PROVENANCE EFFECT ON SEED YIELD, SEED QUALITY AND STORABILITY OF WHEAT (*Triticum aestivum* L.) IN EASTERN UTTER PRADESH

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ABSTRACT

Significant differences among the provenances and three genotypes of wheat were observed for plant height, effective tillers, ear length, grains per ear, seed yield per plant (g), 1000-seeds weight (g),. Higher values for all the traits were noticed at Kumarganj for wheat genotype HUW 234 and closely related to Maharajganj. Wheat genotype UP 2338 and PBW 343 were having higher values for all the traits at Basti location and closely related to Kumarganj and Maharajganj. HUW 234 exhibited higher values for quality parameters like seed recovery (%), seed moisture content (%), seed germination (%), seedling length (cm), and seed vigour at Maharajganj and Basti location and low at Kumarganj location among provenances, while wheat genotype UP 2338 recorded higher values for all these quality parameters at Basti and Kumarganj and low at Azamgarh and Gorakhpur location and PBW 343 noted higher values for these quality parameters at Basti and Kumarganj location and low at Maharajganj, Gorakhpur and Azamgarh location. Seeds of wheat variety viz., HUW 234, UP 2338 and PBW 343 dried and stored in cloth bags, polyethylene bags and gunny bags under ambient conditions for 8 months at Seed Technology Laboratory. Narendra Dev University of Agriculture and Technology, Kumarganj, Faizabad. The results indicated that there was an effect of storage place, packaging materials, duration of storage and kind of seed on the viability during storage period. gunny bags stored seeds showed higher values for seed quality traits in comparison to polyethylene and cloths bags.

KEY WORDS: Provenance, quality, storage, wheat, yield

INTRODUCTION

In India, wheat (*Triticum aestivum* L.) is the second most important cereal crop next to rice and a key crop of the green revolution and post green revolution era. India stands second among wheat producing countries with respect to area and production. Wheat attained its premier position by virtue of its unique protein gluten, which is responsible for bread making properties of wheat flour.

The place of production is one of the most important factors which influences growth, seed yield and quality parameters. Weather conditions like temperature, relative humidity, photoperiod and wind velocity vary from location to location resulting in differential seed yield and quality. Wheat is highly sensitive to environmental hazards like high

temperature and low humidity, which causes poor plant growth, development and seed setting that adversely affect seed yield and its quality. The variation in quality of seed produced at different locations can be related partly to the differences in growth habit, reproduction and partly to adaptability of genotypes to the environmental conditions under which crop was grown. Therefore, selection of suitable provenance for seed production becomes an integral part of seed programme. Zubal (2000) studied the influence of seed provenance on the seed parameters and crop yield in next generation of winter wheat and spring barley varieties. The differences in crop productivity of winter wheat and spring barley resulting from the seed provenance reached 4-6 % in case of winter wheat and in case of spring barley 6-8 per cent. Crop productivity is related to the seed quality parameters (germination and vigour) which mainly formed by seed provenance (environmental effects) and genotype of a variety. Blaha *et al.*, (2004) show substantial effect of environmental conditions during seed production on the chemical composition of winter wheat seeds. Seeds produced from plants grown under abiotic stress conditions have significantly lower amount of energy in dry matter.

Storage of seed till next sowing season is essential part of seed industry. Seeds have maximum potential viability during maturity and then the viability starts declining during storage. In storage, viability and vigour of the seeds is regulated by many physico-chemical factors like moisture content of seed, atmospheric relative humidity, temperature, initial seed quality, physical and chemical composition of seed, gaseous exchange, storage structure, packaging materials (Doijode, 1988). Among these, the major factors affecting the seed quality during storage are temperature and relative humidity, which results in drastic deterioration of seed. Proper storage arrangements slowed down the ageing process and enhanced the longevity of seeds. Very little attention has paid in India regarding the storability of wheat seeds under ambient storage conditions.

Keeping this in view, the present study was planned to evaluate the suitability of different locations for ensuring better growth enhancing expression of various component characters leading to maximum seed yield and quality in wheat followed by effects of varieties, containers and periods of storage on seed and seedling characters under laboratory condition.

MATERIALS AND METHODS

The experiment was carried out during *rabi* 2004 - 2005 at five different locations namely Basti, Gorakhpur, Maharajganj, Azamgarh and Kumarganj (Faizabad) of Eastern Utter Pradesh. The geographical range for different provenances varied from 26.29 - 26.56º N latitude and 82.17 - 82.48º E longitude and at an altitude from 71.63 to 113 m above mean sea level (Table 1a). The soil type of the experimental site of different provenances varying from sandy loam to clay loam in texture with a pH ranging from 7.2 to 8.9 (Table 1b). Foundation stage seed of three varieties of wheat, UP 2338, HUW 234 and PBW 343 were grown at all these 5 provenances following randomized block design with three replications. Recommended agronomic and plant protection practices were followed to raise a good crop in all the five provenances. The observations were recorded for plant height (cm), effective tillers, ear length, grains per ear, seed yield per plant (g), 1000-

seeds weight (g), seed recovery (%), seed moisture content (%), seed germination (%), seedling length (cm) and seed vigour. Statistical analyze were performed following standard procedure.

Simultaneously, the foundation seed of the same varieties were grown in the same season in 0.2 ha area in five different environmental conditions at farmer's field near university research farms situated in same provenances, Basti, Gorakhpur, Azamgarh, Maharajganj and Kumarganj (Faizabad). Sowing at all the five provenances was done. Recommended agronomic and plant protection practices were followed to raise a good crop in the experimental plots at all the five provenances. Five kilogram seed from each provenance was procured and cleaned. Equal quantity of seeds (500g) from each provenance was packed into cloth bags, polyethylene bags and gunny bags and stored under insect free ambient conditions. Observations on seed quality traits viz., seed moisture content (%), seed germination (%), seedling length (cm) and seed vigour index were recorded at bimonthly intervals. The data were analyzed following Completely Randomized Design. The mean weekly data of storage period was recorded are given in Table 3. Germination test conducted by using 100 seeds of each variety in three replications, by the between paper method and temperature was maintained at 20°C in seed germinator. Final count on germination and other observations were recorded as per ISTA standards (ISTA 1996).

RESULTS AND DISCUSSION

Wheat is most sensitive to environmental hazards like high temperature and erratic rainfall, which leads to poor plant growth, development and low seed yield. Significant influence of mean temperatures during the grain growth and development was published by Wheeler *et al.* (1996). The effect of temperature conditions on seed quality was estimated in study of Sanhewe *et al*. (1996). The geographical range for different provenances varied from 26.29 - 26.56º N latitude and 82.17 - 82.48º E longitude and at an altitude from 71.63 to 113 m above mean sea level (Table 1a). The soil type of the experimental site of different provenances varying from sandy loam to clay loam in texture with a pH ranging from 7.2 to 8.9 (Table 1b).

Significant differences due to provenances were observed for plant height, effective tillers, ear length, grains per ear, seed yield per plant and 1000-seeds weight. Higher values for all the traits were noticed at Kumarganj for wheat variety HUW 234 and closely followed by Maharajganj. UP 2338 and PBW 243 had having higher values for all the traits at Basti location closely followed by Kumarganj and Maharajganj (Table 2a). Significant differences due provenances were observed for seed quality parameters like seed recovery (%), seed moisture content (%), seed germination (%), seedling length (cm), and seed vigour (Table 2b). HUW 234 exhibited higher values of these quality parameters at Maharajganj and Basti location and low at Kumarganj location, whereas UP 2338 expressed higher value for these quality parameters at Basti and Kumarganj and low atAzamgarh and Gorakhpur locations, while PBW 343 recorded higher values at Basti and Kumarganj locations and low at Maharajganj, Gorakhpur and Azamgarh location. The variation in seed yield per plant, its component traits could be attributed to differing environments with respect

to weather parameters and soil conditions and agronomic management of the crop at the particular location, while differences in seed germination and other quality parameters among different locations might be due to variation in growing condition, harvest and post harvest condition of the seed. The similar findings were also reported by Narayana Swamy and Shambulingappa (1994), Verma *et al*. (1999) and Saleem and Narayana Swamy (2002).

In the present investigation, the variation in weather parameters and soil conditions of the locations where the experiment was conducted contributed to variations in growth, seed yield and quality parameters. All the provenances having well distributed moderate rainfall, low temperature and high humidity conditions, which provided favour environment for excellent wheat crop growth and considered suitable provenances for wheat cultivation. However, among all these locations Basti followed by Kumarganj were most suitable locations.

Significant differences were observed for seed moisture content (%) and seedling length (cm) in three wheat varieties during storage periods. Significantly highest seed moisture content (12.98 %) was observed in wheat variety UP 2338 than PBW 343, but it was at par with HUW 234. Significantly highest seedling length (19.27 cm) was observed in wheat variety HUW 234 than UP 2338, but it was at par with PBW 343. For the remaining two quality parameters, seed germination and seed vigour, all the three varieties were at par with each other. These differences between varieties might be due to the genetic factors and seed chemical composition influence the expression of seed quality parameters. Moreover, Doijoide *et al.* (1988) stated that the storability of different soybean cultivars is also regulated by initial seed quality, physical and chemical composition of seed as different cultivars possess different physical structure and chemical composition which determine the viability of seed in storage. These results are in good accordance with those obtained by Kandil *et al*. (2013) in soybean.

Significant differences were observed for seed moisture content (%) and seed vigour in storage container during storage periods. Seed moisture content was at par in seed stored in cloth bags (13.14 %) and gunny bags (13.04 %), but it was significantly highest than polyethylene bags. Similarly, significantly highest seed vigour was noted in seed stored in gunny bags (1755.39) as compared to other storage containers, which were at par with each other. For the remaining two quality parameters, seed germination and seedling length, all the seed containers were at par with each other, however maximum values for these traits recorded in gunny bags storage (Table 2B). It is noted that moisture content of seed stored in moisture pervious containers (cloth bag and gunny bag) fluctuated during the storage period, while moisture loss was less in impervious (polythene bags) bags, because fluctuation in moisture content of seeds may be due to fluctuation occurred in temperature and relative humidity during storage period. The results are akin to the findings of Singh and Dadlani (2003), Garg.and Pitam Chandra (2005) and Chattha Shakeel *et al.* (2012).

Significant differences were observed for seed germination per cent, seedling length and seed vigour during period of storage of wheat varieties. seed moisture content expreesed non-significant difference

for period of storage. Seed germination and seedling length was high and at par up to four months of storage and it was decreased significantly after 4 months. Seed vigour was noted highest in 2 months of storage and it was decreased significantly as the period of storage increased (Table 4C). The results are akin to the findings of Singh and Dadlani (2003).

CONCLUSION

From the present investigation, it can be concluded that, all the provenances having well distributed moderate rainfall, low temperature and high humidity conditions, which provided favour environment for excellent wheat crop growth and considered suitable provenances for wheat cultivation. However, among all these locations Basti followed by Kumarganj were most suitable locations. Seed can be stored in gunny bags for a period up to 4 months without deterioration in seed quality.

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Table 1a : Geographical location of different provenances

Sr. No.	Provenance	Latitude ^{o}N	Longitude ^{o}E	Altitude in meter
1	Basti	26.56	82.48	75.00
2	Gorakhpur	26.46	83.21	87.00
3	Maharajganj	26.19	83.14	71.63
4	Azamgarh	26.27	80.16	113.00
5	Kumarganj (Faizabad)	26.47	82.17	113.00

Table 1b : Characteristics of soil different provenances

Sr. No.	Provenance	Soil type	pH
1	Basti	Sandy loam	7.5
2	Gorakhpur	Sandy loam	7.3
3	Maharajganj	Clay loam	7.2
4	Azamgarh	Clay loam	7.5
5	Kumarganj (Faizabad)	Sandy loam	8.9

Table 2a : Effect of provenance on plant height, number of effective tiller per plant, ear length (cm), grains per ear, seed yield per plant (g) and 1000 seed weight (g) of wheat variety HUW 234, UP 2338 and PBW 343

Provenance	Plant Height (cm)			Number of Effective Tiller Per Plant			Ear Length (cm)			Grains Per Ear			Seed Yield Per Plant (g)			1000-Seed Weight (g)		
	HUW 234	UP 2338	PBW 343	HUW 234	UP 2338	PBW 343	HUW 234	UP 2338	PBW 343	HUW 234	UP 2338	PBW 343	HUW 234	UP 2338	PBW 343	HUW 234	UP 2338	PBW 343
Basti	74.63	84.53	86.43	4.47	5.47	6.00	10.15	10.40	10.40	46.60	60.96	57.00	1.75	1.77	2.20	35.30	35.83	41.63
Gorakhpur	76.27	76.60	86.10	4.37	4.00	5.00	9.27	9.24	9.24	46.43	46.00	49.80	1.22	1.31	1.63	33.40	36.90	39.27
Maharajganj	77.20	75.69	84.57	4.00	5.5	5.40	9.75	9.81	9.81	44.00	48.23	53.00	1.63	1.94	1.82	32.50	32.67	36.67
Azamgarh	88.13	82.09	75.33	5.00	6.00	5.38	9.38	10.25	10.25	48.50	60.53	56.00	1.73	1.84	2.13	30.47	36.56	32.63
Kumarganj (Faizabad)	84.33	82.53	73.99	4.51	5.56	5.60	10.18	10.41	10.41	55.00	64.00	49.00	2.15	1.97	1.74	39.50	36.77	31.5
SEm±	0.26	0.18	0.48	0.13	0.07	0.09	0.10	0.06	0.04	0.19	0.07	0.68	0.02	0.06	0.20	0.16	0.30	0.17
CD (P=0.5)	0.84	0.59	1.56	0.41	0.22	0.30	0.33	0.19	0.19	0.63	0.24	2.21	0.07	0.19	0.51	0.53	0.96	0.56

Table 2b : Effect of provenance on seed quality parameters

Provenance	Seed Recovery (%)			Moisture Content (%)			Seed Germination (%)			Seedling Length (cm)			Seed vigour		
	HUW 234	UP 2338	PBW 343	HUW 234	UP 2338	PBW 343	HUW 234	UP 2338	PBW 343	HUW 234	UP 2338	PBW 343	HUW 234	UP 2338	PBW 343
Basti	84.23	85.10	83.83	12.40	12.53	12.59	94.0	91.00	93.67	18.27	22.04	19.81	1718.30	2007.50	1855.70
Gorakhpur	82.73	81.12	83.08	12.00	12.74	11.57	91.67	90.67	92.33	19.35	21.26	21.31	1719.45	1927.52	1967.88
Maharajganj	83.13	81.50	81.33	11.52	12.45	11.55	93.67	91.67	92.67	20.56	20.64	21.11	1923.15	1892.60	1957.66
Azamgarh	85.33	81.67	82.33	11.70	12.03	11.81	92.00	92.33	93.00	19.86	18.43	22.14	1859.94	1702.60	2058.88
Kumarganj (Faizabad)	82.33	82.00	83.33	12.39	11.86	11.69	93.67	92.67	92.35	20.57	18.43	22.02	1894.41	1709.42	2033.53
SEm±	0.19	0.19	0.19	0..31	0..31	0..31	0.67	0.67	0.67	0.67	0.67	0.67	69.23	69.26	69.26
CD (P=0.5)	0.41	0.41	0.41	0..90	0..90	0..90	1..93	1.93	1..93	1..93	1.93	1..93	200.59	200.59	200.59

Table 3:Meteorological data during seed storage periods

Sr. No.	Month	Temperature ◦C			Relative Humidity (%)		
		Minimum	Maximum	Mean	Minimum	Maximum	Mean
1	June	27.30	34.80	31.05	58.10	82.10	70.00
2	July	26.20	33.40	29.80	71.70	89.20	80.45
3	August	26.70	33.40	30.05	81.50	93.50	87.50
4	September	23.70	32.60	28.15	73.80	93.50	83.60
5	October	13.90	30.20	22.05	90.80	93.40	91.00
6	November	10.20	28.10	19.15	39.70	91.20	62.60
7	December	6.30	22.40	14.35	49.70	85.50	68.90
8	January	4.60	22.80	13.70	33.10	88.10	57.95
9	February	14.20	32.60	23.40	34.80	82.80	54.50

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