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Original Research Article

Evaluation of pigeonpea genotypes for pod setting and synchronization

P.M.Khake, A.B.Bagade* and A.B.Jadhav

Department of Agricultural Botany, College of Agriculture,
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani – 431 402, Maharashtra, India
**Corresponding author*

A B S T R A C T

The present investigation was carried out in pigeonpea by using 79 F_1s, 24 male parents, 3 female lines, 3 male lines and one check to study per cent pod setting and synchronization in parental lines. Per cent pod setting ranged from 18.7 to 59.1 per cent with an average value of 38.9 per cent. The highest pod setting was observed in ICPA 2078 x MAL 13 (59.1 per cent) followed by ICPA 2078 x BWR 133 (53.2 per cent). The synchronization between male and female lines was studied on the basis of seed yield per plant. The seed yield per plant was found maximum when male parents were sown ten days later to female parents in crosses ICPA 2043 x ICPR 2671 (96.60 g) and ICPA 2047 x ICPR 2740 (118.45 g) and fifteen days late in a cross ICPA 2092 x ICPR 3762 (108.30 g). This increase in seed yield was due to better synchronization of flowering in parents which resulted in increased pod setting.

Keywords

Pigeonpea hybrids, Male-sterility, Per cent pod setting, Synchronization

Introduction

The main objective of breeding pigeonpea in past was to develop varieties having high production potential. In spite of release of over 100 good varieties, yield level did not increase significantly (Saxena, 2006). Perhaps the other reason for low yield of pigeonpea was susceptibility to diseases and pod borer complex. Although, India produces 2.4 million tons of pigeonpea, the per capita availability of pigeonpea is gradually declining (Saxena, 2005) and one of the main reason for this is widening of demand and supply gap due to mismatch in the growth of human population and production of protein rich pulses. In order to maintain self-sufficiency in pulses production for the ever-increasing population, a proportionate increase in their production is essential. In this endeavour, the use of hybrid pigeonpea technology has potential.

However, in order to increase productivity of pigeonpea, exploitation of hybrid vigour by using male sterility is the solution. In India, efforts have been made by different research institutes to develop hybrids and those have been evaluated on farmers' fields. However, there is a need to make basic studies in hybrids, because hybrids have been developed by using male sterility, which is developed by using wild sources. As this is new technology to improve the yield potential, many aspects of this hybrid technology are not studied such as, the nature of pod setting, yield and yield contributing characters, synchronization of parental lines in hybrids. Taking this in account, the present investigation was carried out to study pod setting in pigeonpea hybrids and synchronization of parental lines.

Materials and Methods

The experimental material consisted of 79 F_1s, 24 male parents, 3 female lines, 3 male lines and one check. The experiment was conducted in a randomized block design with two replications on the experimental farm of Department of Agricultural Botany, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif* season of 2011. The pod setting study was carried out by using 79 F_1s, along with their 24 male parents and one check. Seeds of each entry were hand dibbled by keeping 90 cm as row to row spacing and 30 cm as plant to plant spacing. The recommended package of practices was followed to raise a good crop. In each plot, five competitive plants were identified randomly for recording data on days to flower and maturity, plant height (cm), number of primary branches per plant, number of secondary branches per plant, number of pods per plant, seeds per pod, 100 seed weight (g) per cent pod setting and seed yield per plant (g).

The synchronization in parental lines of pigeonpea was studied by using three female lines i.e. ICPA 2043, ICPA 2047 and ICPA 2092, with three male lines i.e. ICPR 2671, ICPR 2740 and ICPR 3762, respectively.

Before starting the experiment, preparatory tillage on the experimental field was carried out. The female parents were sown on 9th July 2011. Seeds of male parents were sown in four staggered dates *viz.*, sowing of male parents' seeds five days later to female parent, ten days later to female parent, fifteen days later to female parent and simultaneous sowing of both parents. The female to male ratio of 4:3 was kept to assure optimum pollens during the pollination. Female and male parent seeds were hand dibbled in different treatments following a spacing of 90 cm between rows and 30 cm between plants within a row. Two seeds were sown in each hill to ensure optimum plant density. A fertilizer dose of 25:50:00 NPK Kg/ha was applied at the time of sowing. Only one vigorous seedling was kept at each hill by giving thinning 15 days after sowing. Hand weeding was carried out 30 days after sowing. The rouging operation was carried out time to time to remove off types and weed plants in male and female lines.

The genotypes were kept in open environment to facilitate natural cross pollination. After complete maturity in female lines five plants were selected randomly. The seed yield per plant was recorded and average seed yield per plant were estimated in each staggered combinations.

The data recorded on pod setting study as well as synchronization study were subjected to statistical analysis according to model proposed by Panse and Sukhatme (1985).

Results and Discussion

Analysis of variance showed significant differences for all the characters. This indicated the existence of sufficient variation for effective selection for these characters in the material under study. The results of analysis of variation for pod setting study and seed yields of staggered sowings are presented in the Table 1 and 2, respectively.

Per cent pod setting

The results of present investigations shows variation for per cent pod setting in all the genotypes under study (Table 4). The per cent pod setting was ranged from 18.7 to 59.1 per cent with an average value of 38.9 per cent. The highest pod setting was observed in ICPA 2078 x MAL 13 (59.1 per cent) followed by ICPA 2078 x BWR 133 (53.2 per cent). Lower pod setting was recorded in Phule T-03-142 (18.7 per cent) followed by ICPA 2043 x HPL 24-63 (19.4 per cent). Togun and Tayo (1990) studied number of pods developed from total number of flowers produced on a plant. They reported different per cent of pod setting in two different genotypes of pigeonpea. Onim (1981) also studied per cent pod setting in pigeonpea genotypes.

Yield and yield contributing characters

Earliness to days to 50 per cent flowering was observed in ICPA 2078 x MAL 13 (111 days) followed by ICPA 2047 x MA 6 (112.5 days). The genotype ICPA 2047 x ICPR 3407 (271.5 cm) recorded maximum plant height among all the genotypes followed by ICPA 2043 x BSMR 571. Hundred seed weight was found the highest in ICPA 2078 x BWR 134 (13.45 g). While the highest seed yield per plant was recorded by ICPA 2078 x MAL 13 (251.85 g) followed by ICPA 2078 x HPL 24-63 (177.45 g). These results were in close agreement with earlier results reported by Joshi*et al.* (2006) and Baskaran and Muthiah (2007) (Table 4).

Synchronization in parental lines

The synchronization in parental lines was observed maximum when male parent were sown late to female parents by ten days (ICPA 2043 x ICPR 2671and ICPA 2047 x ICPR 2740) and fifteen days (ICPA 2092 x ICPR 3762) (Table 3).

In a cross ICPA 2092 x ICPR 3762 seed yield per plant was recorded maximum when male parent was sown fifteen days late to female parent (108.30 g) followed by a cross in which male parent was sown ten days late to female parent (96.40 g). The minimum seed yield per plant was observed when male and female parents were sown simultaneously (76.40 g).

Maximum seed yield per plant was recorded in a cross ICPA 2047 x ICPR 2740 when male parent was sown ten days later to female parent (118.45 g), followed by a cross in which male parent was sown five days late to female parent (112.55 g). The minimum seed yield per plant was noted when male parent was sown simultaneously with female parent (97.55g).

In a cross ICPA 2043 x ICPR 2671maximum seed yield per plant was recorded when male parent was sown ten days late to female parent (96.60 g) followed by a cross in which male parent was sown fifteen days late to female parent (88.65 g). Lower seed yield per plant was recorded when male parent was sown simultaneously with female parent (71.45 g).

The increase in seed yield was due to better synchronization of flowering resulted in increased pod set. The seed yield per plant was found minimum in all crosses under study when both parents were sown simultaneously.

Table.1 Analysis of variance for yield and yield contributing characters in pigeonpea

Source of variation	d.f.	Days to 50 % flowering	Days to maturity	Plant height (cm)	Primary branches	Secondary branches	No. of pods	Seeds per pod	Test weight (g)	Per cent pod setting	Hard seed %	Yield (g)
1	2	3	4	5	6	7	8	9	10	11	12	13
Replications	1	3.7	7.6	54.4	21.4	0.2	57.1	0.1	2.3	137.4	0.7	271.6
Treatments	103	52.9**	59**	1382.1**	33.1**	166.4**	13106**	0.1	1.8**	131.1**	1.05	1879.5**
Error	103	0.6	0.4	18.2	17.7	7	39.8	0.01	0.1	21.6	0.1	16.1

* and ** indicates significance at 5 and 1 per cent level, respectively.

Table.2 Analysis of variance for seed yield per plant of staggered sowings in pigeonpea genotypes

Source of variation	d.f.	Seed yield per plant		
		ICPA 2092 x ICPR 3763	ICPA 2047 x ICPR 2740	ICPA 2043 x ICPR 2671
1	2	3	4	5
Replication	1	0.0049	0.031	25.92
Treatments	3	387.9**	155.11**	222.7**
Error	3	14.4	21.9	12.32

* and ** indicates significance at 5 and 1 per cent level, respectively.

Table.3 Mean performance of crosses for seed yield per plant with staggered sowings of male parent

Sr. No.	Cross	Yield per plant	Cross	Yield per plant	Cross	Yield per plant
1	ICPA 2029 x ICPR 3762 (9/07/2012) (9/07/2012)	76.40	ICPA 2029 x ICPR 3762 (9/07/2012) (9/07/2012)	97.55	ICPA 2029 x ICPR 3762 (9/07/2012) (9/07/2012)	71.45
2	ICPA 2029 x ICPR 3762 (9/07/2012) (14/07/2012)	84.60	ICPA 2029 x ICPR 3762 (9/07/2012) (14/07/2012)	112.55	ICPA 2029 x ICPR 3762 (9/07/2012) (14/07/2012)	8.340
3	ICPA 2029 x ICPR 3762 (9/07/2012) (19/07/2012)	96.40	ICPA 2029 x ICPR 3762 (9/07/2012) (19/07/2012)	118.45	ICPA 2029 x ICPR 3762 (9/07/2012) (19/07/2012)	96.60
4	ICPA 2029 x ICPR 3762 (9/07/2012) (24/07/2012)	108.30	ICPA 2029 x ICPR 3762 (9/07/2012) (24/07/2012)	110.30	ICPA 2029 x ICPR 3762 (9/07/2012) (24/07/2012)	88.65
	Mean	91.40	Mean	109.70	Mean	85.00
	S.E.±	2.6	S.E.±	3.3	S.E.±	2.5
	C.D. at 5%	12	C.D. at 5%	14.8	C.D. at 5%	11.3

Table.4 Mean performance of selected genotypes for yield and yield contributing characters in pigeonpea

Sr. No.	Name of genotypes	Days to 50 % flowering	Days to maturity	Plant height (cm)	No. of pods per plant	No. of seeds per plant	100 seed weight (g)	Per cent pod setting	Yield per plant (g)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1.	MAL 13	127.0	181.5	207.6	368.0	3.60	10.05	34.1	135.05
2.	ICP 8858	124.0	172.0	199.1	343.5	3.20	11.15	38.2	113.95
3.	Phule T 00-4-11-6-2	121.0	169.5	196.3	273.0	3.75	10.40	30.2	105.55
4.	BWR 24	118.5	169.0	197.6	356.5	3.70	10.50	38.4	135.80
5.	BDN 2004-1	129.0	178.5	188.9	237.0	3.90	10.80	21.3	92.95
6.	ICP 12320	140.5	193.0	212.9	320.0	3.60	8.80	34.0	120.65
7.	BWR 134	125.0	173.5	218.9	299.0	3.25	9.75	33.7	96.70
8.	HPL 24-63	122.5	167.0	196.5	281.0	3.50	9.25	34.5	99.45
9.	ICPR 3407	136.0	189.0	195.6	323.5	3.65	11.50	38.4	121.55
10.	ICPB 2047	122.0	171.0	212.8	469.0	3.15	11.00	49.0	158.80
11.	WRP 1	121.5	171.0	216.3	372.0	3.60	10.25	40.4	135.45
12.	BSMR 571	119.0	167.0	199.9	297.5	4.00	10.90	33.8	123.60
13.	Phule T-04-3-1	120.5	173.0	172.7	297.0	3.60	13.35	26.3	115.35
14.	BWR 87	119.0	169.0	184.2	355.5	3.35	10.05	40.4	119.40
15.	ICPH 2740	114.5	163.0	196.6	403.0	3.55	12.05	48.4	168.65
16.	ICPH 2671	116.0	164.0	190.2	287.5	3.60	11.45	34.4	106.40
17.	ICPA 2078 x ICPR 10934	121.0	169.5	185.4	327.5	3.20	11.85	38.5	103.35
18.	ICPA 2078 x MAL 13	111.0	161.0	167.7	640.5	3.85	13.15	59.2	251.85
19.	ICPA 2078 x BDN 2004-1	120.0	173.5	191.3	399.0	3.55	12.35	46.4	154.15
20.	ICPA 2078 x Phule T-04-3-1	118.5	170.0	181.0	301.0	3.70	12.65	36.4	114.30
21.	ICPA 2078 x WRP 1	117.0	171.0	205.7	256.0	3.60	12.25	24.7	95.95
22.	ICPA 2078 x HPL 24-63	124.0	172.5	225.8	497.5	3.65	11.85	52.1	177.45
23.	ICPA 2078 x ICPR 3407	115.0	165.5	180.6	271.0	3.60	12.35	27.3	97.75
24.	ICPA 2078 x ICP 8878	121.0	168.5	216.8	255.5	3.70	12.35	30.7	98.15

25.	ICPA 2078 x ARECV 2	120.0	174.0	252.6	317.5	3.50	12.25	33.5	115.40
26.	ICPA 2078 x BWR 133	125.5	175.5	200.7	489.5	3.30	12.40	53.3	169.50
27.	ICPA 2078 x BWR 134	122.0	178.0	247.1	315.5	2.95	13.45	34.3	102.95
28.	ICPA 2078 x Phule T-03-142	121.0	175.5	201.7	280.0	3.45	13.15	30.5	93.65
29.	ICPA 2078 x MA 6	121.5	173.0	247.0	397.0	3.30	12.50	40.2	153.05
30.	ICPA 2078 x BWR 301	118.0	170.5	221.3	333.5	3.90	12.95	36.4	130.05
31.	ICPA 2078 x BWR 87	120.0	172.0	239.8	328.5	3.45	12.70	34.2	111.90
32.	ICPA 2078 x BWR 254	122.5	170.0	252.9	430.0	3.55	12.05	41.5	161.00
33.	ICPA 2078 x BSMR 571	128.0	177.0	219.6	319.0	3.50	11.75	35.9	105.80
34.	ICPA 2078 x BWR 153	119.0	170.0	215.3	335.5	3.20	10.90	35.2	107.40
35.	ICPA 2043 x Phule T-04-3-1	122.0	172.5	202.8	310.5	3.50	11.85	33.4	106.25
36.	ICPA 2043 x BWR 133	119.0	170.0	201.0	288.5	3.45	10.80	32.6	103.30
37.	ICPA 2043 x ICP 8858	117.5	168.0	214.4	415.5	3.65	11.85	46.4	153.95
38.	ICPA 2043 x BWR 301	116.0	169.5	205.2	310.0	3.10	11.55	36.1	100.45
39.	ICPA 2043 x WRP 1	118.0	171.5	217.7	267.0	3.55	10.90	28.2	96.65
40.	ICPA 2043 x BDN 2010	118.5	171.0	207.2	403.5	4.05	11.10	42.5	164.50
41.	ICPA 2043 x MAL 13	117.0	169.5	242.5	264.0	3.35	11.25	29.3	90.85
42.	ICPA 2043 x BSMR 571	121.0	172.0	214.3	266.5	3.90	10.75	28.4	107.75
43.	ICPA 2043 x Phule T-03-142	118.0	172.5	229.9	266.5	3.60	11.75	29.4	102.95
44.	ICPA 2043 x BWR 87	116.0	168.0	251.8	377.5	3.60	10.60	40.2	138.05
45.	ICPA 2047 x BWR 133	120.5	174.0	210.9	261.0	3.70	11.75	30.3	100.20
46.	ICPA 2047 x Phule T-04-3-1	116.0	172.0	209.2	249.5	4.00	12.10	28.2	103.60
47.	ICPA 2047 x BWR 24	115.0	172.5	198.8	276.5	3.30	10.40	31.4	98.90
48.	ICPA 2047 x BWR 87	116.0	173.5	219.6	234.0	3.95	10.75	27.3	95.80
49.	ICPA 2047 x BWR 254	120.0	174.0	242.8	245.0	3.55	10.40	26.9	92.85
50.	ICPA 2047 x ICPR 10934	114.5	169.5	243.9	242.5	3.45	10.20	24.2	91.70
51.	ICPA 2047 x WRP 1	114.0	166.5	251.4	247.0	3.60	10.65	28.2	90.20
52.	ICPA 2047 x MA 6	112.5	167.0	242.5	226.0	3.45	11.35	26.9	77.80
53.	ICPA 2047 x Phule T-03-142	117.0	172.5	246.8	238.5	3.40	11.75	25.3	90.00
54.	ICPA 2047 x BSMR 571	113.0	177.0	269.4	253.5	3.85	11.75	27.9	90.70
55.	ICPA 2047 x BWR 301	113.0	175.5	268.9	246.5	3.35	11.70	28.3	90.80
56.	ICPA 2047 x ICPR 3407	121.0	175.5	271.5	252.0	3.60	12.00	28.3	91.70

57.	ICPA 2092 x BDN 2010	116.0	167.0	180.8	321.5	3.60	11.50	33.4	116.60
58.	ICPA 2092 x ICP 8858	115.0	162.5	202.3	253.0	3.50	10.45	24.6	91.30
59.	ICPA 2092 x Phule T-04-3-1	115.0	171.0	234.2	268.5	3.15	10.65	32.6	90.70
60.	ICPA 2092 x MAL 13	119.0	174.0	202.8	298.0	3.70	9.95	34.3	115.20
61.	ICPA 2092 x BWR 153	115.0	175.0	189.2	292.5	3.85	11.75	33.3	115.00
62.	ICPA 2092 x BDN 2004-1	121.0	178.0	194.2	254.5	3.50	10.35	29.4	92.60
63.	ICPA 2092 x ICPR 10934	115.0	174.0	210.9	382.5	3.50	10.25	40.3	135.05
64.	ICPA 2092 x BWR 301	116.0	176.5	213.2	244.0	3.50	10.35	23.3	89.80
65.	ICPA 2092 x BWR 134	115.5	177.5	213.5	336.5	3.95	10.60	38.2	136.20
66.	ICPA 2092 x MAL 6	116.0	165.5	213.6	319.0	3.40	10.50	26.3	111.75
67.	ICPA 2092 x BWR 74	116.5	166.0	236.8	264.5	3.35	10.90	29.3	89.90
68.	ICPA 2092 x BSMR 571	115.5	167.0	204.8	355.0	3.65	10.15	38.2	131.50
69.	ICPA 2092 x BWR 24	116.5	167.0	255.5	396.5	3.80	11.25	42.3	149.20
70.	ICPA 2092 x ICPR 3407	117.0	170.0	231.7	357.5	3.60	11.55	39.2	131.20
	G. Mean	119.5	172	209.7	283.1	3.50	11.20	30.9	103.60
	S.E. ±	0.5	0.4	3	4.4	0.07	0.2	3.2	2.8
	C.D. at 5 %	1.5	1.3	8.3	12.3	0.2	0.6	9.1	7.8

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