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Study of Days Taken to Earing Initiation and Earing Completion in M_1 Generation of Different Wheat Genotypes Irradiated with Various Doses of Gamma Radiation

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Abstract: In all wheat genotypes days to earing initiation were significantly increased due to 25 Krad, 35 Krad and 45 Krad, doses except 15 Krad dose which slightly enhanced the earing but as the doses increased to higher level, a delay in days to earing was observed. The value recorded for various doses of 15, 25, 35 and 45 Krad were ranging from 89.20 to 101.25 days showing a maximum increase of 12.45% in time taken to earing initiation due to 45 Krad dose in comparison to control. Similarly significant delay in earing completion was recorded in all the genotypes with various doses except 15 Krad with which a slight decrease was obtained in time taken to earing completion.

Key words: Wheat, induced genetic variability, genotypes

Introduction

Wheat (*Triticum aestivum L.*) often called as the king of cereals is one of the world premier crops with regard to its antiquity, acreage and importance as an international item of food.

Wheat is self-pollinated crop; the natural variation is very low in wheat crop. As such the genetic variation is required for its improvement. The genetic variation may be obtained in the available natural resources, introduction of the exotic germplasm, hybridization and induced mutations or a combination of all these methods for the improvement of this crop. Hence the plant breeders were inclined to adopt the mutation breeding for crop improvement (Eloit, 1958).

Mutation breeding has been conducted on most crops species including barely, rice peanut etc. Swedish scientists (Hagberg *et al*., 1963 and Gustafson *et al*., 1971) were very vigilant to discover the possible application of radiation for the improvement of crops. In cereals they discovered erectoid mutants in barely. The new variety so released was superior to its mother variety in some characteristics like stiffness of straw, earliness in maturity, high protein contents etc. Ranjan (1947) found that radiation induced mutation increased the baking quality and gluten content in wheat. Mackey (1954) reported some beneficial radiation induced mutation in wheat like increased straw strength, resistance to stem rust and slightly early maturity.

These encouraging results gave impetus to other plant breeders to produce varieties of plants that are capable of performing certain functions in more efficient manners than the varieties currently in existence. The plant breeders attempt to achieve this allusive objective by manipulating genetic variability into a wide array of combination of characters and then selecting those best suited to their need. Muhammad *et al*. (1984) exposed dry seed of wheat variety LU-26 to different doses of gamma rays and a number of mutants were selected.

Although, many improved and modern techniques have been developed e.g. embryo, ovule and pollen culture through tissue culture methods and even insertion of new genes into a crop species through bio technical ways, yet irradiationally induced mutations still maintain their importance. It is because that occurrence of rare types of beneficial mutants by employing this tool is a matter of chance. Moreover, irradiationally induced mutation provides additional facility to evaluate useful mutants, following irradiation with greater economic convenience. Hassan (1986) observed the effects of gamma rays on genetic parameters of wheat and triticale. He noted that 40 Krad dose caused maximum reduction in various genetic parameters of the crop. Wazir (1986) in wheat reported early flowering and short statute mutants. Wang (1993) reported that chines wheat variety when irradiated with laser beam and fast neutron, anthers of a selected early line were then treated with gamma rays, a very early maturing and dwarf variety was derived. Movy and Petrovic (1995) reported that repeated irradiation increased the variation rate in different characters of spring wheat and high dose of 10,000 R produced more variation in the X_2 than lower doses.

As gamma irradiation is an important tool to induce genetic variability for different economic characters. Therefore, the present study was design to create genetic variability in five different wheat genotypes for agro-climatic condition of D.I.Khan region to find out favorable

effects of various radiation doses on days taken to earing initiation and earing completion.

Materials and Methods

The present research project was conducted in the experimental area of Department of Plant Breeding and Genetics, Faculty of Agriculture, Gomal University, Dera Ismail Khan. The effect of different doses of gamma irradiation were studied in M_1 generation on days taken to earing initiation and earing completion of five genotypes of wheat i.e. Pak-81, Pirsabak-85, Khyber-87, Pirsabak-91 and Inqilab-91. The dry and uniform seed of each variety was subjected to gamma irradiation at rates of 15, 25, 35, 45, krad in Co^{60} gamma source at the Nuclear Institute for Food and Agriculture (NIFA), Tarnab, Peshawar. One lot of seed of each variety was kept as a control. Hence there were four irradiated seed lots and one control, totaling five treatments for each variety. The design of the experiment was split-plot with four replications. The experimental plot size was kept at 354.2 m^2. The distance between the two adjacent rows was 30 cm while the plant to plant distance with in the row 15 cm. The five genotypes were allocated at random to main plots, while four levels of gamma irradiation plus control were assigned to sub plot at random in check block. A basal dose of N.P.K. 55-28-00 kg ha^{-1} was applied. The full dose of phosphorus in the form of DAP was applied to the field before sowing, while half of the nitrogen before heading.

The land for sowing of seeds was ploughed properly. Normal agricultural practices for raising the wheat crop were applied uniformly for all the treatments. The irradiated seeds along with control were sown on November 15, 1995, to get M_1 generation. Maximum 10 plants at random were selected for each subplot for each treatment for observing the effect of radiation on Days taken to earing initiation.

Statistical Analysis: The data thus collected was subjected to analysis of statistical manipulation as outlined by Steel and Torrie (1980), for days taken to earing initiation and earning completion. While the effect of radiation doses and varietal response was compared by Duncan,s New Multiple Range Test.

Results and Discussion

Keeping in view the effect of 15, 25, 35 and 45 Krad doses of gamma irradiation on five different wheat genotypes of the above doses on days taken to earing initiation in Pak-81, Pirsabak-85, Khyber-87, Pirsabak-91 and Inqilab-91.

The difference found in the mean values due to varieties for days taken to earing initiation was highly significant. The days taken for earing initiation were 92.57, 94.80, 94.27, 96.50 and 94.40 for Pak-81, Pirsabak-85, Khyber-87, Pirsabak-91, Inqilab-91 respectively. It is clear from the Table 1 that Pirsabak-85, Khyber-87, Pirsabak-91 and Inqilab-91 were statistically at per with each other but they differed significantly from Pak-81 in time taken to earing initiation.

The effects of various doses of radiation were also found highly significant. By comparing the mean values of various doses with one another it was found that days to earing initiation significantly increased due to various doses of radiation except 15 krad dose which slightly enhanced the earing but as the doses increased to higher level, a delay in days to earing was observed. The values recorded for various doses were ranging from 89.20 to 101.25 days, showing a maximum increase of 12.45% in time taken to earing initiation due to 45 krad dose in comparison to control.

The interaction between varieties and doses were also significant and the values computed were between 87.75 to 98.75, 89.50 to 101.75, 88.25 to 101.75, 91.25 to 102.50 and 89.25 to 101.50 for Pak-81, Pirsabak-85, Khyber-87, Pirsabak-91 and Inqilab-91 respectively. It was also found that the 25, 35 and 45 krad doses had increased the earing initiation time, while the 15 krad dose had decreased the earing initiation time in Pak-81, Pirsabak-85, Khyber-87, Pirsabak-91 and Inqilab-91.

The data pertaining to earing initiation showed (Table 1) that the differences in the mean of varieties were found highly significant. Radiation doses has also highly significant effects while interaction between these two varieties was non-significant. There was significant delay in earing initiation with all the doses except 15 krad dose which had slightly stimulated the earing (floral initiation). Maximum days (101.25) to earing were recorded in plots treated with 45 krad dose. Although the time taken to earing initiation was increased in all the five varieties under study, but maximum delay in earing initiation was noted in Pirsabak-85. These results are quite in line with those of Mucci (1962), Chaudhry (1979), who also recorded variations in different parameters of the crop.

The differences in the values due to varietal effects for days taken to earing completion were highly significant. The time taken for earing completion was 99.75, 100.60, 100.00, 102.10 and 100.95 days for Pak-81, Pirsabak-85, Khyber-87, Pirsabak-91 and Inqilab-91 (Table 2). Pirsabak-91 took 2.35, 1.15, 2.1 and 1.50 more days for earing completion as compared to Pak-81, Pirsabak-85, Khyber-87 and Inqilab-91.

The effect of various doses was also found highly significant. By comparing their mean values with one another of various doses, it was noted that time taken to

Table 1: Genotypes X Dose interaction for days to earing initiation in M_1 generation of Wheat

Radiation doses (KR)	Genotypes					
	Pak-81	PS-85	Khy-87	PS-91	Inqilab-91	Average
00	88.85	90.25	88.85	92.50	89.75	90.04D
15	87.75	89.50	88.25	91.25	89.25	89.20D
25	92.50	93.75	93.75	95.75	93.25	93.80C
35	95.00	98.75	98.75	100.50	98.25	98.25B
45	98.75	101.75	101.75	102.50	101.50	101.25A
Mean:	92.57B	94.80A	94.27A	96.50A	94.40A	

Table 2: Genotypes X Dose interaction for days taken to earing completion in M_1 generation of Wheat

Radiation doses (KR)	Genotypes					
	Pak-81	PS-85	Khy-87	PS-91	Inqilab-91	Average
00	95.75	96.00	94.75	98.00	95.75	90.05D
15	94.75	95.75	94.00	97.50	95.50	95.50D
25	99.00	100.50	99.50	101.75	100.00	100.15C
35	102.75	104.00	103.75	105.00	103.50	103.80B
45	105.50	108.50	108.00	108.25	108.25	107.90A
Mean:	99.75B	100.95B	100.00B	102.10A	100.60B	

Any two means sharing same letters are not significantly different according to New Duncan's Multiple Range Test
Capital letters indicate significance at 1% probability level

earing completion increased due to various doses except 15 Krad which slightly decreased the time taken to earing completion. The value recorded for various doses were ranging from 95.50 to 107.90 days, showing an increased of 12.34% in time taken to earing completion due to 45 Krad doses as compared to control (Table 2).

The interaction between variation and doses was also significant and the values computed were between 94.75 to 105.50, 95.75 to 108.50, 94.00 to 108.00, 97.50 to 108.25 and 95.50 to 108.25 days for Pak-81, Pirsabak-85, Khyber-87, Pirsabak-91 and Inqilab-91 respectively. It was also noted that radiation dose of 15 krad had slightly decreased the earing completion time, while the doses 25, 35 and 45 krad had increased the maximum period for earing completion. It is also clear from the results (Table 2) that Prisabak-91 took more days for earing completion with regard to other varieties. These results are quite in conformity with those of Macci (1962), Chaudhry (1979) and Mansur *et al.* (1981), who also observed variations in different genetic parameters of the crop.

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