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Blackgram Co. 4 - An Economic Strain for Tamil Nadu

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Through induced mutagenesis in blackgram (*Vigna mungo* (L.) Happer) a high yielding mutant suitable for cultivation under irrigated and rainfed conditions was released as an improved strain Co. 4 during January 1978 by the Tamil Nadu Agricultural University. This strain is of short duration (70 days), compact, erect in habit determinata in growth with synchronous maturity and photoinsensitive. The strain gives an average grain yield of 1142 kg and 567 kg per hectare accounting for an increase of 17.8 per cent and 31.6 per cent over Co. 2 in grain yield under irrigated and rainfed conditions respectively.

Blackgram or Urad (*Vigna mungo* (L.) Happer) is mostly grown as a mixed crop subsidiary to cotton, maize, sorghum, banana and sugarcane. It is also cultivated as a pure crop under irrigated and rainfed conditions especially in rice fallows. In Tamil Nadu, this crop is grown in an area of 1.6 lakh hectares with the production of 0.43 lakh tonnes of grains. The traditional varieties grown are of long duration (110-120 days) with spreading and indeterminate growth habit often forming tendrils. The reconstruction of the plant type requires a reduction in the maturity period, determinate and compact plant canopy. So, a project for evolving an early maturing high yielding variety with altered plant architecture through mutation breeding, was taken up during 1972-1977 and the results are presented herein.

MATERIAL AND METHODS

The blackgram variety CO.1 is a pure line selection of long duration (110 days), indeterminate in growth habit with tendril forming tendency and having large sized leaves and hairy pods. It has a very low yield potential viz., 356 kg/ha and its performance is also erratic under rainfed conditions. Dry seeds of blackgram CO.1 were soaked in double distilled water for ten hours and then subjected to mutagenic treatment with six doses(0.01, 0.02, 0.03, 0.04 and 0.06 per cent) of MMS (Methyl methane sulphonate) and their progenies were studied).In the M2 generation, at 0.02 per cent concentration of MMS treatment, one mutant (designated as Mutant 3) having determinate compact and erect growth habit and with glabrous pods was isolated. It was early in maturity(70 days). In M3, this mutant bred true for the mutated traits. Mutant 3 was compared for its yielding ability against CO. 2 (65 days duration, irrigated strain) and CO.3 (85 days duration, rainfed strain) during 1973 to 1977 at the Agricultural Research Station, Coimbatore, Bhavanisagar

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and Aliyarnagar, under irrigated and rainfed conditions. Simultaneously 44 trials under irrigated conditions and 15 trials under rainfed conditions were conducted in cultivators' holdings in different districts of Tamil Nadu. Reaction of Mutant 3 to diseases was assessed under field conditions.

RESULTS AND DISCUSSION

The comparative performance of Mutant 3 along with the recommended varieties viz. CO.2 and CO.3 for eight seasons each under irrigated and rainfed conditions during 1973-1977 is presented in Table I. This culture was superior

TABLE I. Performance of Mutant 3 at Research Stations (1973-77)

Year/Season	Location	Yield/ha							
		Irrigated				Rainfed			
		Mutant 3	Co. 2	Co. 3	Mean	Mutant 3	Co. 2	Co. 3	Mean
Monsoon, 1973	Coimbatore	731	649	794	725	—	—	—	—
Winter, 1973	Coimbatore	1455	1255	1454	1388	763	613	500	626
Winter, 1973	Bhavanisagar	—	—	—	—	321	285	—	303
Monsoon, 1974	Coimbatore	1256	1238	1563	1352	—	—	—	—
Winter, 1974	Bhavanisagar	—	—	—	—	711	400	750	620
Winter, 1974	Aliyarnagar	—	—	—	—	397	198	412	336
Monsoon, 1975	Coimbatore	861	838	934	878	—	—	—	—
Winter, 1975	Bhavanisagar	—	—	—	—	525	282	596	468
Winter, 1975	Aliyarnagar	—	—	—	—	770	730	905	802
Winter, 1975	Coimbatore	792	720	735	749	181	186	191	186
Summer, 1976	Coimbatore	1347	1003	1219	1189	—	—	—	—
Monsoon, 1976	Coimbatore	1387	993	1245	1208	870	455	905	743
Summer, 1977	Coimbatore	1311	877	1029	1072	—	—	—	—
Total		9140	7573	8973		4538	3149	4259	
Mean		1142	947	1121		567	394	608	
Per cent on Co. 2		120.6	100.0	118.4		143.9	100.0	154.3	
Per cent on Co. 3		102.0	84.5	100.0		93.3	64 8	100.0	
Duration (in days)		70	65	85		70	65	85	
Per day productivity (kg/ha)		16.3	14.6	13.2		8.1	6.1	7.2	
		Varieties		Locations		Varieties		Locations	
S.E.		38 2		62.4		42.7		65.3	
C.D. (5%)		115.9		189.3		131.7		201.2	

TABLE II. Mean performance of Mutant 3 at Research Stations and Farmers' holdings

	Yield kg/ha						
	Irrigated			Rainfed			
	No. of trials	Mutant 3	Co. 2	Co. 3	No. of trials	Mutant 3	Co. 2	Co. 3
Research Stations	8	1142	947	1121	8	567	394	608
Farmers' holdings	44	950	828	876	15	717	581	685
Total	52	2092	1775	1997	23	1284	975	1293
Mean		1046	888	999		642	488	647
Per cent on Co. 2		117.8	100.0	112.5		131.6	100.0	132.6
Per cent on Co. 3		104.7	88.9	100.0		99.2	75.4	100.0

to other varieties recording on an average grain yield of 1142 kg/ha and 567 kg/ha under irrigated and rainfed conditions respectively. The yield increase over CO.2 was 20.6 per cent under irrigated condition and 43.9 per cent under rainfed condition.

The mean performance of Mutant 3 in farmers' fields and in the yield trials conducted at the research stations are presented in Table II. A scrutiny of the overall comparative performance of this mutant in 52 trials under irrigated conditions and in 23 trials under rainfed conditions revealed that this culture has recorded the maximum mean grain yield of 1046 kg/ha and 642 kg/ha as compared to the mean yield of 888 kg/ha and 488 kg/ha of CO.2 thereby accounting for an increase of 17.8 per cent and 31.6 per cent over CO.2 under irrigated and rainfed conditions respectively. As compared to CO.3, a medium duration (85 days) rainfed strain, Mutant 3 has recorded more or less similar yield but of shorter duration (70 days).

TABLE III. Metric traits and other morphological characters of Mutant 3, Co. 2 and Co. 3

Particulars	Mutant 3	Co. 2	Co. 3
Plant height (cm)	30	25	55
Number of branches/plant	3.9	2.5	3.7
Clusters/Plant	11.8	9.5	9.5
Pods/plant	62	43	46
Seeds/pod	6.7	5.3	6.5
Pod length (cm)	5.7	4.7	5.5
100 grain weight (g)	5.7	5.2	5.5
Hairiness of pod	Glabrous	Glabrous	Hairy
Grain colour	Black dull	Black dull	Black dull
Grain size	Bold	Small	Bold

The comparative morphological features (Table III) showed that while CO.2 is glabrous podded with black dull small seeds, Mutant 3 is also glabrous with black dull bold seeds. Variety CO.3 is hairy podded with black dull bold seeds. Mutant 3 exhibited relatively higher values than CO.1 and CO.3 in respect of number of branches, clusters and pods per plant, pod length, seeds per pod and hundred grain weight.

The hundred grain weight is the highest (5.7 g) in Mutant 3 and lowest (5.2 g) in CO.1. The per day productivity of this mutant is 14.9 kg/ha and 9.2 kg/ha as compared to 13.7 kg/ha and 7.5 kg/ha recorded by CO.2 and 11.8 kg/ha and 7.6 kg/ha recorded by CO.3, under irrigated and rain-fed conditions respectively.

Mutant 3 is tolerant to leaf crinkle virus (1.0 per cent), tip blight (10 per cent) and powdery mildew (20 per cent) under field conditions (Table IV). In respect of root rot, though it is highly susceptible (40 per cent) the degree of susceptiblity was lower than that of CO.2 and CO.3. With regard to pests also this culture is less susceptible to stemfly and pod borer.

TABLE IV. Reaction of Mutant 3 to diseases

Diseases	Reaction to disease (Percentage)		
	Mutant 3	Co. 2	Co. 3
Root rot	40 (HS)	88 (HS)	80 (HS)
Tip blight	10 (T)	10 (T)	5 (T)
Crinkle (Virus)	1 (T)	2 (T)	25 (S)
Powdery mildew	20 (T)	25 (T)	50 (T)

(HS) : Highly susceptible
(S) : Susceptible
(T) : Tolerant

The plants of Mutant 3 are erect, compact determinate in growth habit with synchronous maturity and photo-insensitivity while the parental variety CO.1 is tall (70 cm), indeterminate and photo-sensitive. The economics of cultivation of Mutant 3 as compared to CO.2 and CO.3 are presented in Table V. The cultivation of Mutant 3 in place of CO.2 is estimated to yield over CO.2 an additional net profit of Rs. 395 per hectare under irrigated condition and Rs. 385 per hectare under rainfed condition. The cost benefit ratio is 1 : 2.0 and 1 : 2.1 for Mutant 3 whereas for Co. 2 it is 1 : 1.7 and 1 : 1.6 under irrigated and rainfed conditions respectively. Based on the superior performance and high yield of grain under irrigated and rainfed condition, Mutant 3 was released as strain Co. 4 during January 1978 by the Tamil Nadu Agricultural University, for general cultivation in Tamil Nadu.

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TABLE V. Economics of cultivation of Mutant 3

Characters	Irrigated			Rainfed		
	Mutant 3	Co. 2	Co. 3	Mutant 3	Co. 2	Co. 3
Yield of grain(kg/ha)	1046	888	999	642	488	647
Cost of grain at Rs. 2.50/kg(Rs/ha)	2615	2220	2948	1605	1220	1618
Cost of cultivation (Rs/ha)	1365	1365	1365	755	755	755
Net profit (Rs/ha)	1250	855	1133	850	465	863
Net Addl. return over Co. 2 (Rs/ha)	395	—	278	385	—	398
Cost benefit ratio	1 : 2.0	1 : 1.7	1 : 1.9	1 : 2.1	1 : 1.6	1 : 2.