Int.J.Curr.Microbiol.App.Sci (2020) *9*(6): 529-534

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 9 Number 6 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.906.068

Studies on the Mean Performance of F_2 Segregants of Bhendi [*Abelmoschus esculentus* (L.) Moench]

R. Janarthanan* and V. Sundaram

Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Serumavilangai, Nedungadu (PO), Karaikal-609603, U.T. of Puducherry, India

**Corresponding author*

Keywords

Bhendi, *per se* performance, range, F_2 segregants and Arka Anamika

Article Info

Accepted:
15 May 2020
Available Online:
10 June 2020

A B S T R A C T

In the present study, observations on 12 important biometric characters were recorded from F_2 segregants of two crosses of bhendi *viz.*, Cross 1 [SKY/DR/RS/107 (P 1) X Tiruchi Local (P 2)] and Cross 2 [IC69257 (P 3) X 770 (P 4)], along with their four parents and a check (Arka Anamika). The research work was carried out in Karaikal, U.T. of Puducherry during 2018. The *per se* performance of parents had revealed the highest mean for yield plant^{-1} and fruit girth in P 1 (SKY/DR/RS/107), while the highest mean for number of fruits plant^{-1} was observed in P 3 (IC69257). Segregants of Cross 2 had recorded higher mean for fruit yield plant^{-1}, while mean for number of fruits plant^{-1} and fruit weight were found higher in Cross 1 and both the crosses had shown wide ranges for traits such as fruit length, fruit weight, plant height at final harvest, number of fruits plant^{-1} as well as fruit yield plant^{-1}. The mean performances of both crosses were found superior to the check Arka Anamika for yield as well as most other yield contributing traits indicating the scope for identification of superior segregants of bhendi under coastal conditions of Karaikal.

Introduction

Bhendi [*Abelmoschus esculentus* (L.) Moench] is one of the important short duration vegetable crops capable of fitting well into any cropping system. India is the leading producer of bhendi and several hybrids possessing tolerance to the dreaded Yellow Vein Mosaic Virus disease had already been made available to the farmers for overcoming this important production constraint. However, these hybrids are not only found input intensive but also restrict farmers from generating the seeds on their own, making the cost of production high, especially for the small and marginal farmers who depend most on vegetable cultivation as a regular source of income.

Further, the growing concern of the consumers about health and safety has shifted the focus from an input intensive vegetable cultivation to a low input as well as organic vegetable cultivation system.

This would make farming more profitable and sustainable, which is considered as the need of the hour. Bhendi has been regarded as the best alternative crop all around the world (Duzyaman, 2006). Moreover, the changing global agro-climatic scenario necessitates the identification of suitable bhendi genotypes for a given soil and climatic condition with high yield and acceptable horticultural traits. The exhaustion of natural variability in a predominantly self-pollinated crop like bhendi, requires creation of new variability and one of the probable approaches for such a breakthrough is by hybridization and consequent selection. Bhendi offers greater scope for developing variation *in situ* through recombination as it turns the population more dynamic, helping in selection of a more adaptable genotype. The present investigation on bhendi was hence taken up with specific objective to evaluate the mean performance of F_2 segregants along with their parents and check.

Materials and Methods

The present study on mean performance of F_2 generation in bhendi was undertaken during Kharif 2018 at the Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, U.T. of Puducherry. The study material comprised of two cross combinations of bhendi identified for recombinant breeding in F_1 through combining ability studies involving genoptypes assembled from IIVR, Varanasi. The hybrid combinations include SKY/DR/RS/107 X Tiruchi Local designated as Cross 1 and IC 69257 X 770 designated as Cross 2.

These cross combinations were identified for their superiority with regard to shorter internodal length (Cross 1) and higher number of fruits as well as yield plant^{-1} (Cross 2). The parents were crossed and the resultant hybrids were selfed to generate F_2 for analysing their *per se* performance. About 1000 seeds of F_2, generated from each cross combination along with the respective parents were raised in an unreplicated trial. The bhendi variety Arka Anamika from IIHR, Bengaluru was also raised to compare the performance of segregants.

Observations on twelve characters *viz.*, days to first flowering, node number of first flowering, plant height at flowering, days to first harvest, fruit length, fruit girth, fruit weight, internodal length, plant height at final harvest, number of primary branches at final harvest, number of fruits plant^{-1} and fruit yield plant^{-1} were recorded on 250 randomly selected plants among F_2 crosses and from 25 randomly selected plants of parents and check each. The statistics like mean, standard error (S.E.) and coefficient of variation (C.V.) were computed as per the method of Panse and Sukhatme (1961).

Results and Discussion

The mean values recorded for 12 characters from randomly selected plants of the four parents *viz*., P 1 (SKY/DR/RS/107), P 2 (Tiruchi Local), P 3 (IC69257), P 4 (770) and check (Arka Anamika) are presented in Table 1 and the values pertaining to F_2 segregants of the two crosses *viz*., Cross 1 (SKY/DR/RS/107 X Tiruchi Local) and Cross 2 (IC69257 X 770) are given in the Table 2.

The study of *per se* performance of parents revealed the superiority of P1 (SKY/DR/RS/107) as it has recorded the highest mean yield of 419.25 g plant^{-1} (Table 1). This is attributable to the maximum fruit girth and plant height recorded at final harvest as well as better fruit weight (Table 1). The parent P 4 (770) was found to be the next best with a mean yield of 370.49 g plant^{-1}, which was also attributable to better fruit weight and fruit girth.

Table.1 Mean performance of parents and check for various characters

Character	P 1(SKY/DR/RS/107)		P 2 (Tiruchi Local)		P 3 (IC69257)		P 4 (770)		Check (Arka Anamika)	
	Mean ± S.E	C.V (%)	Mean ± S.E	C.V (%)	Mean ± S.E	C.V (%)	Mean ± S.E	C.V (%)	Mean ± S.E	C.V (%)
Days to first flowering	47.28 ± 0.18	1.67	49.48 ± 0.70	6.21	52.64 ± 0.47	4.17	40.96 ± 0.29	3.49	44.64 ± 0.57	6.40
Node number of first flowering	3.96 ± 0.10	11.48	3.44 ± 0.11	14.73	3.80 ± 0.10	13.16	3.52 ± 0.11	14.49	4.04 ± 0.14	16.73
Plant height at flowering (cm)	34.20 ± 1.13	14.83	28.79 ± 1.24	18.21	31.33 ± 1.14	18.15	17.67 ± 0.50	14.20	26.55 ± 0.96	18.02
Days to first harvest	53.84 ± 0.37	3.16	55.88 ± 0.57	4.11	57.76 ± 0.55	4.45	47.24 ± 0.30	3.13	50.92 ± 0.62	6.13
Fruit length (cm)	12.28 ± 0.34	14.00	13.28 ± 0.37	14.04	13.35 ± 0.33	12.44	13.06 ± 0.34	12.91	14.02 ± 0.41	14.61
Fruit girth (cm)	5.95 ± 0.09	7.96	5.85 ± 0.09	7.41	5.94 ± 0.08	6.66	5.94 ± 0.08	6.09	5.98 ± 0.08	6.92
Fruit weight (g)	15.78 ± 0.61	19.18	15.36 ± 0.44	14.28	14.47 ± 0.52	18.01	15.98 ± 0.59	18.54	15.26 ± 0.51	16.86
Internodal length (cm)	7.10 ± 0.11	7.13	7.46 ± 0.15	9.00	7.49 ± 0.26	17.59	5.33 ± 0.20	18.58	5.95 ± 0.24	19.96
Plant height at final harvest (cm)	145.90 ± 4.27	14.63	104.44 ± 2.78	13.31	131.24 ± 4.64	17.69	88.15 ± 3.10	17.61	112.46 ± 4.26	18.95
Number of primary branches at final harvest	1.88 ± 0.07	17.64	1.88 ± 0.07	17.64	2.24 ± 0.11	19.46	2.52 ± 0.10	19.93	1.88 ± 0.07	17.64
Number of fruits plant^{-1}	25.28 ± 0.76	15.04	23.76 ± 0.73	15.43	29.28 ± 1.05	17.95	24.44 ± 0.97	19.91	37.84 ± 1.45	19.10
Fruit yield plant^{-1} (g)	419.25 ± 16.07	19.16	299.37 ± 9.84	16.44	368.66 ± 12.59	17.08	370.49 ± 14.29	19.28	456.89 ± 17.31	18.94

Table.2 Mean performance of Cross 1 [SKY/DR/RS/107 (P 1) X Tiruchi Local (P 2)] and Cross 2 [IC69257 (P 3) X 770 (P 4)]

Character	Cross 1			Cross 2		
	Mean ± S.E	Range		Mean ± S.E	Range	
		Min.	Max.		Min.	Max.
Days to first flowering	41.86 ± 0.17	38.00	54.00	42.50 ± 0.16	38.00	56.00
Node number of first flowering	3.77 ± 0.04	3.00	8.00	3.88 ± 0.04	3.00	6.00
Plant height at flowering (cm)	24.07 ± 0.37	13.50	63.20	25.91 ± 0.45	13.60	68.70
Days to first harvest	48.49 ± 0.17	44.00	60.00	48.98 ± 0.15	44.00	63.00
Fruit length (cm)	13.28 ± 0.14	10.00	19.50	13.04 ± 0.12	10.00	19.60
Fruit girth (cm)	6.39 ± 0.04	4.90	8.30	6.00 ± 0.04	4.40	7.60
Fruit weight (g)	17.68 ± 0.26	9.94	29.32	16.52 ± 0.25	9.22	28.94
Internodal length (cm)	6.54 ± 0.12	2.30	14.30	7.34 ± 0.14	2.70	15.70
Plant height at final harvest (cm)	135.48 ± 2.05	46.20	219.60	116.24 ± 2.03	44.40	209.50
Number of primary branches at final harvest	2.42 ± 0.05	1.00	4.00	2.81 ± 0.05	1.00	5.00
Number of fruits plant^{-1}	34.68 ± 0.59	7.00	62.00	32.23 ± 0.54	10.00	71.00
Fruit yield plant^{-1} (g)	513.34 ± 9.17	125.89	1068.00	515.78 ± 8.62	202.68	1155.83

P 2 (Tiruchi Local) was the least productive with an yield of 299.37 g plant^{-1}, which might be due to the lower value for fruit girth and lesser number of fruits produced plant^{-1} (23.76). The check, Arka Anamika was found to record higher number of fruits plant^{-1} (37.84) and fruit yield plant^{-1} (456.89 g) over all the four parents. However, its tolerance to YVMV is found lost under different environments, often leading to poor yield. This necessitates the identification of a high yielding genotype with biotic and abiotic stress tolerance in bhendi. The parent P 4 (770) was the earliest to flower (40.96 days), followed by P 1 (SKY/DR/RS/107), which had taken 47.28 days to flower. The parent P 3 (IC69257) was found to be late (52.64 days) to flower as shown in Table 1. Similar range of values had been reported earlier by Phanikrishna *et al.,* (2015). The mean performance of the two cross combinations revealed the superiority of both as the mean yield recorded were found to be higher than all the four parents involved in generation of these crosses. Among the two cross combination, F_2 population of Cross 2 (IC69257 X 770) could be considered better as it has recorded a mean fruit yield of 515.78 g plant^{-1}, which is marginally higher (513.34 g plant-1) over the mean yield recorded for F_2 segregants of Cross 1 (SKY/DR/RS/107) as evidenced from Table 2.

The mean value recorded for fruit weight and fruit yield plant^{-1} among the segregants of both the crosses were superior to the check Arka Anamika. This might have resulted from the higher mean value recorded for fruit weight and number of fruits plant^{-1} in F_2 segregants compared to their parents (Table 2) as well as improvement registered for number of primary branches at final harvest in both Cross 1 and Cross 2. This is an indication of recombination of favourable yield contributing traits from the parental lines. The segregants of Cross 1 were found to be early in flowering (41.86 days) compared to both the parents. It was also observed that the earliest parent (P 4) had produced late flowering genotypes in F_2 suggesting that intermating with late flowering genotype (P 3) would have helped in releasing more variability than in selfing and similar report had been given earlier by Guddadamath *et al.,* (2010). Segregants of both the crosses had shown wide range for traits such as fruit length, fruit weight, plant height at final harvest, number of fruits plant^{-1} as well as fruit yield plant^{-1} and such a high variability could have resulted from genetic recombination in the early segregating generations as reported earlier by Raju *et al.,* (2010). The mean performance of both the crosses with regard to days to first flowering was also found superior to Arka Anamika (Table 1 and 2).

The support by Indian Institute of Vegetable Research (IIVR), Varanasi in sparing the seeds of bhendi germplasm is gratefully acknowledged.

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How to cite this article:

Janarthanan. R. and Sundaram. V. 2020. Studies on the Mean Performance of F_2 Segregants of Bhendi [*Abelmoschus esculentus* (L.) Moench]. *Int.J.Curr.Microbiol.App.Sci*. 9(06): 529-534. doi: https://doi.org/10.20546/ijcmas.2020.906.068