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PERFORMANCE OF DIFFERENT WHEAT GENOTYPES UNDER DIFFERENT TILLAGE OPTIONS

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ABSTRACT

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A field study was carried out at the Regional Wheat Research Center, Shyampur, Rajshahi during Rabi season of 2001-2002 and 2002-2003 to observe the performance of wheat genotypes among the different tillage options. In a strip split plot design, two tillage systems were tested: manually prepared permanent bed (PB-as this is in reference to 2 other crops besides wheat per season sown on the same beds) and conventionally tilled on the flat(CTF). Within each tillage system, ten wheat genotypes were tested. From the results, it was observed that significant different between bed planting and conventional method of sowing was detected for plant population/m^2, grain yield spike/m^2, spikelets/spike, grains/spike and harvest index; but found non–significant for biomass, plant height and 1000 grain weight. Significantly higher grain yield was found in bed planting over conventional was prissily due to more ground cover, higher spike length, more spikelets /spike and grain/spike with Shatabdi variety. Higher harvest index was observed in bed planting over conventional with Shatabdi variety due to greater grain yield biomass ratio was attributed to the advantage of bed planting. The variety and method allowed plants to uptake more nutrients and moisture that contributed to higher grain yield through partitioning of photosynthesis to the grains. More ground cover (85%) was found in Shatabdi and BAW1004 along with bed planting and lowest was (25%) from BAW 968 and Gourab along with conventional planting. Three weed species namely *Chenopodium album*, *Cynodon dectylon* and *Cyperus rotundus* were found in the experimental plot. Maximum weed were found in conventionally treated plot at BAW 968 and Gaurab due to their less ground cover percentage and minimum were Shatabdi and BAW 1004 genotypes with bed planting due to more ground cover percentage. Chenopodium album was the highest infested weed in all the plots.

Keywords: Yield, Raised bed, Genotypes, Tillage options and Weeds

INTRODUCTION

Stepping up food production per unit area using intensive cropping is needed to feed the increasing population of Bangladesh. The single largest constraint to wheat cultivation in Bangladesh is the late planting in winter season crop. Delayed sowing reduces wheat yield because growth is poorly aligned with water availability, nutrient deficiencies resulting in the crop experiencing an "end –of-season" drought (Pellokilla *et.al*.1991). Evidence proves that yields can be improved by raised beds, thereby escaping end of season drought (Borrel et al. 1998). Upland crops such as wheat and maize are not compatible with the flooded culture used for rice production in Bangladesh. Additionally, there has been a shift in economic importance toward the winter season crops over monsoon rice. Therefore, in order to improve compatibility between monsoon rice and upland winter crops, rice may need to be grown under a different system. The successful growth of wheat on raised beds in northern Australia (Borrel et al. 1997) and in eastern Indonesia (Borrel *et al*.1998) and high yielding irrigated wheat growing areas in Mexico and use of those practices has increased dramatically in the last decade (Meisner et al. 1992). This concept has been extended to eastern Indonesia where soybean, maize, sorghum, garlic, mungbean and cassava are grown on raised bed in rotation with rice near Kupang in West Timor (Kelly *et al*. 1997). Bed planting has been shown to improve water distribution and efficiency, fertilizer use efficiency, reduce weed infestation and crop lodging. It also reduces cost of cultivation, soil erosion and degradation (Hobbs *et al*.1998). Therefore, raised beds enable sowing at the optimum time, providing a means of better matching crop growth to water supply. Bed sowing may be a good alternative for Bangladesh where wet culture is more dominant. Therefore, the present investigation is being conducted. While bed shown rice and wheat experiments have shown the dramatic improvement of yields (data not shown), there has been no study on the current genotypes sown under such conditions. Thus, our experiment will try to investigate if there is any interaction among strong wheat varieties/advance lines and tillage options. During the experiment, we will attempt to conduct participatory variety selection methodologies, obtaining grower input and their data on the genotypes and their observation on any interaction with tillage options. The goal is both to teach our selves this methodology within the context of Bangladesh. Bed planting provided the highest N use efficiency for proper water use by the plants. Under these practices additional light enters the canopy resulting significantly the maximum filled grain, 1000 grain weight, straw yield and harvest index. By sowing crops on raised beds, irrigation water moves laterally from the furrow to top and middle of the bed by capillary flow. Bed planting provides deeper root-zone conditions for plant growth because the furrow acts as a drain for removal of excess water, which re-aerates the root zone following irrigation or heavy rainfall (Beecher *et al*., 1998).

METHODS AND MATERIALS

This experiment was conducted during Rabi 2001-2002 and 2002-2003 at Regional Wheat Research Center, Shyampur, Rajshahi in a strip split plot design with three replications. The unit plot size was 5m x 3m. There were two factors are as follows:

Factor A: Main plots (Tillage options)

1. Conventional (Farmers practice)
2. Bed (2 rows/bed)

Factor B: Sub-plot (Different wheat genotypes)

Shatabdi, Gourab, Shourav, Kanchan, Baw-966, BAW-968, BAW-969, BAW-1004,
BAW-1006 and BAW-1008.The soil was clay loam in texture belonging to high Gangatic Flood Plain soil with pH 7.4. Fertilizer were applied at the rate of 100-60-60-20 kg/ha of NPKS. All fertilizer except 1/3 urea was applied at basal at the time of final land preparation. Remaining fertilizer was applied after 1st irrigation of 21 days after sowing.

The seeds were sown on 30 November 2002 and 2 December 2003 and harvested on different dates on March according to maturity. Data were collected from randomly selected 10 plots and grain yield was recorded from whole plots and then converted into hectare. Ground coverage at various stages (Heading, flowering, maturity and harvesting stages) was recorded by Zadok methods (Zadoks 35, 43, 90 and 100 days). Data were statistically analyzed and means were separated by using DMRT methods (Steel and Torrie.1997)

RESULTS AND DISCUSSION

Tillage Options

Significant difference between bed planting and conventional was detected for spike length, grain yield, spikelets/m2, grains/ spike and harvest index; while difference between the two planting methods was found non–significant for biomass, plant height & thousand grain weights.

Significantly higher grain yield was found in bed planting over conventional was possibly due to higher spike length, spikelets/spike and grain/spike. Higher harvest index in bed planting over conventional due to higher grain yield and biomass ratio was attributed to the advantage of bed planting. The bed method allowed plants to uptake more nutrients and moisture that contributed to higher yield through partitioning of photosynthesis to the grains. Moreover, higher spike length, more spikelets/spike and grains/spike contributed towards higher grain yield in bed planting. In addition, number of 8 lines in bed compared to 15 lines in conventional systems, extorted extra advantages of more interception of sunlight and spacing; as a result crops gets more boarder effect, these factor helped higher spike length in bed planting to synthesize more food and translocate to grains with the ultimate more grain yield.

Table 1. Effect of method of cultivation on different character of wheat

Tillage Options	Spike length (cm)	Grain yield (t/ha)	Biomass (t/ha)	Spikelet/spike	Grains/ spike	TGW (g)	Harvest Index (%)
Bed	11.2	3.59	10.06	22.4	48.7	44.7	34.1
Conventional	9.7	3.20	10.50	17.3	42.4	41.9	32.0
LSD (0.05)	1.37	0.717	NS	2.87	4.78	3.23	NS
CV (%)	**9.20**	**6.27**	**10.39**	**8.39**	**5.77**	**6.15**	**7.87**

Genotypes effect

More ground cover (85%) was found in BAW1004 and Shatabdi variety and lowest was (25%) from BAW 968 and Gourab variety. Among all genotypes, the yield of Shatabdi variety (4.35 t/ha and 4.55 t/ha in 2001-2002 and 2002-2003) was significantly higher than all other genotypes except BAW 1004 having same yield of Shatabdi both the years. Similar yield variation was recorded by Sayre et al. 1998. Other characteristics such as spike length, spikelets/spike, grains/spike and TGW were significantly differ from Shatabdi and BAW 1004 genotypes for the years. Higher grain yield on Shatabdi was attributed to more ground cover percentage, more sunlight, higher spike length, Spikelet/spike and grains/spike in both the years. Duxbury *et al* 2000.found similar results from their experiment.

Table 2. Comparative effect of genotypes on different characters of wheat

Varieties	Grain yield (t/ha)		Biomass (t/ha)		Spike length(cm)		Grains/spike		TGW (g)	
	Bed	Con.	Bed	Con.	Bed	Con.	Bed	Con.	Bed	Con.
Kanchan	3.27	3.06	10.46	9.88	21.8	18.3	46.1	44.6	42.2	39.8
BAW 969	3.36	3.11	10.53	9.70	23.4	19.3	48.6	44.8	40.7	36.5
BAW 966	3.24	3.24	10.83	9.73	24.0	18.7	48.4	46.3	40.8	38.5
BAW 1004	4.15	3.43	11.43	10.48	24.8	20.1	48.5	41.7	47.3	45.6
BAW 1008	3.98	3.23	10.43	10.36	24.5	20.8	49.4	44.0	47.3	44.6
BAW 1006	3.70	3.08	11.0	10.40	22.1	17.5	45.8	42.8	49.7	44.0
Shourav	3.49	3.16	9.90	10.46	23.4	18.4	48.6	44.8	43.7	37.7
BAW 968	3.39	3.12	10.01	9.83	24.0	19.2	48.4	46.3	44.7	38.3
Shatabdi	4.01	3.40	10.54	10.40	25.2	20.2	51.4	44.2	49.0	31.0
Gourab	3.31	3.15	10.50	9.41	22.8	17.2	46.8	44.4	39.8	38.8
LSD (0.05)	0.25	0.221	0.717	0.698	0.97	0.78	2.16	1.98	3.23	3.01
CV (%)	**6.27**	**6.02**	**10.39**	**9.89**	**8.54**	**7.85**	**6.11**	**5.89**	**6.15**	**5.91**

Interaction effect

Interaction effect of genotypes and different tillage options significantly influenced percent ground cover, yield and yield components for both the years. More ground cover (85%) was found in Shatabdi variety followed by BAW1004 and along with bed planting and lowest was (25%) from BAW 968 and Gourab along with conventional planting. The higher spike length, spikelet/spike and grains/spike were produced in the variety of Shatabdi and followed by BAW 1004 due to get more sunlight, more boarder effect as a result higher spike length and maximum number of grains/spike along with bed planting .There was a tendency in the increase of spike length, spikelets/spike, grains/spike and 1000 grains weight from Shatabdi variety along with beds planting. The minimum spike length, spikelets/spike and grains/spike due to lower ground cover percentage, minimum sunlight and low boarder effect were recorded from Gaurab and BAW 968 genotypes along with conventional planting.

Table 3. Comparative effect of genotypes on different characters of wheat

Varieties	Days to heading		% Ground cover		Days to flowering		Days to maturity		Dry matter weight (g)	
	Bed	Con.	Bed	Con.	Bed	Con.	Bed	Con.	Bed	Con.
Kanchan	68	70	35	28	75	75	103	104	12.9	11.3
BAW 969	68	68	31	35	76	74	103	104	12.6	10.8
BAW 966	66	66	41	43	74	74	101	102	13.0	10.9
BAW 1004	68	71	85	75	75	76	102	105	14.7	11.6
BAW 1008	66	66	70	55	72	73	100	102	12.7	10.0
BAW 1006	69	72	43	38	74	78	104	106	13.8	12.0
Sourav	72	72	33	26	77	78	105	106	12.0	10.2
BAW 968	67	68	26	25	76	74	100	101	12.6	10.9
Shatabdi	65	73	85	78	75	79	103	107	14.2	11.9
Gourab	65	67	26	25	72	74	101	102	12.4	9.8
LSD (0.05)	0.257	0.221	0.717	0.698	NS	NS	2.16	1.98	1.37	3.01
CV (%)	**6.27**	**6.02**	**10.39**	**9.89**	**8.39**	**8.21**	**6.11**	**5.89**	**5.93**	**5.91**

Weed effect

Three weed species namely *Chenopodium album*, *Cynodon dectylon* and Cyperus *rotundus* were found in the experimental plot. Maximum weed was found in conventionally treated plot with Gaurab and BAW 968 genotypes due to lower ground coverage and minimum was bed planting along with the genotypes of Shatabdi and BAW 1004. Chenopodium album was the highest infested weed in all the plots. Wheat yield gradually decrease with the increasing of weed species for both the years. Similar results variation was found by Ken Sayre, 2000.

Interaction Effect 0f Genotypes and Weed on Grain Yield

Interaction effect of genotypes and weeds significantly influenced on yield and yield components for both years. The higher spike length, spikelet/spike and grains/spike were produced in the variety of Shatabdi and followed by BAW 1004 due to get more sunlight, more boarder effect as a result higher spike length and maximum number of grains/spike along with bed planting .There was a tendency in the increase of spike length, spikelets/spike, grains/spike and 1000 grains weight from Shatabdi variety along with beds planting. The minimum spike length, spikelets/spike and grains/spike due to lower ground cover percentage, minimum sunlight and low boarder effect were recorded from Gaurab and BAW 968 genotypes along with conventional planting.

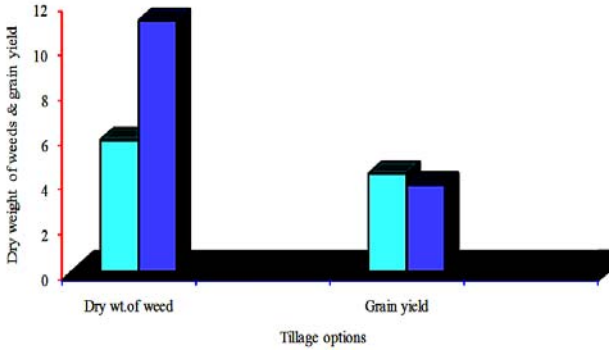

Figure 1. Effect of weeds on grain yield

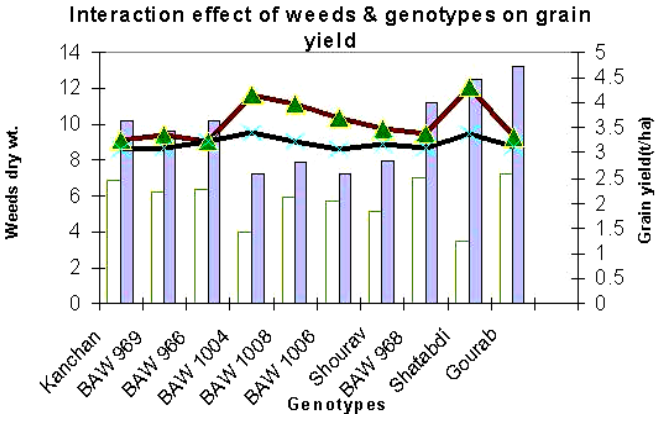

Figure 2: Interaction effect of weeds and genotypes on grain yield

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