Journal of Agricultural Research Advances

Research Article
Open Access

Insect, disease and yield performance of purple and green colored eggplant hybrids in Bangladesh

***Quamruzzaman AKM and Islam Ferdouse**
Olericulture Division of Horticulture Research Centre,
Bangladesh Agricultural Research Institute, Gazipur, Bangladesh

Corresponding author: akmqzs@gmail.com

Received on: 01/06/2020 Accepted on: 13/07/2020 Published on: 22/07/2020

ABSTRACT

Aim: The study was carried out to develop high yielding hybrids resistance to brinjal fruit and shoot borer (BFSB) and bacterial wilt.

Materials and Methods: It was taken five purple and green colored egg plant F_1's at experimental farm of Bangladesh Agricultural Research Institute, Gazipur, Bangladesh.

Results: Wide-ranging of hybrids were significant for reaction to all characters ($P<0.05$). The hybrid F_1 20x5 required minimum 100 days to first harvest. Maximum marketable fruit number was obtained by F_1 1x19 (33.00).Heavy sized fruit was harvested by F_1 1x5 (175 g), followed by F_1 13x12 (156 g), F_1 14x5 (151 g). The range of fruit infection by BFSB was 10.66 -18.00 %, while lowest in F_1 13x12 (10.66 %). In case of bacterial wilt (BW) infestation at field level performance, zero percent incidences was observed in F1 1x19, F1 13x12, BARI Hybrid Begun-2. The yield range of eggplant hybrids was 24.93- 48.03 t/ha. The highest fruit yield was recorded from the line F_1 1x5 (48.03 t/ha), followed by F1 1x19 (45.01 t/ha), $F_1$13x12 (39.23 t/ha). Though the yield was higher in the hybrids F_1 1x5, F_1 1x19, F_1 13x12 but in view of earliness, resistance to infection by BFSB, bacterial wilt infestation, eye-catching fruit shape and color, F_1 1x19 (purple colored hybrid) and F_1 13x12 (green colored hybrid) were found promising.

Conclusion: It was concluded that these two hybrids viz., F_1 1x19, F_1 13x12 can be selected for the farmers of Bangladesh.

Keywords: Colored Eggplant, Disease, Hybrids, Insect, Yield Performance.

How to cite this article: Quamruzzaman AKM and Islam F (2020). Insect, disease and yield performance of purple and green colored eggplant hybrids in Bangladesh. J. Agri. Res. Adv. 02(03): 01-06.

Introduction

The present production, however, is not proportionate to the country's demand. Therefore, the crop deserves a deep deliberation for improvement. Being a centre of origin, brinjal has a huge genetic divergence in our country which offers much scope for improvement through heterosis breeding. The effort could enhance its quality and productivity without sacrificing the consumers' choice. The required goals of increasing productivity in the quickest possible time can be achieved only through heterosis breeding, which is feasible in this crop (Kakikazi, 1931). The estimation of heterosis for yield and its component characters would therefore, be useful to judge the best hybrid combination for exploitation of superior hybrids.

Eggplant (*Solanum melongena* L.) is the most important vegetables of Bangladesh grown throughout the year (average 10.0 t/ha) (Anon., 2017). The productivity of eggplant is very low as compared to that in other tropical countries, owing to use of low yielding cultivars grown for local preference and their susceptibility to pests and diseases. The present production, however, is not balanced to the country's demand. Therefore, the crop deserves a systematic planning for improvement.

Being a centre of origin, eggplant has a huge genetic divergence in our country which offers much scope for enrichment through heterosis breeding. A abundant potentiality exists to obtain higher yield using hybrid exploitation in eggplant. Generally, resistance is organized by a single dominant gene (Ajjappalavara *et al*., 2008; Cao *et al*., 2009) or one recessive gene (Sun *et al*., 2008) or a dominant polygene (Chaudhary, 2000) or recessive polygene (Feng *et al*., 2003). There is a chance of enhancement using heterosis

breeding and offers a great demand to breeders for exploitation of heterosis, relatively large size of flowers, and large numbers of seed produced by a single act of pollination. Increased productivity in the earliest period can be obtained using heterosis breeding (Kakizaki, 1931). Because high-yielding F_1 hybrids are a client concern, utilization of F_1 potencytakesturn into a possibleappliance for development in eggplant (Bavage *et al*., 2005; Dharwad *et al*., 2011; Prabhu *et al*., 2005). The assessment of heterosis for yield and its contributing characters would be beneficial in estimating prominent F_1 combination.

In eggplant, several biotic factors viz., pest and diseases are responsible to reduce the yield, amongst them eggplant fruit and shoot borer (EFSB), *Leucinodes orbonalis*, is the most damaging pest of eggplant in South and Southeast Asia especially in Bangladesh. Its larvae feed inside eggplant fruit, making the fruit unmarketable and unfit for human consumption. To combat this problem several attempts have been taken so far. In recent years, bacterial wilt has become a great problem for eggplant cultivation in Bangladesh. Bacterial wilt caused by *Ralstonia solanacearum* (Yabuuchi *et al*., 1995), synonym *Pseudomonas solanacearum* Smith (1914), is widespread in the tropical, subtropical and temperate region, where it represents a major constraint to the production of numerous crops (Buddenhagen, 1986; Hayward, 1991). It is the most destructive bacterial plant pathogen especially in the warm regions (Kelman, 1953). The main effort to control this disease has been directed towards the development of resistance cultivars. But available information suggests that very few of the cultivars were reported as resistant to this disease. Various attempts to control bacterial wilt of different crops have been reported (Sequeira, 1993) but success was limited. Breeding for resistance, therefore, remains the best control strategy, even though varietal resistance differs in different localities due to extreme variability and adaptation of the pathogen (Persley, 1986). Considering this evidence, we developed five purple and green colored eggplant high yielder hybrid lines. This study was undertaken to study the performance of these hybrids regarding yield and resistance to BFSB and bacterial wilt in different location of Bangladesh.

Materials and Methods

Experimental site

The experiment was conducted at the Olericulture Division of Horticulture Research Centre, Bangladesh Agricultural Research Institute (BARI) during 2017-18. The experimental field was at 23.9920^o N Latitude and 90.4125^o E Longitudes having an elevation of 8.2 m from sea level under agro-ecological zone (AEZ) 28 (Anon., 1995). The average minimum and maximum temperature were18.600C and 29.050C and the average relative humidity varied from 54.25 to 73.40%. The soil of the experimental field was sandy clay loam in texture having a pH range around 6.0.

Plant materials

Seven eggplant hybrid/ varieties viz., F_1 1x5, F_1 1x19, F_1 13x12, F_1 14x5, F_1 20x5, Green Ball (Commercial hybrid) and BARI Hybrid Begun-2 were included in the study as check. The seeds were sown on the seedbed on 22 September 2017. Thirty five days old seedlings were transplanted in the main field on 07 November, 2017.

Experimental design and layout

The experiment was laid out in a RCB design with three replications. The plot size was 7.5 x 0.70 m where 10 plants were planted with space of 75 cm in solitary row.

Land fertilization

The experimental area was enriched with organic fertilizer, Nitrogen, Phosphorus, Potassium, Sulphur, Zinc and Boron @ 3,000, 120, 32, 80, 12, 1.25 and 1.0 kg/ha, correspondingly. One third of the organic fertilizer, 50% of Phosphorus and full of Sulphur, Zinc and Boron were incorporated for the period of last land-dwelling preparation. Rest of organic fertilizer and Phosphorus and 1/3 of Potassium were applied as basal in pit. Whole quantity of Nitrogen and rest of Potassium were applied in four equal portion beginning from 20 days after transplanting. Rest three portions were fertilized at 50, 80 and 110 days after transplanting.

Data recorded

Data on days required for first harvest, fruits no./ plant, individual fruit weight (g), fruit yield/ plant (kg), fruit length (cm), fruit diameter (cm), plant height at 1st harvest (cm), plant height at last harvest (cm), fruit infection by BFSB (%), bacterial wilt infestation (%), little leaf infestation (%), phomopsis blight infestation (%), fruit yield (t/ha), fruit shape and fruit colour were recorded from five randomly selected

plants per entry per replication.

Statistical analysis

The recorded data for different characters were analyzed statistically using MSTAT-C program to find out the variation among the different genotypes by F-test. Treatment means were compared using Duncan's Multiple Range Test (DMRT) and standard error and coefficient of variation (CV %) were also estimated for each character.

Results and Discussion

Performances of eggplant hybrids were showed (Table 1&2 and Fig. 1, 2&3). The hybrids wide-ranging significantly for reaction to all characters studied ($P<0.05$). In respect of days to first harvest, the earliest line was F_1 20x5(100 days) followed by F_1 1x19 (101 days), F_1 13x12 (102 days) and commercial hybrid variety Green Ball was the most delayed (108 days). The range of marketable fruit number was (15.00 – 33.00). The highest marketable fruit number per plant was counted in F_1 1x 19(33.00) which followed byF_1 1x5 (29.00), while lowest fruit number was counted in Green Ball (15.00). Average fruit weight is an important criterion to select a high yielder line. The heaviest fruit was produced in F_1 1x5 (175 g) followed by F_1 13x12 (156 g), F_1 14x5 (151 g), while lightest fruit was in Green Ball (123 g). Fruit yield/plant was maximum in F_1 1x5 (4.36 kg) followed by F_1 1x19 (4.09 kg), F_1 13x12 (3.56 kg), while minimum was in Green Ball (2.26 kg). F_1 1x19 produced the longest fruit (31.66 cm) followed by F_1 1x5 (21.66 cm), F_1 14x5 (18.00 cm) and Green Ball produced the shortest fruit (15.33 cm).

Maximum fruit diameter was produced by the line F_1 13x12 (7.20 cm) followed by F_1 1x5 (6.46 cm) and minimum was by $F_1$1x19 (3.80 cm)(Table 2). The range of plant height at first and last harvest was 55.66 – 80.00days and 86.66- 119.66 days, respectively. The maximum height at first harvest was estimated in F_1 1x5 (80.00 cm), which is statistically significant with F_1 1x19 (75.00 cm), F_1 13x12 (74.00 cm), while minimum was from Green Ball. In case of last harvest the maximum and minimum height was similar with first harvest viz., F_1 1x5 (119.66 cm) and Green Ball (86.66 cm), respectively. In case of little leaf infestation and phomopsis blight infestation, no infestation of little leaf disease and phomopsis blight diseases were observed in the hybrids.

Table 1. The yield and yield contributing characters of 7hybrids of eggplant

Treatment	Days required for first harvest	Fruits no./ plant	Individual fruit weight (g)	Fruit yield/ plant (kg)	Fruit length (cm)
F_1 1x5	104 b	29.00 b	175 a	4.36 a	21.66 b
F_1 1x19	101 bc	33.00 a	124 c	4.09 b	31.66 a
F_1 13x12	102 bc	22.33 b	156 b	3.56 c	15.66 d
F_1 14x5	104 b	22.33 b	151 b	3.16 d	18.00 cd
F_1 20x5	100 c	19.66 b	133 c	2.96 d	17.66 cd
Green Ball	108 a	15.00 c	123 c	2.26 e	15.33 d
BARI Hybrid Begun-2	105 ab	20.33 b	147 b	3.13 d	16.33 cd
Level of sig	*	*	*	*	*
CV (%)	1.27	2.53	3.20	5.90	4.34

Note: Numbers on the same line followed by the same letter were not significantly different in the LSD test on level α 5%

Table 2.The yield and yield contributing characters of 7 hybrids of eggplant

Treatment	Fruit diameter (cm)	Plant height at 1st harvest (cm)	Plant height at last harvest (cm)	Little leaf infestation (%)	Phomopsis blight infestation (%)
F_1 1x5	5.73 c	80.00 a	119.66 a	0	0
F_1 1x19	3.80 e	75.00 ab	111.66 ab	0	0
F_1 13x12	7.20 a	74.00 ab	109.00 a-c	0	0
F_1 14x5	6.46 b	69.33 b	100.33 b-d	0	0
F_1 20x5	5.60 c	68.33 b	96.00 c-e	0	0
Green Ball	4.53 d	55.66 c	86.66 e	0	0
BARI Hybrid Begun-2	4.63 d	67.33 b	94.33 de	0	0
Level of sig	*	*	*	-	-
CV (%)	3.90	7.45	5.60	-	-

Note: Numbers on the same line followed by the same letter were not significantly different in the LSD test on level α 5%

The range of fruit infection by BFSB was 10.66 - 18.00 %, while lowest in F_1 13x12 (10.66 %), which was statistically similar to BARI Hybrid Begun-2 (11.33 %), F_1 1x19 (12.00 %), F_1 1x5 (12.66 %) and highest was in F_1 20x5 (18.00 %). In case of bacterial wilt (BW) infestation at field level performance, zero percent incidence was observed in F_1 1x19, F_1 13x12, BARI Hybrid Begun-2, while maximum was observed in F_1 20x5, Green Ball (6.66 %).

Plant height at last harvest and fruit infection by BFSB usually play role on yield. Linear model indicated plant height at last harvest significantly correlated with fruit yield(y = 0.662x - 30.87) (Fig. 3). This model explained maximum amount of genotypic variation for this relationship (R^2 = 0.936 %). Fruit infection by BFSB significantly correlated with fruit yield (y = -1.720x + 61.01) (Fig. 4.). This model explained moderate amount of genotypic variation for this relationship (R^2 = 0.435 %).

The yield range of eggplant hybrids was 24.93- 48.03 t/ha. The highest fruit yield was recorded from the line F_1 1x5 (48.03 t/ha), followed by F_1 1x19 (45.01 t/ha), F113x12 (39.23 t/ha), and lower yield were recorded from Green Ball (24.93 t/ha) (Fig. 5).

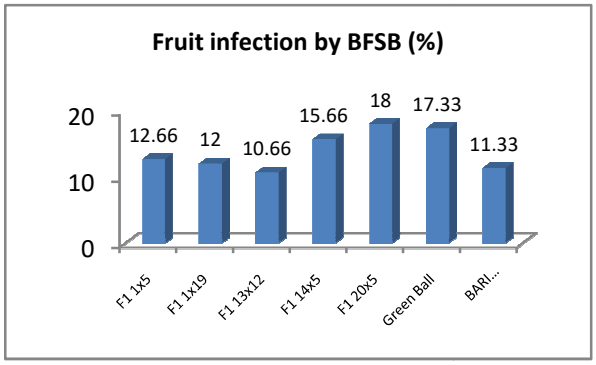

Fig.1.Fruit infection by BFSB of 7 eggplant hybrids

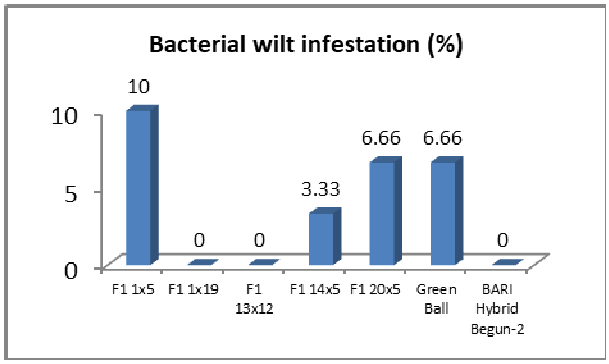

Fig.2. Bacterial wilt infestation of 7 eggplant hybrids

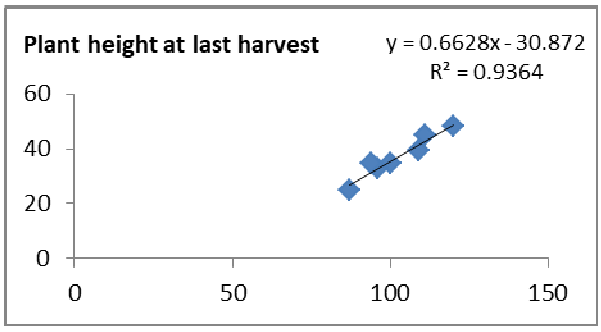

Fig.3. Relationship between plant height at last harvest and fruit yield

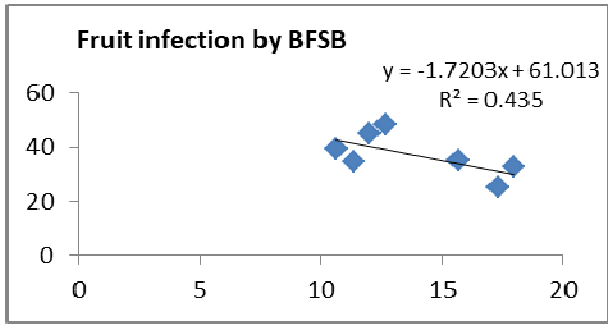

Fig.4. Relationship between fruit infection by BFSB and fruit yield

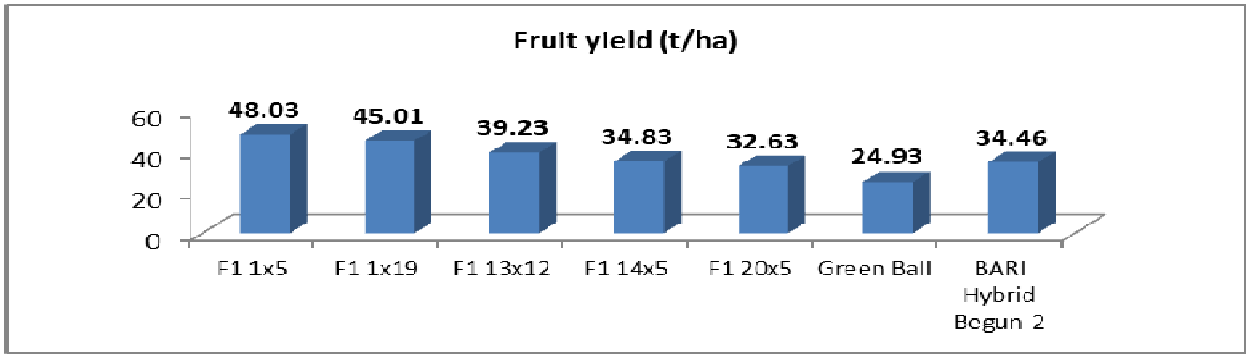

Fig 5. Fruit yield (t/ha) of 7 eggplant hybrids/ variety

Table 3. Qualitative characters of 7 eggplant hybrid lines/ variety

Hybrids	Fruit shape	Fruit color
F_1 1x5	Elongate	Purple
F_1 1x19	Cylindrical	Purple
F_1 13x12	Oval	Light green with white spot at bottom
F_1 14x5	Oblong	Purple
F_1 20x5	Elongate	Light purple
Green Ball	Elongate	Purple
BARI Hybrid Begun-2	Oblong	Purple

Four types of fruit shape was observed among the lines viz., elongate (3 hybrids), cylindrical (1 hybrid), oval (1 hybrid), oblong (2 hybrid/ variety), while in term of fruit color, all the hybrids were purple/ light purple/ deep purple in color except one (F_1 13x12- light green with white spot at bottom).

Conclusion

Though the yield was higher in the hybrids F_1 1x5, F_1 1x19, F_1 13x12 but in view of earliness, resistance to fruit infection by BFSB, bacterial wilt infestation, eye-catching fruit shape and fruit colour, the hybrids F_1 1x19, F_1 13x12 were found promising. So these two hybrids viz., F_1 1x19, F_1 13x12 can be selected for for the farmers.

References

Ajjappalavara PS, Dharmatti RR, Salimath PM, Patil RV, Patil MS and Krishnaraj PU (2008). Genetics of bacterial wilt resistance in brinjal. Karnataka J. Agr. Sci. 21:424–427.

Anonymous (1995). Agro-climatatrological data.Agromet Division, Bangladesh Meteorological Department, Joydebpur, Gazipur. pp. 35-65.

Anonymous (2017). Year Book of Agricultural Statistics of Bangladesh 2016.Bangladesh Bureau of Statistics, Ministry of Planning, Government of Peoples Republic of Bangladesh, Dhaka, Bangladesh.pp 249-290.

Bavage MS, Madalageri MB and Mulge R (2005). Hybrid performance of round fruited brinjal (*Solanummelongena* L.). Karnataka J. Hort. 1:95–97.

Buddenhagen IW (1986). Bacterial wilt revisited. In: Persley GJ, ed. Bacterial Wilt Disease in Asia and the South Pacific. ACIAR Proceedings No. 13. Canberra, Australia: ACIAR, 126-43.

Cao BH, Lei JJ, Yong W, Chen GJ (2009). Inheritance and identification of SCAR marker linked to bacterial wilt-resistance in eggplant. Afr. J. Biotechnol. 8(20): 5201–5207.

Chattopadhyay A, Seth T, Dutta S, Ghosh PP, Chattopadhyay SB and Majumder D (2012). Breeding Eggplant for Higher Productivity and Bacterial Wilt Tolerance.Intl. J. Veg. Sc. 18:376–392.

Chaudhary DR (2000). Inheritance of resistance to bacterial wilt (*Ralstoniasolanacearum* E. F. Smith) in eggplant. Haryana J. Hort. Sci. 29(1): 89–90.

Dharwad N, Patil SA and Salimath PM (2011). Study on genetic diversity and its relation to heterosis in brinjal (*Solanummelongena* L.). Karnataka J. Agr. Sci. 24(2): 110–113.

Feng LL, Qu DY, Jin LP, Lian Y (2003). Genetic analysis of resistance to bacterial wilt in eggplant (*Solanummelongena* L.). Acta Hort. Sinica 30(2): 163–166.

Hayward AC (1991). Biology and epidemiology of bacterial wilt caused by Pseudomonas solanacearum. Annual Review of Phytopathology 29: 65–87.

Kakikazi Y (1931). Hybrid vigour in eggplant and its potential utilization. J. Hered. 21:253–258.

Kelman A (1953). The Bacterial Wilt caused by Pseudomonas solanacearum. A Literature Review and Bibliography. North Carolina Agricultural Experiment Station Technical Bulletin No. 99. Raleigh: North Carolina State University.

Persley GJ (1992). Ecology of Pseudomonas solanacearum, the causal agent of bacterial wilt. Bacterial Wilt ACIAR Proc., 45: 71-75.

Sequeira L (1993). Bacterial wilt: past, present and future. In: Hartman GL, Hayward AC, eds. Bacterial Wilt. ACIAR Proceedings No. 45. Canberra, Australia: ACIAR, 12-21.

Yabuuchi E, Kosako Y, Yano I, Hotta H and Nishiuchi Y (1995). Transfer of two Burkholderia and an Alcaligenes species to Ralstonia gen. nov.: proposal for Ralstonia pickettii, Ralstonia solanacearum and Ralstonia eutropha. Microbiol. Immunol., 39: 897-904.

Zhu H, Yao YG, Liu ZM, Yang JG, Chen HM (2004). On resistance to bacterial wilt in eggplant (*Solanummelongena* L.). J. Hunas Agr. Univ. 30(3): 288–289.

****