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EVALUATION OF GROWTH, PHENOLOGY AND YIELD OF DIFFERENT CAPSICUM GENOTYPES UNDER MODHUPUR TRACT AGRO-ECOLOGICAL ZONE OF BANGLADESH

Q.M. AHMED[1*], A.K.M.A. HOQUE[2], S. ROY[3], M.A. ISLAM[4] AND S. KUNDU[5]

[1, 2]Scientific Officer, RHRS, BARI, Shibpur, Narsingdi; [3]Scientific Officer, OFRD, BARI, Tangail; [4]Scientific Officer, OFRD, BARI, Gaibandha and [5]Scientific Officer, Agronomy Division, BARI, Joydebpur.

*Corresponding author & address: Quazi Maruf Ahmed, E-mail: quazimaruf@yahoo.com
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ABSTRACT

Ahmed QM, Hoque AKMA, Roy S, Islam MA, Kundu S (2018) Evaluation of growth, phenology and yield of different capsicum genotypes under Modhupur Tract Agro-Ecological Zone of Bangladesh. *Int. J. Sustain. Crop Prod.* 13(1), 5-9.

The performance of elite color capsicum genotypes for growth and yield parameters were evaluated under (AEZ-28: Modhupur Tract) at Narsingdi region which is nearly the center of Bangladesh especially in the Regional Horticulture Research Station of Bangladesh Agricultural Research Institute (BARI) at Shibpur in Narsingdi during *rabi* season of 2015 to 2016. Six colored capsicum genotypes *viz.*, 'California Wonder', 'CA 0025 F_1', 'Yellow Square', 'Red Master F_1', 'Yolo Wonder' and variety 'BARI Mistimorich-1' as a check. Under the agro climatic condition at AEZ-28 most of genotypes performed well. Considering the plant growth characteristics and phenology, such as plant height, early flowering dates and the longest harvest duration, line 'CA 0025 F_1' was found the best in this region. In case of yield contributing characteristics, the maximum (16.67) fruits plant^{-1} was recorded from the line 'CA 0025 F_1' and the minimum (8.84) was recorded from the line 'Yellow Square'. However, individual fruit weight was found the highest in 'Red Master F_1' (148.71 g) whereas, the lowest was found from line 'CA 0025 F_1' (43.39 g). In prospect of yield, 'Red Master F_1' produced 22.05 t ha^{-1}, followed by check variety 'BARI Mistimorich-1' (19.64 t ha^{-1}), followed by California Wonder (17.90 t ha^{-1}). The maximum seeds fruit^{-1} and thousand seed weight was found in line 'CA 0025 F_1' (122.2 and 5.17 g), followed by 'Red Master F_1' and 'California Wonder'.

Key words: *capsicum, agro climatic, growth and yield*

INTRODUCTION

Pepper (*Capsicum* sp.) is a high value crop that belongs to the Solanaceae family under the genus *Capsicum* (Lovelock 1973). It is originated from tropical America; Peru and Mexico and spread to Europe where it grows as a shrub. From Europe it spread to other parts of the world such as African, Caribbean and Pacific countries (Dennis 2013). *Capsicum annuum* L. is commonly known as hot pepper, chili or chile pepper, and as well sweet pepper and bell pepper in worldwide (Bosland 1996). The sweet pepper or capsicum is relatively non-pungent with thick flesh and it is the world's second most important vegetables after tomato (Acquaah 2004). Sweet pepper (*Capsicum annum*) is one of the most important vegetable crops grown extensively throughout the world especially in the temperate countries. Capsicum cultivars display a wide range of plant and fruit traits and its fruits vary in shape, color, pungency and texture. Fruit of capsicum may be eaten as cooked or raw as well as sliced in salad. In Bangladesh, capsicum cultivation is faced some problem such as unavailable seed, superior variety and rare knowledge of production technology. As production technology is vary greatly from region to region (Berke *et al*. 2005). Most of the seed are imported; for example variety 'California Wonder', 'Yolo Wonder' and 'BARI Mistimorich-1' are seldom available in the seed market. The crop is also very much sensitive to environmental factors. The optimum temperature requirement of sweet pepper growth is from 16 to 25˚C; whereas, below 16˚C temperature at night and above 32˚C at daytime causes flower dropping. Sweet peppers are photo insensitive; day length does not affect flowering, flower setting or fruiting (Bakker and Van Vffelum, 1987; Zakaria *et al.* 2003 and De Swart 2007). Preliminary experimental evidences at Horticulture Research Centre (HRC), BARI, showed that quality production is possible under protected cultivation technique where night temperature can be maintained up to 4˚C higher than outside temperature (Zoran *et al.* 2011). Considering high nutritive value, export potentiality and increasing demand in local market. It is necessary to take attempts for successful cultivation of capsicum in Bangladesh. Nowadays capsicum demands are raising because of new generation are adapted to fast food and different western food habit. During 2009, Olericulture Division, HRC, BARI was released BARI Mistimorich-1, which is the first open pollinated (OP) capsicum variety in Bangladesh. Some selected promising OP color (red, yellow, pinks) capsicum lines collected from Asian Vegetable Research and Development Center (AVRDC) and other sources are now available. So, evaluation is the most vital criteria for reveal the genetic mutability and also development program for any crop species. Therefore, the present study was undertaken with a view to develop improved color capsicum variety(s) and its adaptability at Narsingdi region (AEZ-28; Modhupur Tract) of Bangladesh.

MATERIALS AND METHODS

Experimental location

The experiment was carried out under AEZ-28 (Modhupur Tract) at Narsingdi region (23˚ 55′ 22″ N and 90˚ 43′ 03″ E) of Bangladesh especially in the Regional Horticulture Research Station (RHRS), Bangladesh Agricultural Research Institute (BARI), Shibpur, Narsingdi during winter (*Rabi*) season of October 2015 to April 2016. The land type was sandy loam soil and analytical data of soil sample was presented in Table 1.

Table 1. Analytical data of soil sample of RHRS of BARI, Shibpur, Norsingdi

Lab. No.	Sample No.	pH	O.M %	Ca	Mg	K	Total N %	P	S	B	Cu	Fe	Mn	Zn
				meq/100 ml				$\mu g/ml$						
5420	2 (East)	6.8	0.34	6.3	2.2	.070	0.018	44.0	25	0.10	2.0	45	3.6	0.80
Critical level		**-**	**-**	**2.0**	**0.5**	**0.12**	**-**	**7.0**	**10**	**0.2**	**0.2**	**4.0**	**1.0**	**0.6**

Source: Bangladesh Agricultural Research Institute, Division of Soil Science, Joydebpur, Gazipur

Experimental design

Five lines of color capsicum *viz.*, California Wonder (T_1), CA 0025 F_1 (T_2), Yellow Square (T_3), Red Master F_1 (T_4), Yolo Wonder (T_5) with a variety 'BARI Mistimorich-1' were used as experimental materials. The seeds were sown on October12, 2015 in the seed bed. Fifteen days after sowing when the seedlings attained 2-3 leaf stages, they were transferred to the polybags filled with potting media. Thirty five days old seedlings were transplanted in the experimental plots. The experiment was laid out at Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 4.2 m × 1.0 m and plants spacing was 60 cm × 50 cm. The number of plants in a unit plot was fourteen.

Management practices

Cowdung, Urea, TSP, MoP, Gypsum and ZnO at the rate of 10 ton, 217 kg, 330 kg, 110 kg, 6.5 kg, and 5 kg ha^{-1}, respectively were applied. Half of the quantity of cowdung was applied during final land preparation. The remaining cowdung, entire quantity of TSP, ZnO, Gypsum and one third of urea and MoP were applied during pit preparation. The rest of urea and MoP were applied in two equal installments at 25 and 50 days after transplanting as top dressing. The intercultural operations such as weeding, irrigation etc. were done as and when needed.

Data collection and statistical analysis

Data were collected on different parameters like plant height at last harvest (cm), days to 50% flowering, harvest duration, fruit length (cm), fruit diameter (cm), peduncle length (cm), peduncle breadth (cm), single fruit weight (g), no. of fruits/plant, wt. of fruits/plant (g), average seed per fruit, 1000 seed weight (g), yield (t ha^{-1}) were recorded. Five plants were selected to record the yield and yield contributing characters. Mean data were analyzed statistically by analysis of variance (ANOVA) techniques using Statistical Tool for Agricultural Research (STAR), version 2.0.1. Analysis and significant means were separated at 5% level of significance.

RESULTS AND DISCUSSION

Weather condition during experimental time

Inside tunnel cover with polythene and nylon net, night temperature was as high as 5-9°C compared to open field and other treatments, during December to January when the crop attained at vegetative and fruiting stage. Shading of plants or partial reduction in solar radiation by nylon net increased the yield and yield contributing characters (Vethamoni and Natarajan, 2008). In the month of December to February, night temperatures of Narsingdi region in Bangladesh were minimum, range of 16°C to 14°C (Table 2). Therefore, winter production of pepper, the minimum night temperatures in the greenhouse should be maintained at 16–18°C (Shaked *et al.* 2004). Very minimum infestation of fruits borer, white fly and mite were observed in tested lines/varieties as the plots were covered by nylon net.

Table 2. Within crop duration 2015 to 2016 analytical data of monthly temperature and rainfall in the RHRS, Shibpur, Narsingdi

Month	October	November	December	January	February	March	April
Maximum Avg. Tem. (^oC)	32.17	30.19	25.84	24.53	29.39	33.39	34.76
Minimum Avg. Tem. (^oC)	24.23	19.94	16.04	14.55	15.94	22.44	26.61
*D/N Difference (^oC)	7.94	10.24	9.80	10.18	10.45	10.95	8.15
Rainfall (inch)	0.08	0.00	0.00	0.00	0.07	0.05	0.37

*D/N: Day / Night temperature difference, Source: Regional Horticultural Research station, Shibpur, Narsingdi

Period of growth and development

The results are presented in Table 3. The line/varieties California Wonder (T_1) took maximum time (65.33 days) whereas Yellow Square (T_3) took minimum time (45 days) that followed by CA 0025 F_1 (47.67 days) and BARI Mistimorich-1 (48.87 days) for 50% flowering dates. The longest harvest duration was found in CA 0025 F_1 (73 days) and minimum in Yolo Wonder (40 days). Also, Red Master F_1 (64.67 days) and BARI Mistimorich-1 (50 days) was found harvest duration. The highest (73.34 cm) plant height was observed in CA 0025 F_1 and the lowest in Yellow Square (53.67 cm). The maximum leaf length was found Red Master F_1 (13.16 cm), whereas the lowest leaf length was found BARI Mistimorich-1 (9.73 cm). The significant influence was observed on plant height, Number of leaves, leaves length and breadth (Zakarai *et al.* 2003). The range between leaf breadth

6.49 to 4.69 cm and all treatments were statistically non-significant. Fruits peduncle length (3.38 cm) and peduncle breadth (0.93 cm) were maximal in Red Master F_1 whereas minimum was found BARI Mistimorich-1 (Table 3). Significant variation was found in morphological, plant growth habit and agronomical characters of different peppers genotypes which similar to my research (Bozokalfa and Esiyok, 2011).

Table 3. Plant Characteristics of different capsicum lines/genotypes

Treatments	50% Flowering days	Harvest Duration	Plant Height (cm)	Leaf Length (cm)	Leaf Breadth (cm)	Peduncle Length (cm)	Peduncle Breadth (cm)
California Wonder (T_1)	65.33a	42.67d	44.89bc	11.79ab	6.49	1.80bc	0.42d
CA 0025 F_1(T_2)	47.67bc	73.33a	73.34a	11.45ab	5.17	2.92a	0.53cd
Yellow Square (T_3)	45.00c	52.67c	40.78bc	9.98b	4.69	1.69c	0.65bc
Red Master F_1 (T_4)	50.33abc	64.67b	53.67b	13.16a	6.46	3.38a	0.93a
Yolo Wonder (T_5)	62.67ab	40.33d	35.5c	11.83ab	5.36	2.24b	0.79ab
BARI Mistimorich-1	48.87abc	50.00c	42.12bc	9.73b	4.74	1.53c	0.58bcd
CV (%)	11.78	3.70	10.00	7.93	12.63	10.25	11.92
Level of Sig.	**	**	**	**	NS	**	**

** indicate significant at 1% and NS = Not significant

In pepper (*Capsicum annuum*) Low night temperatures were affected pepper vegetative growth flower morphology and reproduction causing the formation of larger flowers, with swollen ovaries and shorter styles than those of plants grown under higher temperature conditions (Polowick and Sawhney, 1985; Shaked *et al.* 2004).

Fruit quality and characteristics

The highest (148.71 g) individual fruit weight was found Red Master F_1 and the lowest (43.39 g) was found CA 0025 F_1. Whereas Individual fruit weight was observed California wonder (112.93 g) and BARI Mistimorich-1 (97.69 g). The range between fruits per plant 13.01 to 8.84. Fruit length varies from 9.34 to 6.29 cm different genotypes but statistically non-significant. The fruit breadth was found maximum in Red Master F_1 (7.31 cm) and minimum in CA 0025 F_1 (3.85 cm). Also significant result was observed in individual fruit weight (Sharma *et al.* 2010) and fruit breadth (Kumari 2013) of different capsicum genotypes. The fruits color of Yellow Square was yellow and the CA 0025 F_1 had the fruits which turned into yellowish to red at mature stage whereas BARI Mistimorich-1 and rest of the line had the red/reddish brown color fruits turned at the mature stage. Corresponding observation as immature to mature fruit color was also reported by Pradheep and Veeraragavathatham (2006). Only three categories of fruits shape were found among the lines under study. Fruits of CA 0025 F_1 were conical shape and Yellow Square was square shape while rests of the lines were bell shape (Table 4). Fruit shape was determined based on comparison with the shapes proposed in the list of descriptors of the IPGRI (1995).

Table 4. Fruit characteristics of different capsicum lines/genotypes

Treatments	Individual Fruit Weight (gm)	No. of Fruits/ Plant	Fruit Length (cm)	Fruit Breadth (cm)	Fruit Shape	Fruit Color of Mature Stage
California Wonder (T_1)	112.93b	9.77b	6.93	6.76ab	Square oblong	Reddish Brown
CA 0025 F_1 (T_2)	43.39e	13.01a	9.34	3.85c	Conical	Red
Yellow Square (T_3)	71.50d	8.84b	6.84	6.29b	Square	Yellow
Red Master F_1 (T_4)	148.71a	9.15b	7.81	7.31a	Square Bell	Reddish Brown
Yolo Wonder (T_5)	86.28c	8.96b	6.29	6.35b	Bell	Red
BARI Mistimorich-1	97.69c	12.40a	8.29	7.28	Bell	Red
CV (%)	4.99	6.00	14.46	6.67		
Level of Sig.	**	**	NS	**		

** indicate significant at 1% and NS = Not significant

Yield and yield component

The yield result was observed in Table 5. The maximum (1.36 kg) yield per plant was found in Red Master F_1 which were followed by BARI Mistimirich-1(1.21 kg/plant) and California Wonder (1.11 kg/plant) whereas minimum in Yellow Square (0.63 kg/plant). Significant desirable result for fruit yield per plant was also reported earlier Sharma *et al*. (2010) and Kumari (2013). The highest (22.05 t ha^{-1}) yield was produced by Red Master F_2 as check variety BARI Mistimorich-1 (19.64 t ha^{-1}) which was followed by California Wonder (17.90 t ha^{-1}). The lowest (10.22 t ha^{-1}) yield was Yellow Square. Similar yield variation was also found of different capsicum genotypes (Sharma and Sharma, 2006; Sood *et al.* 2009).

Table 5. Yield and yield contribute characteristics of different capsicum genotypes

Treatments	Yield/plant (kg)	Yield/plot (kg)	Yield (t ha^{-1})	No. of Avg. Seed/fruit	1000 Seed weight (g)
California Wonder (T_1)	1.11b	15.47b	17.90b	53.77c	4.60bc
CA 0025 F_1 (T_2)	0.72c	10.11c	11.69c	122.28a	5.17a
Yellow Square (T_3)	0.63c	8.83c	10.22c	46.83c	3.30d
Red Master F_1 (T_4)	1.36a	19.05a	22.05a	32.83d	4.70b
Yolo Wonder (T_5)	0.78c	10.84c	12.55c	27.50d	3.60d
BARI Mistimorich-1	1.21ab	16.97ab	19.64ab	61.64b	4.27c
CV (%)	8.55	8.53	8.53	4.50	3.36
Level of Sig.	**	**	**	**	**

** indicate significant at 1%

Pepper yield varies significantly from one region to the other and several factors for example topography, soil type, water quality, variety, different cultural practices method, soil tillage and fertilizer application (Liu *et al*. 2008). The varied from 122.28 to 27.50 no. of average seed per fruit. The maximum no. of average seed per fruit was found in CA 0025 F_1 and minimum in Yolo Wonder. The range was found between average thousand seed weight 5.17 to 3.30 g. The highest thousand seed weight was found CA0025 F_1 and the lowest was observed in Yellow Square (Table 5). Similar variability result was also reported by Kumari (2013).

CONCLUSION

The performance of the six sweet pepper lines was accomplished under the agro-climatic and adapted conditions at center region of Bangladesh especially in the Regional Horticulture Research Station, BARI, Narsingdi and the ultimate goal of the field performance was to estimate the yield potentialities and growing condition of the lines. In aspect of growth condition, early flowering dates, fruit setting, the longest harvest duration and the highest fruit per plant CA 0025 F_1 showed as the most adaptable line in this agro-climatic condition under AEZ-28 of Bangladesh. In aspect of yield, the highest yield resulted due to some yield contributing characters was found in Red Master F_1, BARI Mistimorich-1 and California Wonder. Considering yield and overall performance of the lines/varieties, Red Master F_1, BARI Mistimorich-1 and California Wonder were found superior to other lines/varieties.

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