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Effect of Gamma Irradiation on Some Morphological Characters of Three Wheat Varieties

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Abstract

The effect of gamma irradiation (0, 15, 25, 35 and 45 kR) was studied on three varieties of wheat viz; Pak-81, LU-26 and SS-5. Significant differences were observed due to varieties and different doses of gamma irradiation. A trend of reduction was observed in seedling emergence percentage and plant height in response to doses. Significant reduction in seedling emergence percentage (79%) and plant height (19.9%) were observed due to 45kR as compared to control. On application of various doses, the parameters of days taken to earing started, days taken to earing completion, number of tillers, number of leaves per plant and spike length increased gradually as compared to control.

Introduction

Wheat (*Triticum aestivum* L.) is the most important crop both in regard to its antiquity and its use as a source of human food. Wheat serve as a staple food in as many as 43 countries of the world including Pakistan. It provides about 20 per cent of the total food calories for the human race. Today is the period of food security. Twenty first century can be truly called as the century of food. Food security is very essential for survival in the 21st century. Any country can be sound only if it is self sufficient in food. Therefore, we should not leave any stone unturned to increase the productivity of wheat.

Mutation breeding is an important tool for creating genetic variability in the available breeding stock. Mutation can be easily induced by application of various radiation like alpha, beta and gamma. Useful mutations have been manipulated in various crops by the application of gamma radiation. For increasing productivity new cultivars need to be developed which are high yielding, insect resistant. Therefore various doses of gamma radiation should be tested to develop useful mutants. These useful mutants can be utilized for developing high yielding varieties.

Materials and Methods

To observe the effect of various doses of gamma rays on some important genetic parameters of wheat (*Triticum aestivum* L.) varieties, a field experiment was conducted in the experimental area of Department of Plant Breeding and Genetics, Gomal University, Dera Ismail Khan. The genetic material comprised of three varieties of wheat viz., Pak-81, LU-26 and SS-5. The effect of different doses of gamma radiation were studied in M1 on some morphological characters of wheat. The seeds of the above mentioned varieties were radiated in NIFA, Tarnab, Peshawar. The doses were 0, 15, 25, 35, and 45 kR in gamma research unit from cobalt 60. The different morphological effects of various doses of gamma rays on M1 generation were studied. The design of the experiment was split plot with three replications. The experimental plot size was kept at 8.3m x 11m. A basal dose of 55-28-0 Kg per hectare NPK was applied. The irradiated seed along with control was sown on November 14. The experiment was irrigated at suitable intervals in such a manner that the crop did not experience with water stress. The data regarding the seedling emergence percentage, days to earing started, days taken to earing completion, plant height, number of tiller per plant, and number of leaves per plant were recorded in M1 generation.

The above collected data for each character were averaged and subjected to statistical manipulation as outlined by Steel and Torrie, 1980 for all the level of significance among various M1, generation. When a significant F-ratio was obtained, Duncan's New Multiple Range Test was applied by comparison among the treatment means

Results and Discussion

It is evident from the results that different doses of gamma radiation induced variations in almost all morphological characters under study. All varieties responded differentially to various gamma radiation doses. Higher doses exerted inhibitory effects on most of the characters. Mean values for some of the characters like days to earing started, days taken to earing completion, number of tillers and number of leaves per plant were increased. This differential response of wheat varieties is in great agreement with the earlier research findings of Ahmad (1985), Lin *et al.* (1993), Wang *et al.* (1995), Tulmann *et al.* (1996) and Petrovic (1997).

Seedling emergence percentage: The data regarding the seedling emergence percentage showed that the differences in the mean values due to radiation doses and interaction between varieties and doses were highly significant, whereas varietal differences were not significant. Range of mean values for radiation doses was 15.75 to 75.5. The lower doses of 15 kR did not reduce the seedling emergence percentage significantly from control, however significant reduction was recorded due to higher doses of 25, 35 and 45 kR. A maximum reduction in seedling emergence percentage (79.14%) was due to 45 kR dose. This sort of information had already been reported by Singh

Table 1: Effect of gamma radiation on different morphological characters in wheat varieties

Radiation Doses (Krad)	Seedling emergence	Days to earing started	Day taken to earing completion	Plant height (cm)	Tiller per plant	Leafs per plant
0	75.50a	89.88a	98.66a	93.85a	6.77a	34.62ab
15	73.91a	89.33a	99.33ab	93.97a	5.80b	29.00b
25	58.25b	90.44a	99.99a	91.51a	7.47a	37.00a
35	37.83c	91.33a	101.88c	90.37a	7.67a	37.72a
45	15.75d	94.66b	105.77d	75.16b	8.29a	38.22a

Mean sharing the common letters do not differ significantly from each other. Small letters indicate significance at 1 per cent probability level and capital letter indicate significance at 5 per cent.
Note: Mean values of three varieties are give for different doses of Krad.

et al. (1978), Hasan *et al.* (1982), Hasan (1986) and Sadiq (1986) and li *et al.* (1994).

Days to earing started: From the analysis of variance it was observed that the differences in the mean values due to the doses of gamma rays and varieties were highly significant, whereas the interaction was non-significant. The values recorded for various radiation doses were ranging from 89.33 to 94.66 days. A maximum increase of 5.32 per cent was observed due to 45 kR as compared with control. Delay in earing was recorded in all the doses. However, the time taken to earing started was increased in all the varieties under study but maximum delay in time taken to earing started was observed in Pak-81. These observations are in conformation with those already expressed by Ganguli and Bahaduri (1980), Sadiq (1986) and Wang *et al.* (1995).

Days taken to earing completion: The data regarding the total days taken to earing completion revealed that the differences in mean values due to varieties, doses and interaction were highly significant. It was noted that the variety Pak-81 had taken more days for earing completion in comparison with LU-26 and SS-5. By comparing the mean values of various doses with one another, it was found that days taken to earing completion were increased as the intensity of the doses was increased. The values computed for various doses ranged from 98.66 to 105.77 days. A maximum increase of 7.2% days was found due to 45kR dose as compared to control. It was also found that days taken to earing completion were significantly increased by higher doses of 25, 35 and 45 kR in Pak-81, LU-26 and SS-5. These results conformed the findings of Khalil *et al.* (1986), Hasan *et al.* (1988a) and Wang *et al.* (1995).

Plant height (cm): The analysis of variance for plant height of Pak-81, LU-26 and SS-5 indicated that the differences in the mean values due to radiation doses and varieties were highly significant. The results presented in the table 4 revealed that the variety SS-5 exhibited dwarfness as compared to LU-26 and Pak-81 and the average plant height was decreased due to various doses of radiation except 15 kR dose where negligible increase was observed. The mean values for plant height due to different radiation doses ranged between 75.16 to 93.77 cm. Maximu reduction in plant height was observed due to 45 krad. Th plants showed a reduction in height corresponding to increase in the radiation doses. These findings are in clo agreement with those Khalil *et al.* (1986), Sadiq (198 Hassan *et al.* (1988 b), Pandani *et al.* (1997), Petro (1997), Tulmann *et al.* (1996) and Wang *et al.* (1995)

Tillers per plant: Abridged from analysis of variance it w revealed that differences in the mean values due to vario doses of radiation were highly significant, while varietal a interaction effects were non-significant. It is obvious fr the results in table 5 that there was increase in all doses except 15 kR dose where there was decrease number of tillers per plant. The tiller per plant ranged fr 5.80 to 8.29. The highest value was obtained due to krad dose, which was computed as 22.4 per cent comparison with the mean value of control. The increa number of tillers per plant may be attributed to low pl population in response to higher doses of radiation. Th results are in accordance with Siddiqui et al. (1978 Siddiqui *et al.* (1979), Chauhan *et al.* (1984), Sadiq (19 and Lin *et al.* (1993) who advocated that there increase due to higher doses.

Leaves per plant: The analysis of variance revealed that differences in the mean values due to doses w significant, while the differences in the mean values du varieties and interaction were non-significant. Result table 6 showed that there was an increase in the numb leaves per plant in all the doses except 15 kR dose w there was decrease in the number of leaves per plant. root of study has already been reported by Burton Powell (1966), Ibrahim and Shareen (1974), Hassan (1 and Sadiq (1986). Scant literature is available that h doses increase the leaves per plant.

Spike length (cm): The difference in the mean valu spike length due to doses were significant, whereas varieties and interaction, these were observed as significant. The range of the mean values was 9. 10.35 cm. The results (Table 7) indicated that there dose dependent increase in spike length, whereas slight decrease was observed due to 15 kR but

negligible. Spike length is an important parameter and it was increased when we increased. the doses that is by increasing the intensity of radiation, the spike length was increased. This was in close agreement with those of Mishra and Das (1977), Siddiqui *et al.* (1978a) and Siddiqui *et al.* (1979).

Reference

Ahmad, H., 1985. Genetic parameters as affected by gamma rays in maize (*Zea mays* L.) varieties. M.Sc. Thesis, University of Peshawar, pp: 90.

Burton, G.W. and J.B. Powell, 1966. Morphological and Cytological response of pearl millet to thermal neutrons and EMS seed treatments, Crop Sci., 6-180.

Chauhan, S.V.S., R. Kumar and Kinoshita, 1984. Protein and malt quality in some gamma rays induced high yielding mutant in barley *Hordeum vulgare.* J. Fac. Agri., Hokkaido University, 62: 55-60.

Gauguli, P.K. and P.N. Bahaduri, 1980 Effect of gamma rays (*Phaseolus aureus* RO and B) Genet., 34: 257-276.

Hassan, S., 1986. Gamma radiation induced variations in genetic parameters of wheat and Triticale. Sarhad. J. Agri. 173-179.

Hassan, S., I. Ali, T. Muhammad and S.A. Shah, 1988a. Effect of gamma rays and sodium azide (NaN_3) on morphological characteristics of wheat. The Nucleus, 25: 19-22.

Hassan, S., T. Muhammad and A. Jabbar, 1988b. Effect of gamma rays and sodium azide on some yield components of wheat. The Nucleus, 25: 27-29.

Hassan S., T. Muhammad and M.A. Haq, 1982. Radio-sensitivity in hexaploid wheat and triticale. J. Soc. and Tech., 6: 41-46.

Ibrahim, M.F; and A.N. shareen, 1974. Studies on certain early barley mutants in M_3 and M_4 generation after seed irradiation with gamma rays. Pl. Br. Abst., 47: 977.

Khalil, S.J., S. Rehman, K. Afridi and M.T. Jan, 1986. Damage induced by gamma radiation in morphological and chemical characteristics of barley. Sarhad J. Agri., 2: 45-54.

Pandani, F., F.I.F. Carvahlo, J.F.B. Neto and F.I.F. De Carvahlo, 1997. Plant height reduction in populations of triticale by induced mutation and artificial crosses. Brazilian J. Gen., 20: 483-488.

Petrovoic, 1997. variability of quantitative traits in wheat after gamma irradiation seeds of different age Actafvtotechnica, 52:47-54

Sadiq, M., 1986. A comparative study on morphological effects of gamma irradiation in pearl millet. Varieties, M.Sc. Thesis, N.W.F.P. Agri. Univ. Peshawar.

Siddiqui, K.A., M.A. Rajput, M.A. Arain and K.A. Jafri, 1978a. Induced variability for useful agronomic traits in bread wheat. Proceedings of 5th Int. Wheat genetics Symp., 1: 547-558.

Siddiqui, K.A., M.A Rajput and K.H. Tahir, 1979. Inter-relationships of straw architectures with grain yield of wheat mutants. Genetic Agraria, 33: 221-230.

Singh, R.B., R.M. Singh and V. Lami, 1978. Seedling injury Pollen sterility and morphological mutation induced by gamma rays and EMS in pearl millet. Indian. J. Gen. and Pl. Br., 38: 330-389.

Tulmann Neto, A; C.E de-o. Camargo,M.C. Alves, A. Pettinelli Janior, and A.W.P.

Feffeira Filho, 1996. Plant height reduction and disease resistance in wheat (*Triticum aestivum*) cultivar TAC-18 by gamma radiation induced mutations. Brazilian J. Gen., 19: 275-281.

Wang Guixne, Zhu Xiao Da, G.X Wang and X.D. Zhu 1995. Genetic effects of 137 Cs gamma rays and 60 Co gamma rays irradiation on heading date and plant height of wheat. Acta Agriculturae Nucleatae Sinica, 9: 20-24.