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EFFECT OF SEED SIZE AND SEEDING DEPTH ON THE YIELD PERFORMANCE OF WHEAT (*TRITICUM AESTIVUM* L.)

A. Al-Amin, A. Hamid, M. T. Islam and T. Chand[1]

Department of Agronomy
Institute of Postgraduate Studies in Agriculture
P.O. IPSA, Gazipur 1703, Bangladesh

Abstract

Effects of variable seed size and sowing depth on the yield and its attributes of wheat were evaluated in a field experiment. Three different seed sizes (large, medium, and small), and four sowing depths (0, 2, 4, and 6 cm) were used as treatment variables. Sowing at surface or at 2 and 4 cm depth made no appreciable difference in grain yield but sowing deeper than 4 cm greatly reduced yield. Seed size caused no significant variation in yield and most yield components. Difference in yield was attributed to variation in plant population and spike density affected by sowing depth.

Key words : Seed size, Seeding depth, *Triticum aestivum* L.

Introduction

Wheat is an important food crop in Bangladesh covering an area of about 0.5 million ha. The yield of the crop is generally low giving an average of 2.0 t/ha. Apart from environmental factors, poor stand establishment and consequential poor spike density per unit area result in poor yield. It has been suggested that for a high yield of wheat spike density should be over 400 per m^2. But earlier studies (Matsunaga *et al.*, 1989) indicate that actual population density in the farmers' fields is much lower than the standard density. Tillering in wheat is generally low and attainment of adequate spike density depends mostly on the initial population density prior to tillering stage. In Bangladesh, wheat is mostly grown under rainfed condition and seed germination is often constrained by lack of soil moisture. During land preparation and immediately after sowing soil moisture runs out quickly and the seeds, particularly those placed at shallower depths are at risk of germination failure. The risk can be avoided by deep sowing. On the other hand, deep sowing is often reported to have adverse effects on crop establishment. Emergence of seedling and their survival, at least in the beginning, varies heavily on the stored

1 *Principal Scientific Officer, Bangladesh Rice Research Institute, Joydebpur, Gazipur 1701, Bangladesh.*

materials into seeds. Large seeds have an advantage over small seed of the same cultivar because of the stock of nutrients at the disposal of the embryo before it has developed a root system (Singh and Rai, 1988). The influence of seed size on subsequent crop performance is well documented. Arndt and Philips (1986) planted cotton seeds at 2.5, 5, 7.5 and 12.5 cm depths and observed a decrease in total emergence with increasing depth. Haque *et al.* (1992) reported that both aggregate size distribution and seeding depth greatly influenced the emergence and stand establishment of rice. Srivastava and Nigham (1973), however, observed no significant effect of seed size on yield, kernel weight, and flag leaf area in wheat. Wheat being a comparatively recently introduced crop in Bangladesh, not much work on its management has been done. The present study aims to elucidate the influence of seed size and sowing depth on the yield performance of wheat.

Materials and Methods

A field experiment was conducted with wheat seeds of different sizes (large, medium and small) and seeding depths (0 cm, 2 cm, 4 cm, and 6 cm) in the experimental farm of the Institute of Postgraduate Studies in Agriculture, Salna, Gazipur. A well drained highland soil, clayey in nature with P^H about 6.5 was used for the experiment. Treatments were arranged in a split-plot design. Treatments on seeding depths were in the sub-plots and seed size on the main plots. Unit plot size was 5m × 2m. Each of the treatment was replicated four times.

Seeds of a high yielding variety of wheat (cv. Agrahani), collected from Bangladesh Agricultural Research Institute were used. The seeds were sieved and arbitrarily graded into small, medium, and large categories and were sown at the specified depths. Before sowing, the land was finely cultivated and fertilizers applied at the rate of 120 kg N, 80 kg P_2O_5 and 40 kg K_2O per ha in the form of urea, triple superphosphate and muriate of potash, respectively. Seeds were sown in rows 25 cm apart on November 23, 1989. A light irrigation was applied immediately after sowing in order to ensure uniform germination. Intercultural operations including weeding and insecticides application were done as and when needed during the growing season.

At maturity 10 plants were harvested at random cultting at the base from each plot and agronomic data relating to plant height, number of tillers per plant, number of spikes per m^2, number of grains per spike, and grain size were recorded. Seed yield was estimated by harvsting a sample area of 7.5 m^2.

Results and Discussion

Grain yield exhibited a great deal of variation due to sowing depth, but the yield difference due to seed size was not statistically significant (Table 1). Seed yield varied between 947 kg to 2,190 kg per ha across sowing depth treatments. Placing seeds on soil surface and sowing upto 4 cm depth produced similar yields. Sowing at 6 cm depth caused yield reduction to the extent of 57%. There was no significant interaction of sowing depth and seed size in respect of grain yield or yield attributes. Irrespective of treatment differences, wheat grain yield was generally low. However, sowing medium seeds deeper than 4 cm performed better than other two treatments which might be due to longer coleoptile to protrude through the soil surface. Studies carried out at ICARDA (1990) indicated that longer coleoptile had a significant positive effect on stand establishment in less dry environment. In certain soils seedling emergence and stand establishment is better with bolder seeds but when the seed number of the seeds of similar size group are planted, the size of the seeds can

Table 1. Influence of seed size and seeding depth on grain yield of wheat.

Seeding depth (cm)	Seed size group			Mean
	Small	Medium	Large	
	Grain yield (kg/ha)			
0	2,231	1,708	2,103	2,014
2	1,836	2,238	2,330	2,135
4	2,340	2,123	2,108	2.190
6	765	1,347	728	947
Mean	1,793	1,854	1,817	

LSD 0.05 for seeding depth 162.61
CV (%) 15.87

have little effect on the final yield (Carver, 1977).

Table 2 shows plant population density at harvest. Sowing depth affected population density which ranged from 127 to 248 per m^2 across the sowing depth treatments. However, variation in seed size caused no significant differences in plant population density although there was a tendency of increasing population with increasing seed size. Woodruff (1986) reported that for rainfed wheat, increase in planting depth increased the depth of the crown node thus giving better stand establishment, because deeper the crown node, the better is nodal root production following subsequent rain or irrigation. Recent studies in ICARDA (1990) suggest that in general deep sowing has no advantage for crop establishment. Plant population count as recorded during harvest (Table 2) may not reflect the status of seedling emergence or stand establishment at early vegetative phase. Earlier studies by Masle-Meynard and Sebillotte (1981) and Roy and Gallagher (1986) suggest that tiller production in wheat increases gradually from vegetative phase and reaches a maximum and afterwards declines and eventually stops around the time of terminal spikelet formation.

Table 2 shows that sowing seeds deeper than 4 cm reduced emergence rate significantly which eventually contributed to lower spike density or ear bearing tillers per unit area. Tillers increased with increasing sowing depths upto 4 cm but further increase in depth reduced ear bearing tillers appreciably. Our results compare favorably with those of Hadjichrisodouloa *et al.* (1977) who observed that shallower sown plants developed more crown roots from their tiller than deep sown plants, and this more than compensated for the shallow rooting patterns of shallow sown plants.

There were significant variations in plant height due to seed size and seeding depth (Table 2). Plant height varied from 71.46 cm to 75.79 cm due to differences in seeding depths. Seeds planted at the surface and at 2 cm depth produced taller compared to those developed from plants originated from the deeper placed seeds. However, the magnitude of difference was small. Plant height tended to increase

Table 2. Influence of seed size and seeding depth on yield attributes of wheat.

Treatments	Plant height (cm)	Plant population ($No./m^2$)	Ear bearing tiller ($No./m^2$)	Grains per spike (No.)	Grain size (mg)
Seed size					
Small	71.77	200	162	34	37.48
Medium	73.71	207	143	33	36.46
Large	75.66	236	150	34	36.18
LSD 0.05	2.72	—	—	2.72	—
Seeding depth					
0	75.23	171	143	34	38.03
2	75.79	210	173	37	36.47
4	71.46	248	194	36	36.44
6	72.35	127	97	27	35.89
LSD 0.05	3.36	59	26.13	—	—
CV (%)	8.05	9.58	14.71	13.46	3.12

progressively with the increase in seed size but the magnitude of the difference was small. Sowing depth caused significant variation in grains per spike. Number of grains per spike ranged between 26.77 to 36.93 across sowing depths. Seeding on the surface and at two shallower depths produced identical number of grains per spike but larger than that obtained from deeper sowing. Number of grains per spike differed a little among seed size group (Table 2).

Grain size ranged between 35.89 mg and 38.05 mg across the sowing depth treatments and it varied from 36.18 mg to 37.48 mg due to seed size group (Table 2). Variation in grain size among the treatments was very small and not statistically significant.

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