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EFFECTS OF THIOUREA IN M_1 GENERATION OF BREAD WHEAT (*TRITICUM AESTIVUM* L.)

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Seeds of bread wheat (*Triticum aestivum* L.) var. HUW-234 were treated with thiourea to create genetic variability for improving the yield of the crop through mutation. This showed negative effect in nearly all quantitative characters like plant height, spike length, number of spikelets per spike, hundred seeds weight and other characters. Mutagen treated plants showed reduced yield and the reported data have been discussed in the light of earlier investigations. The present study reveals the possibility to produce dwarf mutants through such type of mutation breeding.

Key Words : Bread wheat, mutagen, yield, quantitative characters, mutants.

Wheat (*Triticum aestivum* L.) is one of the staple food crop of the world and constitutes the principal food for nearly 36% of the human race. Therefore, improvement in this crop has been the major concern of plant breeders for the past several years. Several conventional approaches like introduction, selection and hybridization have been utilized in this crop in past. But these conventional approaches use either available genetic variability or the genetic variability released due to a recombination of existing alleles at the available gene loci.

However, mutations provide an opportunity to create allele, which never existed in the past, thus plant breeder does not remain helpless due to limited allelic variation at one or more loci of interest. Mutagen treatment generally induces and increases genetic variability in population. In the present study, an effort has been made to create genetic variability in bread wheat to improve the crop through mutation breeding using thiourea as mutagen. Various biological parameters were studied to find the potential of the use mutagen.

MATERIALS AND METHODS

The experimental material for the present study was comprised variety HUW-234, commonly known as Malveeya, which is late shoeing, high yielding, late maturing and well adopted to the agroclimatic conditions of India. Thiourea (NH_2CSNH_2), the sulfur analogue of urea was used as mutagen to induce genetic vaiability.

Uniform and healthy seeds of wheat variety HUW-234 were treated with freshly prepared aqueous solutions of 0.5, 1.0, 2.0, 2.5. 3.0, 2.5, 4.0, 4.5 and 5.0 percent of thiourea for 6 hours at room temperature (27+ 1°C). The treated seeds were washed thoroughly with tap water and sown in ten separate plots of 5 rows each. Control (untreated) was planted in the form of five border rows in all sides of the treated materials. For knowing the mutagenic effect of thiourea on seed germination, percent of injury and seeding growth, twenty five seeds and their seedlings (25 days old) were taken in account. Ten random plants from each plots were selected for observations for quantitative characters (eg. plant height, spike length, spikelets per spike and 100 seed weight). Suitable analysis of variance was also studied with the recorded data.

RESULTS AND DISCUSSION

Seed germination and inhibition: Mutagenic treatment delayed and reduced the germination (Table 1). The treated seeds germinated 3-4 days after germination of control seeds. The effect was pronounced at 5.0% concentration of thiourea, where seeds germinated five days after germination of control and only 60% seeds could be germinated (Table 1). The degree of inhibition was gradually increased with increasing the concentration of thiourea. Percentage of seed germination was ranged between 100 to 60%

Delayed germination and inhibition of germina-

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Table 1. Effect of thiourea on seed germination, delay in germination, survival percentage and seedings growth of bread wheat (*Triticum aestivum* L.) var. HUW-234 in M_1 generation.

Treatments (%)	% Seed germination	Delay in seed germination (days)	Survival percentage	Root Length			Shoot Length		
				Mean ± S.E. (cm)	S.D.	C.V.%	Mean ± S.E. (cm)	S.D.	C.V. %
Control	100	0	100	11.75 ± 0.24	0.78	6.71	11.24 ± 0.31	1.00	8.92
0.5	100	0	100	11.30 ± 0.32	1.04	9.23	10.56 ± 0.23	0.75	7.13
1.0	96	1	100	11.24 ± 0.31	1.00	8.92	10.37 ± 0.36	0.84	8.19
1.5	92	2	95.6	10.76 ± 0.25	0.79	7.39	9.66 ± 0.25	0.81	8.46
2.0	88	2	90	10.53 ± 0.27	0.86	8.20	9.24 ± 0.23	0.74	8.01
2.5	84	3	90	9.44 ± 0.99	0.60	6.37	8.84 ± 0.16	0.52	5.98
3.0	72	4	86.2	9.20 ± 0.15	0.49	5.36	8.14 ± 0.35	1.13	13.95
3.5	68	3	83.3	9.18 ± 0.13	0.43	4.74	7.91 ± 0.21	0.67	8.52
4.0	64	4	77.7	9.10 ± 0.13	0.43	4.81	7.07 ± 0.07	0.22	3.22
4.5	64	4	75	9.12 ± 0.28	0.90	9.87	6.20 ± 0.50	1.58	25.50
5.0	60	5	62.5	9.13 ± 0.28	0.92	10.14	5.42 ± 0.37	1.19	21.98

Table 2. Effect of thiourea on plant height, spike length, spikelets per spike and 100 seed weight of bread wheat (*Triticum aestivum* L.) var. HUW-234 in M_1 generation.

Treatment (%	Plant Height			Spike Length			Spikelets per spike	100 seeds weight (g)
	Mean ± S.E (cm)	S.D.	C.V.%	Mean ± S.E. (cm)	S.D.	C.V.%		
Control	67.70 ± 1.08	3.43	5.04	7.54 ± 0.06	0.22	2.9	179	4.172
0.5	67.60 ± 1.45	4.58	6.78	7.51 ± 0.21	0.67	8.92	79	4.156
1.0	64.00 ± 2.05	6.51	10.17	7.31 ± 0.2	0.72	9.87	72	4.094
1.5	63.80 ± 0.31	5.07	7.95	7.18 ± 0.13	0.41	5.76	70	4.005
2.0	63.54 ± 1.89	5.99	9.42	7.17 ± 0.11	0.35	5.00	70	3.985
2.5	60.50 ± 1.38	4.38	7.25	6.92 ± 0.07	0.24	3.52	64	3.976
3.0	58.50 ± 1.55	4.92	8.41	6.77 ± 0.23	0.72	10.75	65	3.932
3.5	58.50 ± 1.15	3.64	6.22	6.52 ± 0.05	0.23	3.61	59	3.875
4.0	49.60 ± 2.31	7.31	1.73	6.03 ± 0.10	0.31	5.24	58	3.876
4,5	47.00 ± 1.77	5.62	11.96	6.00 ± 0.24	0.76	12.82	50	3.806
5.0	42.00 ± 1.67	5.31	12.64	5.29 ± 0.22	0.70	13.40	48	3.765

tion due to mutagenic treatments in several crops have also been reported earlier (Favret 1963, Hutterman *et at.*, 1978, Pitrimova, 1989). Delayed seed germination may be attributed to the depression in the rate of mitotic proliferations (Favret, 1963). The denatured DNA, after sometimes may be repaired resulting in the activation of biological prosess involved in germination, thus germination may be delayed (Hutterman *et al.*, 1978).

A decrease in percentage of seed germination has also been reported earlier (Swaminathan *et al.*, 1962). Inhibition of germination after mutagenic treatments had been attributed to chromosome organization (Evans and Sparrow, 1961) and changes in the variety of biochemical and physiological systems. The lowered respiratory quotient in treated seeds may be the cause of inhibiting the germination (Woodstock and Justice, 1967).

Seedling growth and injury: Thiourea adversely affected the seedling growth. There was reduction in both shoot length as well as in root length (Table 1). Total seedling length of 25 days old seedling was ranged between 21.86 cm (0.5%) to 14.55 cm (5.0%) in treated material while it was 22.99 cm in control.

Percent injury was noticed in increasing order (4.91 to 36.71%) with increasing the concentration (0.5% to 5.0%) of thiourea (Table 1). Seedling growth reduction has been reported in other crops also (Ananthaswamy *et al.*, 1971, Rajput, 1970, Coniger and Stevenson, 1969, Khan 1990). Various explanations like physiological disturbances due to accumulation of toxic substance, structural damage to chromosome constitutes due to mutagenic treatment have been suggested by several workers (Saric *et al.*, 1961). Destruction of primordial cells (Lindgreen, 1970) and reduced enzymatic activity (Zhang and Mao, 1993) also considered to be responsible for reduction in seedling growth.

Plant height and spike length: The mean values for plant height and spike length were shifted in the negative direction (Table 2) Significant differences in plant height and spike length were noted in all the treatments. The plant height ranged between 67.60 cm (0.5%) and 42.00 cm (5.0%) in treated material while it was 67.70 cm in control (Table 2). The highest degree of S.D. and C.V. were noted in 4.0% concentration. The spike length was ranged from 7.51 cm (0.5%) to 5.29 cm (5%) while it was 7.54 cm in control (Table 2). The highest degree of S.D. and C.V. were noted 0.7696 and 13.4045 in 4.5% concentration respectively.

Growth depression has been reported due to disruption and disorganization of the tuinical layer (Chauhan and Singh, 1975). Destruction and decrease in auxin synthesis in mutagen treated material (Rilley, 1954) may be one factor for reduction in height and other characters. The reduced plant height, spike length may be due to presence of mitotic inhibitors in meristimatic regions (Gunkel, 1957, Natrajan, 1958) due to mutagenic treatments and changes in the specific activity of several enzymes (Cherry *et al.*, 1962).

Spikelets per spike and hundred seeds weight: Significant differences were observed for spikelets per spike and seed weight (Table 2). There was gradual reduction in number of spikelets per spike with the increasing concentration. In control, mean value for spikelets was 79 and it was reduced up to 48 (5.0%). Thus the effect of thiourea on spikelets per spike was found to be in increasing order. The reduced number of spikelets per spike reduced the yield of crop.

The mean valued for 100 seeds weight in all the treatments were shifted in negative direction (Table 2). The range of 100 seed weight varied from 4.1.56 g to 3.765 g, while it was 4.17 g in control. The mutagenic effects of various mutagens for reduced yield has been reported earlier (Ryskal, 1990, Ryzhov, 1985).

Although, thiourea (analogue of urea) used for the better growth and development of crop but it induced the mutations in negative direction in M_1 generation in almost characters in the present study. It seems that thiourea may lead to development of dwarf mutants in next generations: Dwarf mutants are good for high yield and are able to express all the desirable characters controlled by genes under adverse climatic conditions. Although, noted differences are not important for the crop improvement directly, but indeed, the negative mutation will be proved to be important for water lagging and other characters. Work on further generation is in progress.

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