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## PHYSIOLOGY OF PARENTS AND HYBRID BLACKGRAM FOLLOWING GAMMA IRRADIATION

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### ABSTRACT

Gamma rays induced high rate in blackgram photosynthesis and total chlorophyll content in parents and F<sub>1</sub> hybrid. Chlorophyll a and b was maximum in hybrid followed by Vamban 1 and Co 5. The ratio of chlorophyll a/b, showed a positive trend during mutagenesis, however declined at higher doses. In both parents and hybrid, the rate of respiration gradually increased, while flagging subsequently.

**KEY WORDS :** Gamma rays, photosynthesis, chlorophyll, respiration, blackgram

In blackgram (*Vigna mungo* (L.) Hepper), like any other species, the gene complexes of parents produce considerable variability in hybrid (Ahmed John, 1995 a and 1997), and subjecting the heterozygous material to mutagenic treatment can further enhance the variability. The potential physical mutagen like gamma rays caused severe breakdown of the genetic system (Ahmed John, 1995b) and induce physiological variations in crop plants. Such investigations help to unravel the sequency and the interrelation of changes (Ahmed John, 1995c). So far no work has been made on the comparative physiology of blackgram following gamma irradiation. Accordingly the present investigation undertaken to analyse the physiology of parents and their F<sub>1</sub> hybrid of blackgram following gamma irradiation.

### MATERIALS AND METHODS

Conventional hybridization using the method of rapid hand pollination were adopted for producing the hybrid seeds. The crossing was effected using the variety Co 5 as ovule parent and Vamban 1 as pollen parent. The dry seeds of blackgram parents Co 5, Vamban 1 and their F<sub>1</sub> hybrid (Co 5 x Vamban 1) were treated with 30, 40 and 50 krad of gamma irradiation at the School of

Genetics, Tamil Nadu Agricultural University, Coimbatore, in a 60 Co gamma source. Five samples of 250 seeds were taken for each treatment and control. The irradiated seeds were sown in the field along with control in five replications laid out in factorial randomized block design. The experiment was conducted at 40 days old blackgram plants. The data were gathered from five replications and were analysed (Panse and Sukhatme, 1967). The photosynthesis and respiration (Umbreit et al. 1965), and chlorophyll content (Arnon, 1949) were studied with reference to gamma irradiation in parents and their F<sub>1</sub> hybrid of blackgram.

### RESULTS AND DISCUSSION

Photosynthesis controls the gas exchange and water balance in between the plant leaves and environment. The photosynthetic rate was found to increase during gamma irradiation, which is presented in Table 1. The maximum increase of 15.22 per cent in hybrid was recorded at 40 krad, however the level slightly decreased in both parents and hybrid at 50 krad of gamma irradiation. There are reports about the increase of photosynthesis with final decrease in rice (Ahmed John, 1996). Photosynthetic increase is correlated with the

**Table 1.** Changes in photosynthesis, total chlorophyll content and respiration in blackgram following gamma irradiation.

Gamma rays (Krad)	Photosynthesis ( $\mu\text{l}$ of $\text{O}_2$ evolved/hr/g of dry leaf tissue)			Total chlorophyll (mg of chlorophyll/g of dry leaf tissue)			Respiration ( $\mu\text{l}$ of $\text{CO}_2$ evolved/hr/g of dry leaf tissue)		
	Co 5	Vamban 1	Hybrid	Co 5	Vamban 1	Hybrid	Co 5	Vamban 1	Hybrid
0	1876.5	1885.3	1921.2	2.28	2.15	2.73	946.3	991.6	1019.7
30	1892.3	1948.1	2101.4	2.57	2.93	3.23	983.8	1012.4	1072.3
	+0.84	+3.33	+9.38	+12.72	+36.28	+18.32	+3.93	+2.10	+5.16
40	1989.4	1997.4	2213.6	2.85	3.18	3.71	1048.2	1121.3	1146.1
	+0.06	+5.95	+15.22	+25.00	+47.91	+35.90	+10.77	+13.08	+12.40
50	1628.8	1754.6	1893.9	1.83	1.89	2.14	910.4	946.8	997.4
	-13.20	-6.93	-1.42	-19.74	-12.09	-21.61	-3.79	-4.52	-2.19

increase in chlorophyll content. The reason for appearance of higher amount may be due to involvement of polygenes. The rate of photosynthesis declined at higher doses of gamma irradiation. Decrease in photosynthesis is usually correlated with chlorophyll loss at the later stages of irradiation. Photosynthetic activity was maximum in hybrid followed by Vamban 1 and Co 5. Similar findings were made by Ahmed John (1996) in rice.

The present work showed that the total chlorophyll content markedly increased with doses of gamma rays. The total chlorophyll content increased in both parents and hybrid at 30 and 40 krad however subsequently declined at 50 krad of gamma rays. The maximum of 47.91 per cent chlorophyll content was decreased in Vamban 1 followed by hybrid and Co 5. With the increase of dose the higher amount of reduction was found in Co 5. The decrease may be attributed to the low synthesis (Ahmed John, 1996) or destruction of chlorophyll by gamma rays.

The chlorophyll concentration is taken as an indication of irradiation. In the present study there was a significant increase in chlorophyll a and b content during mutagenesis (Table 2). The chlorophyll a and b was higher in hybrid followed

by parents. The chlorophyll content of 79.07 per cent in Vamban 1 and 27.27 percent in hybrid was recorded at 40 krad of gamma rays, for chlorophyll a and b, respectively.

Chlorophyll mutation showed a proportionate increase with doses of gamma rays in both parents and hybrid (Ahmed John, 1995 b). The chlorophyll a/b ratio also increased to a maximum at middle doses of gamma rays. The ratio was maximum of 40.30 per cent in Vamban 1 followed by hybrid (15.58%) and Co 5 (14.70%). The chlorophyll a and b ratio widened due to age (Ahmed John, 1996).

Respiration occupies a vital part of metabolism which provides energy to support cellular processes. The energy from respiratory metabolism is used by the host to carry on its responsive reaction against irradiation. The rate of respiration gradually increased but decreased at 50 krad of gamma rays. In the mutagenic plants, the respiratory rate was higher than the control. Such respiratory increase was reported in rice by Ahmed John (1996). The changes represented mainly an increase in the transformation of carbohydrates by the direct oxidative pathway. A wide variety of plant species by mutagenesis exert a general reaction ; which is expressed as an increase of respiratory rate, which

**Table 2.** Changes in chlorophyll a, b and a/b ratio in blackgram following gamma irradiation.

Gamma rays (Krad)	Chlorophyll a (mg of chlorophyll/g of dry leaf tissue)			Chlorophyll b (mg of chlorophyll/g of dry leaf tissue)			Chlorophyll a/b ratio (mg of chlorophyll/g of dry leaf tissue)		
	Co 5	Vamban 1	Hybrid	Co 5	Vamban 1	Hybrid	Co 5	Vamban 1	Hybrid
0	0.92	0.86	1.19	1.36	1.29	1.54	0.68	0.67	0.77
30	1.13	1.35	1.48	1.44	1.58	1.75	0.78	0.85	0.85
	+22.83	+56.98	+24.37	+5.88	+22.48	+13.64	+14.70	+26.97	+10.35
40	1.24	1.54	1.75	1.61	1.64	1.96	0.77	0.94	0.89
	+34.78	+79.07	+47.06	+18.38	+27.13	+27.27	+13.24	+40.30	+15.58
50	0.71	0.63	0.91	1.12	1.26	1.23	0.63	0.50	0.74
	-22.83	-26.74	-22.53	-17.65	-2.33	-20.13	-7.35	-25.37	-3.90

seems to be one of the most important phenomenon in the physiology of irradiated crop plants. The respiratory increase in the irradiated plants due to (i) uncoupling of oxidative phosphorylation and (ii) synthetic process stimulated. In these instances the consumption of ATP lead in synthetic processes and the resultant increase in ADP lead to the higher rate of respiration. The rate of respiration was more in parents as compared to F<sub>1</sub> hybrid.

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## EFFECT OF SURGE IRRIGATION ON YIELD ATTRIBUTES, YIELD AND ECONOMICS OF SUNFLOWER (CO-2)

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#### ABSTRACT

Experiments were conducted at Tamil Nadu Agricultural University, Coimbatore to study the effect of surge irrigation on yield attributes, yield and economics of sunflower (Co-2) in summer and monsoon seasons of 1996. The crop was grown in double row planting. No significant difference was observed between surge and continuous irrigation. Considering amendments, coconut fibre waste application (with additional dose of NPK) significantly increased yield attributes and yield as compared to FYM application. Among the sectors, sector I recorded higher values which was comparable with Sector II and IV. Sector III significantly different from other sectors in first crop. In second crop Sector-I was comparable with sector II and IV and again Sector IV was comparable with sector III. The higher net returns with high benefit cost ratio was observed in surge irrigation as compared to continuous irrigation. Also coconut fibre waste applied plots recorded increased yield.

**KEY WORDS :** Surge irrigation, sunflower, yield attributes, yield, economics

#### INTRODUCTION

Sunflower is an important vegetable oil source noted for its poly unsaturated fattyacids. Irrigation is the single largest factor contributing to the success of sunflower crop.

Among the surface irrigation methods surge irrigation is the possible alternative for basin furrow due to its effectiveness in land use through lengthy furrow, delivery of water into the furrow, water economy and reduced labour requirement for irrigation. Ease of operation for the worker through reducing the burden of irrigation work yet another advantage. There is also scope to reduce the cost of operation after formation of ridges.

Surge irrigation is the delivery of water into the furrow in an ON/OFF fashion relatively over the short span of time and involving lesser opportunity time for water front advance due to the formation of surface sealing after displacement, migration and reorientation of clay particles.

#### MATERIALS AND METHODS

The experiments were conducted at Tamil Nadu Agricultural University, Coimbatore during summer and monsoon season of 1996 to study the effect of surge irrigation in 100 m furrows with a surge cycle ratio of 0.5 (10 minutes ON and 10 minutes OFF timings) in sunflower Co-2.