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RESEARCH ARTICLE

Mean performance of gynoecious cucumber hybrids in sub-tropical climate of eastern India

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ABSTRACT

Using two gynoecious lines, two monoecious lines, and one parthenocarpic gynoecious line, using two gynoecious lines, two monocious lines. For 10 quantitative measures out of the 13 employed in the study, analysis of variance in randomised block design revealed significant differences across genotypes. The results showed that gynoecious hybrids (those with both gynoecious parents) had a shorter time to first female flower anthesis. The hybrid BRPCU-8 ×BRGCU-4 was found to be better for earliness related parameters such as days to first flowering, first fruit harvest, and node to first female bloom in the current study. Fruit morphological traits such as fruit length, fruits per plant, and yield-related features were better performed by hybrid BRCU-10× BRCU-1, while vegetative growth traits such as crop duration and vine length were better performed by hybrid BRCU-1 ×BRPCU-8. Overall, the hybrid BRGCU-10 ×BRCU-1 genotype was found to be the best.

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INTRODUCTION

Consumption of cucumbers has been linked to reduced risk of heart disease and stroke (Vimala et al., 1999). So, cucumber's nutrients help you lose weight and stay healthy. It is used in cosmetics as well as fitness. The gynoecious sex type is notable for its early flowering and fruit harvesting (Tanurdzic and Banks, 2004; Bai et al., 2004). The cucumber sex type is unstable under hot and extended photoperiods (Lai et al., 2018). In order to achieve high yields and stability, gynoecious parthenocarpic hybrids should be bred. Production of stable gynoecious cucumber hybrids and seasonal evaluation is required to choose acceptable types or hybrids.

Despite its historical importance, little is known about its commercial use (Pawelkowicz et al., 2019). Hybrids that produce predominantly pistillate flowers are called gynoecious variations (may be coloured or put in separate packets). As long as a pollinator (monoecious variety) is present, gynoecious variants will out-produce standard kinds. Using gynoecious lines provides for faster hybrid growth, higher yield, and more concentrated fruit set than monoecious hybrids. Using a gynoecious line also avoids the need to remove male flowers by hand and the cost of crossing work (Robinson, 2000). The predominant monoecious sex type (generating only male flowers) produces fewer fruits per plant than gynoecious dependent cucumber hybrids. Thus, our study's goal was to assess the average performance of gynoecious cucumber hybrids during the zaid season.

MATERIALS AND METHODS

This study evaluated cucumber genotypes at BAU's Vegetable Research Farm in Sabour, Bhagalpur, during the 2019 zaid season. The study included 27 cucumber genotypes. BAU, Sabour produced and kept seeds of all parents.

The genotypes' yield was examined for 13 quantitative traits. The experiment employed a Randomized Block Design, with 150 cm between rows and 50 cm between plants. In March 2019, the genotypes were tested in the field. Each genotype consisted of ten plants, two lines each replication. All needed inputs were implemented as instructed, and multicultural operations were undertaken regularly. Marketable yield was observed on five randomly chosen plants from each genotype in all replications. Fruits were collected regularly at the green tender point, weighed, tallied, and averaged to calculate total yield per plant. The data were evaluated statistically using INDOSTAT software from INDOSTAT Services in Hyderabad.

RESULTS AND DISCUSSION

For a node to first female flower, hybrid BRGCU-4 ×BRPCU-8 (2.97) was found first, followed by BRCU-1 BRGCU-4 (3.0), and BRPCU-8 × BRGCU-4 (50.90) was found first (Table 1). Except for two hybrids, almost all of the 20 F1 hybrids studied were spotted first over Don and Malini. Early maturing and harvesting genotypes have a shorter day to initial female flower anthesis. With cucumber, Airina et al. (2013) and Pati et al. (2015) found that gynoecious hybrids were superior in terms of earliness features.

The traits like crop duration showed significant, whereas vine length exhibited non-significant differences. The crop duration range varied between 80.67-97.67 days and 115.67-174.00 cm for vine length (Table 1). Hybrid BRCU-1 × BRPCU-8 (97.67) followed by BRCU-1 × Punjab Naveen (96.67) had the longest crop duration, whereas hybrids Punjab Naveen × BRCU-1 (174.00 cm) followed by BRCU-1 × Punjab Naveen (166.00 cm) had the longest vine length (Table 1).

The crosses involving monoecious parents had better growth than their gynoecious counterparts. Generally, the more vigorous the vines, the more is the yield in cucumber. Vegetative characters have an indirect effect on marketable fruit yield. Shukla et al. (2010) and Veena et al., (2012) while performing a genetic evaluation of cucumber, also revealed that monoecious cucumber genotypes were superior in growth characters.

Table 1. Mean performance of the parents, hybrids and standard checks in *zaid* season for earliness and growth-related characters

Characters	*Zaid* season				
Hybrids	Days to first female flower anthesis	Node to first female flower	Days to first fruit harvest	Vine length (cm)	Crop duration (days)
BRGCU-4 × BRPCU-8	39.97	2.97	52.87	137.67	83.21
BRGCU-4 × BRGCU-10	43.97	3.23	53.00	126.67	84.33
BRGCU-4 × Pb. Naveen	44.43	3.53	53.73	143.33	83.31
BRGCU-4 × BRCU-1	45.47	6.03	55.70	146.00	92.06
BRPCU-8 × BRGCU-4	37.40	5.20	50.90	115.67	83.33
BRPCU-8 × BRGCU-10	39.07	3.93	54.00	133.33	83.12
BRPCU-8 × Pb. Naveen	40.87	4.33	55.33	155.67	84.67
BRPCU-8 × BRCU-1	41.13	5.33	52.00	159.33	89.33
BRGCU-10 × BRGCU-4	38.94	3.67	55.13	123.33	80.67
BRGCU-10 × BRPCU-8	37.67	3.67	54.63	133.33	88.07
BRGCU-10 × Pb.	41.20	4.63	55.00	153.00	86.67
BRGCU-10 × BRCU-1	42.58	6.00	56.60	149.00	87.22
Pb. Naveen × BRGCU-4	42.10	3.87	54.80	137.67	86.07
Pb. Naveen × BRPCU-8	39.67	4.40	52.33	144.00	83.67
Pb. Naveen × BRGCU-	41.83	4.87	54.60	128.00	86.33
Pb. Naveen × BRCU-1	47.87	11.20	60.33	174.00	94.67
BRCU-1 × BRGCU-4	44.57	3.00	53.73	156.67	90.67
BRCU-1 × BRPCU-8	39.23	5.13	53.47	148.00	97.67
BRCU-1 × BRGCU-10	41.27	3.80	56.33	151.00	83.33
BRCU-1 × Pb. Naveen	47.83	10.27	57.73	166.00	96.67
Range	37.40-47.87	3.00-11.20	50.90-60.33	115.67-174.00	80.67-97.67
Parents					
BRGCU-4	41.27	3.50	55.33	119.33	90.33
BRPCU-8	39.07	6.87	52.33	136.00	82.67
BRGCU-10	42.57	3.57	56.67	132.67	85.33
Pb. Naveen	48.40	9.17	55.37	164.33	81.64
BRCU-1	50.77	9.73	63.73	192.00	87.33
Range	39.07-50.77	3.50-9.73	52.33-63.73	119.33-192.00	81.64-90.33
Standard checks					
Don (Check 1)	51.03	7.93	61.80	137.67	91.67

Malini (Check 2)	49.23	8.87	59.13	140.00	89.67
CV	5.40	9.22	5.35	6.68	5.32
CD (5%)	3.81	0.83	4.86	15.83	7.61

Table 2. Mean performance of the parents, hybrids and standard checks in *zaid* season for fruit morphology-based characters

Characters	*Zaid* season			
Hybrids	Fruit length (cm)	Fruit diameter (cm)	Flesh thickness (cm)	Fruits per plant
BRGCU-4 × BRPCU-8	17.07	4.08	1.32	6.23
BRGCU-4 × BRGCU-10	15.47	4.50	1.77	6.27
BRGCU-4 × Pb. Naveen	16.57	4.54	1.48	7.67
BRGCU-4 × BRCU-1	16.58	4.28	1.47	7.15
BRPCU-8 × BRGCU-4	16.72	4.32	1.28	7.09
BRPCU-8 × BRGCU-10	15.92	4.51	1.52	7.84
BRPCU-8 × Pb. Naveen	17.76	3.77	1.37	6.45
BRPCU-8 × BRCU-1	19.63	3.42	1.30	6.45
BRGCU-10 × BRGCU-4	18.13	4.41	1.50	7.36
BRGCU-10 × BRPCU-8	18.98	3.96	1.47	6.10
BRGCU-10 × Pb. Naveen	16.14	4.20	1.43	6.10
BRGCU-10 × BRCU-1	22.07	4.64	1.87	7.98
Pb. Naveen × BRGCU-4	16.70	4.39	1.45	6.10
Pb. Naveen × BRPCU-8	17.59	3.81	1.35	7.11
Pb. Naveen × BRGCU-10	15.56	4.17	1.52	8.19
Pb. Naveen × BRCU-1	18.11	4.09	1.90	4.31
BRCU-1 × BRGCU-4	18.51	4.50	1.70	5.62
BRCU-1 × BRPCU-8	21.34	3.74	1.60	7.51
BRCU-1 × BRGCU-10	17.50	4.07	1.52	8.36
BRCU-1 × Pb. Naveen	16.24	3.73	1.47	5.45
Range	15.47-22.07	3.42-4.64	1.28-1.87	4.31-8.36
Parents				
BRGCU-4	13.29	4.77	1.77	6.43
BRPCU-8	18.40	4.48	1.33	6.81
BRGCU-10	15.40	4.47	1.80	7.88
Pb. Naveen	17.85	4.80	1.63	6.17
BRCU-1	21.34	3.86	1.70	6.28
Range	13.29-21.34	3.86-4.80	1.33-1.80	6.17-7.88
Standard checks				
Don (Check 1)	16.56	3.74	1.83	7.22
Malini (Check 2)	15.75	4.50	1.47	6.64
CV	6.35	8.21	3.54	5.29
CD (5%)	1.81	0.57	0.09	0.59

Fruit length was not significantly different from diameter, average fruit weight, and flesh thickness. Fruit length was 15.47-22.07 cm, fruit diameter was 3.42-4.64 cm, fruit weight was 166.78-325.80 g, and flesh thickness was 1.28-1.87 cm (Table 2). Both BRGCU-10 × BRCU-1 (22.07 cm) and BRGCU-10 × BRPCU-8 (21.34 cm) had longer fruits. A hybrid of BRGCU-10 and BRCU-1 (4.64 cm) has the largest fruit diameter (Table 2). On average, Punjab Naveen BRCU-1 (325.80 g) has the largest fruit followed by BRPCU-8 ×BRCU-1 (261.68 g). 1 hybrid Punjab Naveen BRCU-1 (1.90 cm), followed by BRGCU-10 × BRCU-1 (1.87 cm). Fruit morphology-based features directly affect fruit output. Thus, focusing on these traits in the

selection programme would optimise marketable production. In this investigation, 18 F1 hybrids had longer fruits, 5 had maximum fruit diameter, 19 had average fruit weight, and 11 had maximum flesh thickness over the checks Don and Malini. To maximise marketable yield, Golabadi et al. (2012), Kumar et al. (2013), and Pal et al. (2017) evaluated genetic variation in cucumber fruits.

Table 3. Mean performance of the parents, hybrids and standard checks in *zaid* season for yield and yield attributing characters

Characters	*Zaid* season			
Hybrids	Number of harvests	Average fruit weight (g)	Yield per plant (kg)	Fruit yield (q ha^{-1})
BRGCU-4 × BRPCU-8	5.67	181.40	1.18	140.11
BRGCU-4 × BRGCU-10	6.11	180.73	1.10	140.72
BRGCU-4 × Pb. Naveen	9.33	208.81	1.56	200.46
BRGCU-4 × BRCU-1	9.21	229.66	1.60	207.71
BRPCU-8 × BRGCU-4	6.67	205.72	1.47	189.20
BRPCU-8 × BRGCU-10	6.33	166.78	1.30	167.93
BRPCU-8 × Pb. Naveen	6.67	209.89	1.44	174.07
BRPCU-8 × BRCU-1	9.33	261.68	1.68	217.25
BRGCU-10 × BRGCU-4	5.78	183.63	1.35	173.76
BRGCU-10 × BRPCU-8	6.33	227.11	1.43	179.90
BRGCU-10 × Pb. Naveen	9.33	206.58	1.32	156.66
BRGCU-10 × BRCU-1	9.67	226.87	1.81	236.47
Pb. Naveen × BRGCU-4	9.33	213.16	1.34	167.16
Pb. Naveen × BRPCU-8	9.03	222.19	1.56	203.00
Pb. Naveen × BRGCU-10	10.06	181.19	1.46	186.35
Pb. Naveen × BRCU-1	10.02	325.80	1.42	179.21
BRCU-1 × BRGCU-4	6.61	225.08	1.30	162.27
BRCU-1 × BRPCU-8	10.07	222.58	1.66	214.23
BRCU-1 × BRGCU-10	10.23	212.07	1.75	228.22
BRCU-1 × Pb. Naveen	10.07	247.91	1.40	177.03
Range	5.67-10.23	166.78-325.80	1.10-1.81	140.11-236.47
Parents				
BRGCU-4	5.53	174.09	1.16	144.47
BRPCU-8	7.63	182.07	1.27	160.85
BRGCU-10	5.67	185.32	1.47	188.38
Pb. Naveen	7.67	240.95	1.47	189.53
BRCU-1	8.33	239.48	1.48	194.05
Range	5.53-8.33	174.09-240.95	1.16-1.48	144.47-194.05
Standard checks				
Don (Check 1)	8.00	172.25	1.28	161.68
Malini (Check 2)	7.33	190.99	1.31	165.50
CV	12.93	6.58	5.24	6.12
CD (5%)	1.69	22.77	0.12	18.22

Fruit yield (q ha-1) and yield per plant (kg) were significantly different, although fruits per plant were not. The mean yield per plant of F1 hybrids was 1.10-1.81 kg, with 4.31-8.36 fruits per plant, 5.67-10.23 harvests, and 140.11-236.47 (q ha-1) fruit yield (Table 3). The hybrid BRGCU-10 BRCU-1 (1.81 kg) had the highest fruit output per plant (Table 3). (1.75

kg). Similarly, hybrid BRCU-1 BRGCU-10 (8.36) had more fruits per plant (Table 3).

The most harvests were from BRCU-1 x BRGCU-10 (10.23), followed by Punjab Naveen (7.67) and BRCU-1 x BRGCU-10 (Table 3). (10.07). Fruit output was highest for hybrid BRGCU-10 BRCU-1 (236.47 q ha-1), followed by BRGCU-10 BRCU-1 (228.22 q/ha). Characters with higher yield contribute directly to the ultimate yield and so get paid more. In analysing cucumber germplasm, Praneetha et al. (2020), Veena et al. (2012), and Ranjan et al. (2015) found that yield attributing characteristics contributed to an increase in overall yield.

CONCLUSION

The research findings have improved our understanding of gynoecious cucumber hybrid performance. Monoecious crosses improved growth and fruit morphology, while gynoecious crosses improved earliness and yield-related parameters. For fruit morphological traits and yield, the current study indicated that hybrid BRPCU-8 BRGCU-4 was the earliest to fruit in the zaid season, whereas hybrid BRCU-10 BRCU-1 was superior for vegetative development traits. Overall, the BRGCU-10/BRCU-1 hybrid genotype was the safest. Thus, superior genotypes can be used in cucumber development and cucumber hybridization programmes to improve cucumbers.

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