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Pleiotropic Effects of Reduced Plant Height on Yield and Its Components in Bread Wheat (*Triticum aestivum* L.)

LOKESH KUMAR GANGWAR, VIKAS, S. A. KERKHI AND POORAN CHAND

Department of Genetics & Plant Breeding, S. V. B. P University of Agriculture & Technology Meerut 250110, India
E-mail : gangwarlk@gmail.com

Abstract

Six induced reduced plant height mutants and their respective parents viz. K68, Kharchia 65 and C 306 were used in the present study. The mutants were isolated in M_2 generation from gamma rays treated population. In all the six mutants, the mutation causing reduction in plant height also altered the expression of few to all the 10 traits including the traits related to plant height, grain yield, biological yield and harvest index. It is concluded that induced mutations in plant height may cause both positive and negative pleiotropic and negative pleiotropic effect in yield and its components.
Key words : Bread wheat, Pleiotropic effect, Mutation.

Wheat (*Triticum aestivum* L.) is the second major cereal crop next to rice. The increase in both the production and productivity of wheat could be realized due to the adoption of high yielding, fertilizer responsive and lodging resistant semidwarf varieties (1). The majority of the semi-dwarf varieties grown in India carry either Rht_1 or Rht_2 dwarfing genes singly or in combination. Thus, this genetic uniformity, as in other cases, may lead to the vulnerability of semidwarf wheat's to certain biotic and abiotic stress factors. Thus, there is need to identify new sources of dwarfness so as to broaden the gene base of dwarf varieties. The use of induced mutation is one of the feasible approaches to develop new sources of dwarfness. During the past five decades research in induced mutagenesis has expanded rapidly and large number of cereal and leguminous crops have been sujected to physical and chemical mutagenic treatments and so far 2,252 mutant varieties have been developed (2). Keeping these in view the present study in six reduced plant height mutants of bread wheat was aimed to assess the pleiotropic effects of the reduced plant height on yield and other yield related traits, and also to evaluate the utility of the mutant genotypes in wheat breeding.

Methods

The selfed seed of six induced reduced plant height morphological mutants of bread wheat and their respective parents genotypes viz. K68, Kharchia 65 and C306 were used in the present study. The mutants were isolated in M_2 generation from gamma rays treated populations (3,4). The details of the name of mutants, their parents and mutagen dose used to isolate the mutants are given in Table 1. The three families each including a parent genotype and the mutants derived from the parent genotype were planted in a compact family block design with three replications at the Research Farm of Department of Agricultural Botany, Ch.Charan Singh University, Meerut. The parents and mutants were evaluated in three row plots of 2.5 m length with row to row distance of 30 cm and plant to plant distance of 15 cm within the rows. The genotypes within family were also randomized to control the soil heterogeneity. Recommended agronomic and cultural practices for the crop were followed. The observations were recorded on 11 characters of five random plants in each of the parents and their mutants.

Results and Discussion

The results partaining to the grain yield and related traits and grain protein content of the six induced reduced plant height mutants of bread wheat (*Triticum aestivum* L.) derived following gamma rays irradiation are presented in Table 2. In all the six mu-

Table 1. The name of mutants, their parents and dose of the mutagen used to induce the mutants.

	Mutants	Parent genotype	Gamma rays dose (Kr)
1.	K83-5	K68	30
2.	K93-1	K68	30
3.	K87-7	K68	30
4.	446	Kharchia 65	30
5.	525	Kharchia 65	30
6.	C168-4-2-21	C 306	30

tants the mutations causing reduction in plant height also altered the expression of few to all the 10 traits including the traits related to plant height, grain yield, biological yield and harvest index (Table 2). However, the grain protein content of all the six mutants remained unchanged. With the reduction in plant height, there was significant and negative pleiotropic effect on peduncle length in all the mutants. Four mutants, namely K93-1, K87-7, 525 and C 168-4-2-21 had significantly higher yield than their respective parent genotypes.The high yielding mutant K-93-1 showed positive pleiotropic change in tillers/plant, spike traits, biological yield and harvest index. Similarly, the mutant K87-7 had positive pleiotropic change in number of tillers/plants spike lengthen, spikelets/ spike, grains / spike and biological yield. The remaining two mutants namely 525 and C168-4-2-21 had positive pleiotropic change in number of tillers/plant (except C168-4-2-21), spike length (except 525), spikelets / spike, florets / spike grains/spike and harvest index. Parallel to present study, Mackey (5) also observed pleiotropic effects in short straw mutants. Negative

Table 2. Mean values for 11 characters of six reduced plant height mutants and their parent genotypes. *,** : Mean significantly different than that of the parent cv K68 at 5% and 1% levels, respectively. +++ : Mean significantly different than that of the parent cv Kharchia 65 at 5% and 1% levels, respectively.†,†† ; Mean significantly different than that of the parent cv C 306 at 5% and 1% levels, respectively.

Mutant no/ parent	Plant height	Peduncle length	Number of tillers/ plant	Spike length	Number of spikelets/ spike	Number of florets/ spike
K-863-5	90.57**	44.88*	12.95**	11.05**	19.60	53.95
K-93-1	84.05**	35.45**	19.40*	11.05**	21.95**	67.40*
K-87-7	104.00*	40.33**	22.95**	12.85	23.10*	62.17
K-68 (parent)	114.00	53.15	16.60	11.55	19.90	61.30
446	93.80++	44.60	15.30	8.95+	20.00++	39.50
525	85.60++	39.80+	19.80++	8.90	17.40+	52.10+
Kharchia-65 (parent)	107.52	49.87	18.77	8.65	16.50	45.87
C-168-4-2-21	67.60†	35.55	8.82 ††	13.10††	18.35†	60.57†
C-306 (parent)	75.90	37.50	12.90	7.40	18.20	52.80

Table 2. Continued.

Mutant no/ parent	Number of grains/spike	Grain yield/plant	Biological yield/plant	Harvest index (%)	Grain protein (%)
K-863-5	50.90	21.90**	91.50*	23.93*	13.20
K-93-1	63.40**	31.50*	97.50*	32.30*	12.57
K-87-1	62.65**	38.90**	122.30**	31.80	13.59
K-68 (parent)	53.10	25.42	85.30	29.80	13.33
446	38.00	19.90++	47.80++	41.63+	14.58
525	48.40+	26.25+	61.20++	42.85++	13.27
Kharchia 65 (parent)	43.57	25.25	83.20	30.32	14.63
C-168-4-2-21	59.37†	19.10†	56.75††	33.66†	11.37
C-306 (parent)	52.50	17.86	59.60	29.96	12.41

pleiotropic changes in some traits in different mutants were also noted. Therefore, it is concluded that induced mutations for plant height may cause both the positive and negative pleiotropic effects in a number of other traits. None of the six reduced plant height mutants showed significantly higher protein content than its respective parent genotype. However, four out of the six mutants, namely K93-1, K87-7, 525 and C 168-4-2-21 were significantly higher yielding than their respective parent genotypes (Table 2). These four mutants were also superior thantheir parent genotypes for several other traits. Therefore these mutants are valuable source and may be used in wheat breeding programs aimed at developing high yielding genotypes.

References

1. Athwal D. S. 1971. Semidwarf rice and wheat in global food needs. Quart. Rev. Biol. 46 : 1—34.
2. Nichterlein K., H. Bohlmann, S. Nielen and M. Maluszynski. 2000. Achievements and trends of using induced mutation in crop improvement Proc. DAEBRNS Symp. on the use of nuclear and molecular technology in crop, BARC, Mumbai, India, pp. 27—35.
3. Singh J.V. 1998. Induced mutations in common wheat (*Triticum aestivum* L.) cv K68. M.Sc. thesis, CCS Univ. Meerut, India.
4. Singh N. K. 1997. Induced mutation in bread wheat (*Triticum aestivum* L.) cv Kharchia 65. M. Sc. thesis, CCS Univ. Meerut, India.
5. Mackey J. 1954. Mutation breeding in polyploid cereals. Acta Agric. Scand. 4 : 549—557.