is a perennial but usually grown as an annual. The plant reaches to 0.5-1.5 m in height. It prefers full sun and well-drained soil. Jalapeno is a medium to large sized chilli pepper with 5-9 cm length when mature. It is conical in shape, tapered tip more rounded than pointed. The intense green colour, smooth texture, thick and fleshy skin are the prominent characters of Jalapeno (Thushari and Jayasekera, 2006). Jalapenos are a great source of Potassium, Folic acid, vitamin A, C, E and dietary fiber.

Processed products of Jalapeno such as salsas (sauces) and pickles have good demand in Japan, USA and Europe. They are processed in wine vinegar or brine salt. The brined pods are debrined and reprocessed in the form of full pods and diced or sliced. It is important to harvest pods at correct maturity stage (45 mm to 60 mm pod length with 20 mm to 26 mm pod diameter) to reach the export standard. In Sri Lanka,

commercial Jalapeno cultivations started in year 2000 Yala. At present, cultivations are done in all three zones of Sri Lanka including Kurunegala and Anuradhapura districts. From 2006-2008, Jalapeno production in Sri Lanka was 28 MT (Gunarathna Banda, 2010).

However, demands for Jalapeno peppers are increasing in the world and production is not sufficient. Therefore, increased production can contribute to Sri Lankan export market and bringing in more income to the cultivators.

To enhance the commercial cultivations, it is important to introduce new varieties. Many new hybrid Jalapeno varieties are being developed by seed companies in different countries. Therefore, suitable varieties for Sri Lanka should be identified and introduced to farmers after evaluating for their adaptability in different agro ecological zones and for their potential yield, resistance to pests and diseases and market requirements. It will increase the quality and quantity of Jalapeno production and increase foreign exchange earnings. And also generate employment opportunities in the country and enhance the farmer income and life standard. Further, it will directly increase the agricultural productivity of Sri Lanka. Therefore, this study was conducted to evaluate six new Jalapeno varieties introduced from Vietnam, China and India with one locally recommended variety.

MATERIALS AND METHODS

Experimental Site

The study was carried out at the Faculty of Agriculture and Plantation Management, Wayamba University of Sri Lanka, Makandura

(Low Country Intermediate Zone, IL_{1a}) at an elevation of 30 m above mean sea level. The experiment was conducted from March to July 2010. The average weather condition at Makandura during the experimental period was 75.88 mm of rainfall, 88.57 % of relative humidity and 32.21 °C of maximum temperature.

Nursery Management

Seeds of seven Jalapeno varieties obtained from Sunfrost (Pvt) Limited were sown in 3m×1m size raised nursery bed which was prepared as recommended by the Department of Agriculture for Chillii. The nursery medium was treated with Thiram to prevent damping off disease and Carboufuran was used to protect seeds from insects until germination. Daily irrigation was carried out.

Treatments

The seven Jalapeno pepper varieties (Mitla (control), Coyame, Tajin, Grande, Tula, Perfecto, and Ixtapa) were tested as treatments.

Site Preparation and Field Layout

The experimental site was ploughed up to 30 cm depth and 21 raised beds (3×1.8 m) were prepared with drains (0.5 m) between plots. Each plot was planted with 04 week old healthy seedlings. 40 seedlings were planted in each plot at a spacing of 45×30 cm. The treatments were arranged in a Randomized Complete Block Design with three replicates.

Crop Establishment and Maintenance

Fertilizers were applied according to the fertilizer schedule given in Table 1. Foliar fertilizer was sprayed fortnightly (28 ml/28 l of water) to provide micronutrients. Irrigation was carried out when necessary. Harvesting was done according to the standard specifications provided by Sunfrost (Pvt.) Limited.

Table 1. Fertilizer application schedule

	Time of application	Dosage (Kg/ha)
BD	3DBP	TSP 175
		MOP 50
		Compost 500 g/plant
1 st TD	7DAP	Urea 25
		14DAP
2 nd to 7 th TDs	At 10 day intervals	Urea 100
		MOP 100

BD-Basal Dressing *TSP-Triple Super Phosphate*
TD-Top Dressing *DAP-Days After Planting*
MOP-Muriate of Potash *DBP-Days Before Planting*

Data Recording

Five randomly selected plants from each plot were used for data collection and following parameters were recorded.

Plant Characterization

Characteristics of following 16 parameters were recorded according to the descriptors given by Anon (1995).

Plant growth habit, branching habit, stem pubescence, leaf shape, leaf pubescence, flower position, calyx pigmentation, calyx margin, calyx annular constriction, fruit shape, fruit shape at pedicel attachment, neck at base of fruit, fruit shape at blossom end, fruit blossom end appendage, fruit surface and fruit cross sectional corrugation.

Vegetative and Reproductive Parameters

Plant Height (cm)

Recorded from ground level to terminal point of the plant at 1½ months and 2½ months after transplanting.

Days to First Flowering

Number of days from transplanting to 50 % of plants have at least one open flower (Anon, 1995).

Fruit Quality Parameters

Fruit Length (mm)

Measured from stem end to blossom end of the fruit taking five well matured fruits from each plot (Anon, 1995).

Fruit Colour

Recorded by using Royal Horticultural Society Colour Chart (RHS Colour Chart).

Fruit Diameter (mm)

Measured at the widest point in average of five well-matured fruits from each plot, using the vernier caliper.

Fruit Diameter at Net Formation (mm)

Recorded from five selected fruits in maximum girth without net formation.

Pericarp Thickness (mm)

Measured at the point of maximum diameter in average of five well matured fruits using the vernier caliper.

Fresh Seeds Percentage

Seeds were separated from the fruits and weighed to calculate the percentage of seed weight.

Fresh Placenta Percentage

Placenta of fruits were separated and weighed to calculate the percentage placenta weight.

Yield Parameters

Yield and yield parameters were calculated taking five randomly selected plants from each plot. Number of pods were counted from all picks and weighed. Taking these values, i.e., yield per plant (g), number of fruits per plant and fruit weight (g), number of pods per 1 kg and average yield (T/ha) were calculated for each treatment.

Pests and Disease Resistance

Pests and disease incidences were recorded throughout the experimental period.

Statistical Analysis

The data obtained from the study were statistically analyzed using Minitab 11.12 software.

RESULTS AND DISCUSSION

Plant Characterization

The 16 parameters under study were characterized according to Anon (1995). The characterization results are given in Table 2.

Out of the 16 characters studied, 12 characters did not show any differences among varieties. They were branching habit, leaf shape, stem pubescence, leaf pubescence, flower position, calyx pigmentation, calyx annular constriction, fruit shape at pedicel attachment, neck at base of fruit, fruit blossom end appendage, fruit surface and Fruit cross sectional corrugation. However, for remaining four characters, the variety Tajin showed marked differences with intermediate plant growth habit, dentate calyx margin, blunt fruit shape and sunken fruit shape at blossom end. The variety Perfecto showed an intermediate plant growth. The variety Coyame and Ixtapa showed elongate fruit shape.

Vegetative and Reproductive Parameters

Plant Height (cm)

No significant differences were observed in plant height among varieties at 1 ½ months and 2½ months after planting (Table 3).

Height of the plants at 1½ month after planting ranged from 29.7 cm to 37.9 cm. Plant

height at 2½ months after planting ranged between 36.5 cm and 50.5 cm.

Days to First Flowering

There were no significant differences in days to first flowering between tested varieties (Table 3). The number of days to first flowering varied from 19.7 to 25.7 days after transplanting.

Table 3. Vegetative and reproductive parameters of Jalapeno pepper varieties

Treatment	Plant height(cm)		Days to first flowering
	1 ½ MAT	2 ½ MAT	
Mitla	36.2	50.5	19.7
Coyame	34.0	43.3	23.3
Tajin	36.1	45.3	21.0
Grande	37.9	45.1	22.3
Tula	29.7	36.5	25.7
Perfecto	33.2	41.5	23.7
Ixtapa	36.9	49.5	23.7
CV	17.63	14.23	14.09

MAT-Months after transplanting

Fruit Quality Parameters

Fruit Length (mm)

Significant differences were observed among varieties (Table 4) in fruit length and it ranged from 55.4 mm to 64.5 mm. Tajin and Grande varieties had longest fruits (64.3 mm and 64.5 mm) while variety Mitla had the shortest (55.4 mm). Except Variety Mitla and Perfecto, others had no significant differences in each other. However, all the varieties were able to maintain required fruit length needed for export quality. Since Sri Lankan produced Jalapenos are exported in sliced form, longer pods are preferred as they can yield more slices (Thushari and Jayasekera, 2006).

Table 2. Characterization of 16 parameters studied in Jalapeno pepper

Parameter	Character							
	Mitla	Coyame	Tajin	Grande	Tula	Perfecto	Ixtapa	
1. Plant growth habit	E	E	I	E	E	I	E	
2. Branching habit	S	S	S	S	S	S	S	
3. Stem pubescence	S	S	S	S	S	S	S	
4. Leaf shape	L	L	L	L	L	L	L	
5. Leaf pubescence	S	S	S	S	S	S	S	
6. Flower position	I	I	I	I	I	I	I	
7. Calyx pigmentation	A	A	A	A	A	A	A	
8. Calyx margin	I	I	D	I	I	I	I	
9. Calyx annular constriction	P	P	P	P	P	P	P	
10. Fruit shape	TR	EL	B	TR	TR	TR	EL	
11. Fruit shape at pedicel attachment	T	T	T	T	T	T	T	
12. Neck at base of fruit	A	A	A	A	A	A	A	
13. Fruit shape at blossom end	B	B	SU	B	B	B	B	
14. Fruit blossom end appendage	A	A	A	A	A	A	A	
15. Fruit surface	SM	SM	SM	SM	SM	SM	SM	
16. Fruit cross sectional corrugation	SC	SC	SC	SC	SC	SC	SC	

E=-Erect S=Spars P=Present L=Lanceolate I=Intermediate SM=Smooth T=Truncate
 B=Blunt A=Absent El=Elongate TR=Triangular D=Dentate SU=Sunken SC=Slightly corrugated

Table 4. Fruit quality parameters of Jalapeno pepper varieties

Treatment	Fruit length (mm)	Fruit diameter (mm)	Fruit diameter at net formation (mm)	Pericarp thickness (mm)	Fresh seeds percentage	Fresh placenta percentage
Mitla (control)	55.3 ^b	22.3 ^d	23.5 ^c	3.6 ^{bc}	6.2	12.9 ^{bc}
Coyame	62.2 ^{ab}	24.1 ^{bc}	24.8 ^{bc}	3.4 ^{bc}	7.2	15.8 ^{ab}
Tajin	64.3 ^a	27.3 ^a	29.3 ^a	3.8 ^b	6.9	15.6 ^{ab}
Grande	64.5 ^a	26.1 ^{ab}	26.0 ^b	3.5 ^{bc}	6.5	16.0 ^{ab}
Tula	61.2 ^{ab}	23.7 ^c	23.9 ^{bc}	3.3 ^c	9.8	17.6 ^a
Perfecto	56.6 ^b	24.9 ^{bc}	25.1 ^b	4.3 ^a	6.4	9.5 ^c
Ixtapa	62.4 ^{ab}	25.5 ^b	26.5 ^{ab}	3.5 ^{bc}	7.2	14.9 ^b
CV	5.74	4.36	4.46	7.58	24.82	12.01
LSD	4.2	1.3	1.4	0.3	N.S.	2.1

Means in a column followed by the same letters are not significantly different at 0.05 level

Fruit Colour

There were no colour differences between the varieties and all varieties showed green group 141 A colour which is within the export quality colour range (Adikari and Jayasekera, 2007).

Fruit Diameter (mm)

Significant differences among fruit diameter were observed between tested varieties (Table 4) and it varied from 22.3 mm (Mitla) to 27.3 mm (Tajin). All the varieties had maintained required diameter for export quality.

Fruit Diameter at Net Formation (mm)

Fruit diameter at net formation was significantly different in seven Jalapeno pepper varieties (Table 4). Variety Tajin (29.3 mm) showed the largest diameter at net formation while the lowest value was in variety Mitla (23.5 mm).

Pericarp Thickness (mm)

Significant differences were observed in pericarp thickness among the tested varieties of jalapeno pepper (Table 4). Variety Perfecto had the highest pericarp thickness (4.3 mm) and variety Tula had the lowest thickness (3.3 mm). However, Mitla, Coyame, Grande and Ixtapa varieties were not significantly different from each other. Thicker pericarp is preferred in export market.

Fresh Seeds Percentage

All the tested varieties were greater in seed percentage than control variety while the highest

value was in variety Tula (9.8).

High seed amount is a disadvantage in processing due to the additional cost involved in seed separation (Gunarathna Banda, 2010).

Fresh Placenta Percentage

All tested varieties showed significant differences in placenta percentage by weight (Table 4). The lowest percentage was in Perfecto (9.5) and highest value (17.6) was in Tula. High placenta percentage value would not be ideal for sliced Jalapeno prepared for export.

Yield Parameters

Yield per Plant (g)

There were no significant differences in yield per plant among tested varieties (Table 5). The highest yield per plant recorded from variety Tajin (414 g) and that is due to higher fruit weight than the number of pods per plant. The lowest value recorded from variety Tula (213.5 g) and that was due to low number of pods per plant.

Number of Fruits per Plant

Number of fruits per plant was not significantly different between the varieties (Table 5). The highest number of pods per plant was recorded in Mitla and Perfecto varieties (174 and 161.7). However, their yields per plant were not increased due to lower fruit weight. Lower number of fruits per plant was recorded from variety Tula (88.3).

Table 5. Yield parameters of Jalapeno pepper varieties

Treatment	Yield per plant(g)	Number of fruits per plant	Fruit weight(g)	Average yield(t/ha)	Number of pods per kilo gram
Mitla	320.6	174.0	9.2 ^c	7.0 ^b	108.7 ^a
Coyame	353.0	137.7	12.6 ^{ab}	9.5 ^a	80.0 ^{bc}
Tajin	414.0	140.7	14.7 ^a	9.0 ^{ab}	68.0 ^c
Grande	406.0	148.3	13.6 ^{ab}	10.4 ^a	74.0 ^{bc}
Tula	213.5	88.3	12.3 ^b	4.3 ^c	81.5 ^{bc}
Perfecto	367.3	161.7	11.2 ^{bc}	5.5 ^{bc}	89.6 ^b
Ixtapa	389.7	145.7	12.6 ^{ab}	8.8 ^{ab}	80.8 ^{bc}
CV	35.93	31.15	7.61	27.36	7.18
LSD	N.S.	N.S.	1.1	2.5	7.2

Means in a column followed by the same letters are not significantly different at 0.05 level

Fruit Weight (g)

There were significant differences in fruit weight among varieties (Table 5). The highest fruit weight was observed in Tajin and Grande varieties (14.7 g and 13.6 g). There were no significant differences among Grande (13.6 g), Ixtapa (12.6 g) and Coyame (12.6 g) varieties. The lowest fruit weight observed in variety Mitla (9.2 g).

The fruit weight had influenced by the size of the fruit. Since Tajin and Grande had larger fruits, their weight per fruit been increased.

Number of Pods per 1kg

Significant differences were observed in Number of pods per 1kg among the varieties and the values varied from 108.7 (Mitla) to 68.0 (Tajin). Coyame, Grande, Tula and Ixtapa varieties did not show any significant differences among them.

Average Yield (t/ha)

Average yield was significantly different among tested varieties. The highest yield observed in variety Grande (10.4 t/ha) and Coyame (9.5 t/ha) while the lowest yield was in variety Tula (4.3 t/ha).

Pests and Disease Resistance

Damages from Pod borer (*Maruca testulalis*) was observed but no serious damage caused during the experimental period.

Leaf curl complex was the major disease observed during the experiment. Imidaclorpid was sprayed for sucking insects to control Leaf curl complex. Leaf curl incidence was low in varieties Tajin, Ixtapa, Coyame compared to standard check, Mitla. Choanephora Blight (*Choanephora cucubitarum*) and Anthracnose (*Colletotrichum gloeosporioides*) diseases were observed with high rainfall but did not cause any serious damage. Bacterial wilt (*Ralstonia solanasiarum*) was observed towards the end of the experimental period. Since bacterial wilt is a soil born disease, improvement of drainage and good soil and crop management helped to keep this disease at minimum level.

CONCLUSIONS

The new varieties tested showed significant differences over the variety Mitla. Tajin, Grande, Coyame and Ixtapa varieties showed their superiority by giving higher values for fruit length, fruit diameter, fruit weight, pericarp thickness, number of fruits per plant, yield per plant and average yield. Therefore, it can be concluded that varieties such as Tajin, Coyame, Grande and Ixtapa are superior than the recommended variety Mitla. Further, the varieties Tula and Perfecto did not perform well and gave lower yield than Mitla. Therefore, the varieties Tajin, Grande, Coyame and Ixtapa can

be considered for recommendation for distribution among farmers for commercial cultivation.

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