Int.J.Curr.Microbiol.App.Sci (2018) Special Issue-6: 766-771

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Special Issue-6 pp. 766-771**
Journal homepage: http://www.ijcmas.com

Original Research Article

Induced Mutagenesis in *rabi* Sorghum

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Keywords

Sorghum, Gamma rays, EMS and Mutation

A B S T R A C T

Sorghum cultivar 'Parbhani Moti' was used to induce mutation by gamma rays and EMS. The experimental material comprised of 8 different mutagenic treatments treated with different doses of gamma rays and EMS viz., T1 (10kR), T2 (20kR), T3 (30kR) were gamma rays treatments and T4 (0.1%), T5 (0.2%), T6 (0.3%) and T7 (0.4%) were EMS treatments and T8 (10kR + 0.1% EMS) of sorghum cultivar ' Parbhani Moti' with two control treatments viz., T9 (wet control) and T10 (dry control). The treatments T1, T4 and T8 were recorded superior as compared to control treatments over days to panicle initiation, days to maturity, plant height, earhead length, number of grains per primary, grain yield per plant, 100 seed weight and harvest index.

Introduction

Sorghum [*Sorghum bicolor* (L.) Moench] is an important cereal crop in India popularly known as 'Jowar' and large size of among other grain millets is called 'Great millet'. In India it ranks third, next to wheat and rice and most important food crop grown under rainfed condition. Mutation breeding has a milestone in crop improvement programme. The main advantage of mutation breeding is that basic genotype of the variety is usually slightly changed, while the improved characters are added. Mutation breeding has been useful in introducing traits *viz.*, short stature, earliness and resistance to certain diseases in an otherwise well adapted varieties without significantly altering their basic genotype (Sigurbjornsson and Micke, 1969).

Hence in present investigation efforts have been made to induce mutation in rabi sorghum cultivar and test their performance for different agronomical traits.

Materials and Methods

Eight different mutagenic treatments of Parbhani Moti viz., T1 (10kR), T2 (20kR), T3 (30kR) were gamma rays treatments and T4 (0.1%), T5 (0.2%), T6 (0.3%) and T7 (0.4%) were EMS treatments and T8 (10kR + 0.1% EMS) obtained from B.A.R.C. Trombay, Mumbai, along with two control treatments viz., T9 (dry control) and T10 (wet control) were sown in *Randomized Block Design* with 3 replications, at spacing of 15 cm within plants and 45 cm between plants in M_2 at the field of Sorghum Research Station, VNMKV Parbhani during *rabi* 2016. The observations were taken on selected 10 plants from each treatment. The treatments along with checks were studied

for different thirteen yield and its attributing traits *viz.*, initial plant count, days to panicle initiation, days to 50 % flowering, days to maturity, plant height (cm), earhead length (cm), number of primaries per panicle, number of seeds per primary, fodder yield per plant (g), total biomass content (g), 100 seed weight (g), harvest index and grain yield per plant (g).

Results and Discussion

Mean performance of mutagenic treatments along with their checks for different thirteen yield and its attributing traits is presented in Table 2.

Among gamma rays treated treatments, the treatment T1 showed highest plant count of 299.33 and among EMS treated treatments the treatment T4 recorded highest initial plant count 295.33. Among all the mutagenic treatments the treatment T1 exhibited highest plant count. The mean values for initial plant count was decreases with increase in dose level of gamma rays and EMS. Same results were reported by Ambavane *et al*., (2015) in finger millet, Cheema and Atta (2003) in rice and Talebi and Talebi (2012) in rice. The gamma rays treatment T1 (65) was found earlier while the EMS treatment T4 (67) was found earlier in days to panicle initiation among the treatments treated with gamma rays and EMS but among all the treatments, the treatment T8 (59.66) was found the earliest for days to panicle initiation.

For days to 50% flowering treatment T8 (64) found earliest followed by T4 (77.67). The gradual increase in the dose level of gamma ray and EMS leads to delay in days to 50% flowering. Similar results were reported by Gnanamurthy *et al*., (2012) in corn, Pavadai and Dhanavel (2004) in soybean and Girija (2008) in cow pea. For days to maturity treatment T8 (120) was found the earliest among all followed by T1 (126) and T4 (127). The lowest mean value for plant height was found in treatment T4 (183.3) followed by T6 (189.53) and T5 (205.53). EMS treated treatments had lowest mean value for plant height. Similar results were reported by Khawar *et al*., (2010) in maize and wheat, Irfaq and Nawab (2001) in wheat and Rizwana Banu *et al*., (2005) in cow pea. The highest mean value for earhead length was found in treatment T1 (16.3) and T4 (15.76) while lowest mean value for earhead length was found in T3 (15.03) and T6 (15.23) among Gamma rays and EMS respectively. A gradual decrease in earhead length was observed in response to increase in doses of mutagens. Similar results were found by Irfaq and Nawab (2003) in bread wheat. For number of primaries per panicle treatment T4 (56.9) was recorded highest mean value for number of primaries per panicle among all mutagenic treatments. The treatment T8 (39.7) gave the highest performance for number of seeds per primary followed by treatments T4 (39.3) and T1 (38.2) among all the treatments and over the both checks.

For grain yield per plant T1 (59.3) exhibited highest grain yield per plant among gamma rays treatments while T4 (59.3) was found highest among the EMS treatments. Among all the treatments, treatment of combination T8 recorded for grain yield per plant (66). There was increase in yield from plants of mutagen treated seeds. Same results were reported by Rahimi and Bahrani (2011) in wheat. For 100 seed weight treatment T4 (3.91) found for highest mean value across all the mutagenic treatments and over both checks. Mean values for trait 100 seed weight in all M_2 progenies of 'Parbhani Moti' were higher than control. Similar results were reported by Anand and Kajidoni (2014) in sorghum.

Table.1 Uniformity coefficient under different operating pressures

Sr. No.	Treatments	Initial plant count	Days to panicle initiation	Days to 50% flowering	Days to maturity	Plant height (cm)	Earhead length (cm)	Number of primaries per panicle
1	**T1 (10kR)**	299.333	65	78.3333	126	217.1667	16.3	51.4
2	**T2 (20kR)**	296.6667	67	79.6667	127.6667	215.1667	16.1333	51.1667
3	**T3 (30kR)**	285.3333	68.6667	80.6667	128.3333	205.7333	15.0333	47.8333
4	**T4 (0.1% EMS)**	295.3333	67	77.6667	127	183.3	15.7667	56.9
5	**T5 (0.2% EMS)**	288.3333	68	78.3333	128	203.5333	15.6	53.1333
6	**T6 (0.3% EMS)**	284.6667	68.3333	79.6667	128.6667	189.5333	15.2333	48.88
7	**T7 (0.4% EMS)**	282	68.6667	80.6667	129	211.7	15.3	50.3
8	**T8 (10kR + 0.1% EMS)**	297.6667	59.6667	64	120	215.2667	14.4	48.2333
9	**T9 (wet control)**	254.6667	70	80.3333	128	223	14.7667	54.2333
10	**T10 (dry control)**	254	70.6667	79.3333	129	221.7667	13.4333	48.1333
	G. Mean	283.80	66.8	77.966	127.1667	208.6167	15.1967	51.0133
	S.E. ±	1.594	0.5294	1.0983	0.5698	3.4702	0.2639	0.784
	C.D. 5%	4.7348	1.5729	3.2631	1.693	10.3106	0.7839	2.3294

Sr. No.	Treatments	Number of seeds per primary	Grain yield per plant (g)	100 seed weight (g)	Fodder yield per plants (g)	Total biomass content (g)	Harvest index (%)
1	**T1 (10kR)**	38.2	59.3	3.79	208.5033	183.2233	31.6967
2	**T2 (20kR)**	36.7	55.3	3.73	228.5067	196.15	19.7567
3	**T3 (30kR)**	33.3	42.2333	3.607	209.2167	306.94	15.93
4	**T4 (0.1% EMS)**	39.3	59.3	3.9133	191.8567	259.2867	28.68
5	**T5 (0.2% EMS)**	33.3	52.2	3.85	217.9433	206.8933	25.4
6	**T6 (0.3% EMS)**	32	50.5667	3.7533	242.9233	218.52	22.5833
7	**T7 (0.4% EMS)**	27.7	47.6	3.7367	211.5	244.8967	21.4933
8	**T8 (10kR + 0.1% EMS)**	39.7	66	3.7733	247.7333	218.1	30.8167
9	**T9 (wet control)**	38	37.2667	3.04	223.07	222.4233	18.0133
10	**T10 (dry control)**	36.3333	36.9667	3.1467	212.2067	216.8133	20.5233
	G. Mean	35.4533	50.6733	3.634	219.346	277.3246	23.4893
	S.E. ±	1.3542	1.876	0.0712	8.9064	2.014	1.1807
	C.D. 5%	4.0234	5.574	0.2114	26.4626	5.984	3.5081

For fodder yield per treatment T8 (247.73) showed highest performance among all the treatments and checks. The treatments T_3 (306.94), T_4 (259.28), T_6 (218.52), T_7 (244.89) and T_8 (218.1) gave better performance for total biomass content over the control treatments T_9 (222.42) and T_{10} (216.81). While the treatments T_1 (31.69), T_2 (19.75), T_4 (28.68), T_5 (25.4), T_6 (22.58), T_7 (21.49) and T_8 (30.81) showed high value for harvest index over the both control treatments T_9 (18.01) and T_{10} (20.52).

Mutagenic treatments T1, T4 and T8 were recorded superior across all the treatments and as compared to control treatments over days to panicle initiation, days to maturity, plant height, earhead length, number of grains per primary, grain yield per plant,100 seed weight and harvest index. Hence the mutagens from these treatments need to evaluate further for multilocation and Mutants with various desirable characters can be used for future breeding programmes.

References

Ambavane A.R., Sawardekar S.V., Sawantdesai S.A. and N.B. Gokhale N.B. 2015. Studies on mutagenic effectiveness and efficiency of gamma rays and its effect on quantitative traits in finger millet (*Eleusine coracana* L. Gaertn). *Journal of Radiation Research and Applied Sciences*, 8: 120-125.

Anand Y. and S.T. Kajidoni, S.T. 2014. Genetic enhancement of grain size and other productivity related traits through induced variability in *kharif* Sorghum. *Karnataka Jr. Agric. Sci.* 27(2): 121-124.

Cheema, A. and Atta, B.M.. 2003. Radiosensitivity studies in basmati rice. *Pak. J. Bot.* 35(2): 197-207.

Girija, M. 2008. Studies on induced mutagenesis in cow pea (*Vigna unguiculata* (L.) Walp) M. Phil. Thesis, Annamalai university, Annamalainagar, Tamil Nadu.

Gnanamurthy S., Dhanavel D., Girija M., Pavadai P and Bharathi T. 2012. Effect of chemical mutagenesis on quantitative traits of maize (*Zea mays* (L.). *International Journal of Research in Botany*, 2(4): 34-36.

Irfaq, M. and Nawab, K. 2001. Effect of gamma irradiation on some morphological characteristics of three wheat (*Triticum aestivum* L.) Cultivars. *Journal of Bolological Sciences*, 1(10): 935-937.

Irfaq Muhammad and Khalid Nawab. 2003. A study to determine the proper dose of gamma radiation for including beneficial genetic variability in bread wheat (*Triticum aestivum* L.). *Asian Journal of Plant Sciences*, 2(13): 999-1003.

Khawar, A., I.A. Bhatti, Q.M. Khan, H.N. Bhatti and Sheikh, M.A. 2010. A Germination Test: an easy approach to know the irradiation history of seeds. *Pak. J. Agric. Sci.*, 47(3): 279-285.

Pavadai, P. and Dhanvel, D. 2004. Effect of EMS, DES and colchicines treatments in soybean. *Crop Res*., 28(1-3): 118-120.

Rahimi, M.M. and Bahrani, A. 2011. Influence of gamma irradiation on some physiological characteristics and grain protein in wheat (*Triticum aestivum* L.). *World Applied Sciences*, 15(5): 654-659.

Rizwana Banu, M., A. Kalamani, S. Ashok and N. Makesh. 2005. Effect of mutagenic treatments on quantitative characters in M_1 generation of cow pea (*Vigna unguiculata* (L.) Walp). *Ad Plant Sci.*, 18(II): 505-510.

Sigurbjornsson, B. and Micke, A. 1969. Progress in mutation breeding induced

mutation in plants. Proc. Symp. Pullman, Washington, 1969. FAO/IAEA, Vienna. 673-698.

Talebi, A.B. and Talebi, A.B. 2012. Radiosensitivity study for identifying the lethal dose in MR219 (*Oryza sativa* L.spp. Indica Cv. MR219). *International Journal of Agricultural Science, Research and Technology*, 2(2), 64-67.