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Short Communication

Induced Genetic Variation for Different Characters Following Hybridization and Mutagenesis in Cowpea

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Variability is the basic prerequisite in any crop improvement program. Variability can be created either by hybridization or by induced mutations. Hybridization is very often used for creation of variability. However, mutations have also been shown to increase useful variation in many crops. It can be used to improve productivity and its component traits. The combination of hybridization and mutations has been shown to release more variability (Onkarsingh and Paroda, 1986; Swamy, 1986). In cowpea, relative advantage of combination of hybridization and irradiation for increasing variability in number of clusters per plant and number of pods per plant has been reported (Virupakshappa *et al.*, 1980). However, the approach needs to be applied very carefully on selected crop combinations for better results.

The evaluation of about 200 germplasm lines of cowpea revealed the superiority of C-11 and C-70 in respect of pod length, number of pods per plant and boldness, thus acting as a source for creation of different plant types. C-152 is a local adopted variety, but lacks in some of the desirable features that are present in C-11 and C-70. Therefore, it was planned to attempt hybridization with C-152 as base and C-11 and C-70 as the sources of different specific features. The resulting F_2 population and F_2M_2 populations were evaluated for different productivity parameters.

Half of the F_1 seeds of two single crosses (C-152 x C-11 and C-152 x C-70) and C-152 were irradiated with gamma radiation at 25 kR to raise F_2M_1 and M_1 populations and later these populations along with the remnant F_1 seeds were selfed to raise F_2 populations. The field experiment was conducted during kharif 2000. The F_2, F_2M_2 and M_2 populations were sown in 3 rows of 8 m length each. The rows and plants were spaced at 45 and 10 cm, respectively. Observations were recorded on number of clusters per plant, pod length, number of seeds per pod and seed yield per plant. The data were used to adjudge superior germplasm over the standard check variety in positive direction for quantitative traits. The simple correlation coefficients between yield and yield components were estimated as per the standard procedure.

A comparison of different characters between the F_2, M_2 and F_2M_2 populations indicated (Table 1) relatively higher in mean value case of irradiated hybrids of single crosses for number of cluster per plant, number of pods per plant and seed yield

Table 1. Mean, range and variance of different yield compoents in the F_2, M_2 and $F2M_2$ populations of cowpea

Population		Clusters/ plant	Pods/ plant	Pod length (cm)	Seeds/ pod	Seed yield (g plant^{-1})
C-152	Mean	11.57	18.68	12.58	11.29	9.82
M_2	Range	4-26	7-47	9-17.2	7-15.8	6.2-35.7
	Variance	23.69	84.13	1.54	3.45	42.42
	CV	42.07	49.10	9.86	16.45	66.32
C-152 x C-11	Mean	11.37	15.64	13.16	12.89	14.45
F_2	Range	2-29	6-36	10.8-15	5.5-15.6	4.6-32.8
	Variance	21.54	40.10	0.78	2.99	30.24
	CV	40.82	40.48	6.71	13.41	38.05
	% increase over M_2	-2.97	-17.55	-31.94	-18.48	-42.62
C-152 x C-11	Mean	13.18	22.54	13.40	11.46	17.14
F_2M_2	Range	5-60	7-74	9-17.4	7.2-14.8	4.3-62.6
	Variance	41.83	11.92	1.94	4.24	93.98
	CV	49.07	48.43	10.39	17.96	56.55
	% increase over F_2	20.21	19.63	54.84	33.92	48.62
	% increase over M_2	16.63	-1.36	5.37	9.17	-14.73
C-152 x C-70	Mean	12.39	19.85	13.21	12.50	13.07
F_2	Range	7-27	6-76	11.4-16	9-17.8	3.5-48.3
	Variance	22.35	109.76	1.31	2.51	55.52
	CV	38.16	52.77	8.66	12.67	57.00
	% increase over M_2	-9.29	7.47	-12.17	-22.97	-14.05
C-152 x C-70	Mean	11.37	19.84	13.61	10.76	14.36
F_2M_2	Range	5-42	8-114	9.2-18.4	5.8-15.6	4-90.3
	Variance	23.45	133.84	2.90	4.56	74.41
	CV	42.59	58.31	12.51	19.84	60.07
	% increase over F_2	11.60	10.49	7.99	56.59	5.38
	% increase over M_2	1.23	18.75	26.87	20.60	-9.42

per plant. This shows that irradiation of hybrids has shifted the mean values towards positive side. Such shifts have been reported by Swamy (1986). For other characters viz., pod length and number of seeds per pod, such a shift over the hybridized populations was not observed. Similar findings in cowpea were also reported by Virupakshappa *et al.* (1980).

For most of the characters except number of seeds per pod, the range of variations induced by mutation was wider than hybridized populations. The variations were high for all the characters except number of pods per plant in M_2 and F_2M_2 populations. Thus, in general mutation of heterozygous genotypes produced more variability than hybridization alone for several characters. Two sources of variability were cumulative and the amount of variability due to segregation was enhanced by the mutation-induced variation. Similar findings

Table 2. Simple correlation coefficients between yield and yield components in cowpea

Characters	C-152 M_2	C-152 x C-11 F_2	C-152 x C-11 F_2M_2	C-152 x C-70 F_2	C-152 x C-70 F_2M_2
Seed yield vs.					
Plant height	0.163*	0.015	0.205**	0.056	0.170
Number of clusters	0.652**	0.601**	0.507**	0.816**	0.643**
Number of pods	0.723**	0.737**	0.569**	0.884**	0.690**
Pod length	0.259**	0.290**	0.164**	0.497**	0.263**
Seeds per pod	0.120	0.042	0.047	0.167	o.097
Test weight	0.625**	0.028	0.279**	0.313**	0.313**
Plant height vs.					
Number of clusters	0.242**	0.049	0.209**	0.118	0.191**
Number of pods	0.319**	0.029	0.228**	0.191	0.185**
Pod length	o.166*	0.150	0.146*	0.035	0.133
Seeds per pod	0.024	0.137	0.007	0.221	0.014
Test weight	0.104	0.034	0.128	0.294**	0.134
Number of clustcrs vs.					
Number of pods	0.884**	0.708**	0.880**	0.866**	0.875**
Pod length	-0.0004	0.125	0.179*	0.350**	0.080
Seeds per pod	-0.040	0.130	-0.018	0.0001	-0.062
Test weight	0.413**	0.013	0.013	0.214**	0.182
Number of pods vs.					
Pod length	0.029	0.141	0.115	0.393**	0.059
Seeds per pod	-0.065	0.246	-0.119	-0.061	-0.125
Test weight	0.422**	0.014	0.254**	0.316**	0.187**
Pod length vs.					
Seeds per pod	0.422	0.551**	0.477**	0.357**	0.405**
Test weight	0.127	0.058	0.289**	0.142	0.388**
Seeds per pod vs.					
Test weight	0.062	-0.007	-0.092	-0.023	-0.065

** Significant at 1% level.

were also reported by Swamy (1986) in sesame.

The coefficient of variability decreased in F_2 of C-152 x C-11 compared to C-152 M_2 population for all the quantitative characters. The increased variability was observed for all the characters in F_2M_2 compared to the F_2 populations, while for number of pods per plant and seed yield per plant the variability, decreased compared

to the C-152 M_2 population. In C-152 x C-70 F_2 population, the variability decreased for all the characters except for number of pods per plant compared to C-152 M_2. The variability increased for all the characters in the F_2M_2 population of C-152 x C-70 compared to F_2 population of the same cross. The F_2M_2 of the same cross showed increased variability for all the characters over C-152 M_2 population except for seed yield. The increased variability in M_2 may be attributed to induction of mutation in some of the polygenes governing these characters. An increased genetic variability in the F_2M_2's over F_2's was recorded for all the traits in two crosses. Thus, hybridization followed with irradiation was the best in producing wider and greater variability for yield and its component traits.

Number of pods per plant, number of cluster per plant and pod length showed positive and significant association with seed yield in all the populations (Table 2). Test weight had significant positive association in most of the populations except in C-152 x C-11 F_2. The plant height was associated positively with seed yield in two populations i.e., in C-152 M_2 and C-152 x C-11 F_2M_2. Non-significant association between number of seeds per pod and seed yield was observed in all the populations. Biradar *et al.* (1996) reported that yield was associated with number of cluster per plant, pod weight, number of pods per plant, pod length and number of seeds per pod.

The correlation coefficient among yield components revealed that plant height had positive significant association with number of pods per plant and number of cluster per plant in three populations, while with pod length in two populations and with test weight in one population. The number of clusters had positive significant association with number of pods per plant and test weight in almost all the populations. This was supported by the earlier findings of Gowda (1996). Thus it may be concluded that the selection based on number of clusters per pod, number of pods per plant and pod length would be appropriate for yield improvement in cowpea.

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