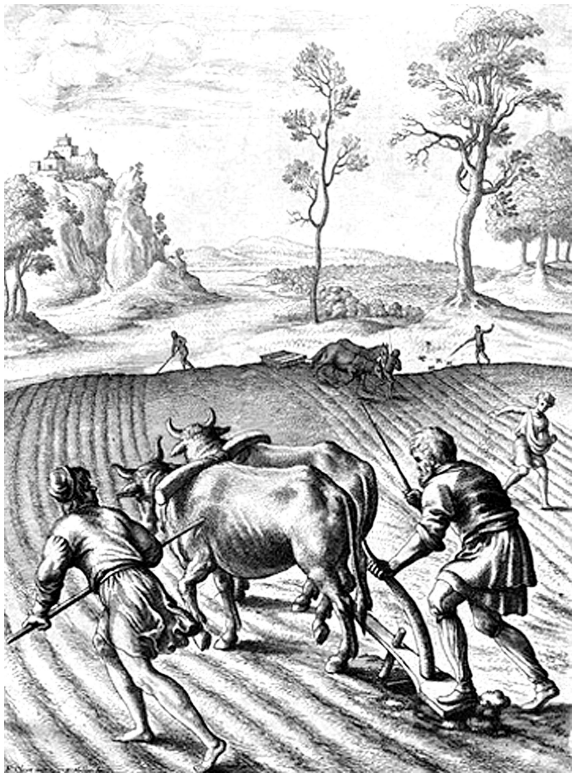
ISSN : 1812-5379 (Print)
ISSN : 1812-5417 (Online)
http://ansijournals.com/ja

JOURNAL OF AGRONOMY



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Pakistan Journal of Agronomy 2 (1): 28-33, 2003
ISSN 1680-8207

Effect of Hall Tonic Fertilizer on Irrigated Wheat Yield

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Abstract: Out of 36 plots of wheat cultivar inqilab-91 measuring 10 × 10 m^2 each, half received hall tonic at the rate of 10 kg ha^{-1}. There was no significant effect of the application of hall tonic on any plant characteristics except 1000 grains weight, which was slightly increased. Days to 50% heading plant height, grain yield and harvest index was slightly decreased with the application of hall tonic. Hall tonic increased spikes m^{-2}, grain $spike^{-1}$ and 1000 grains weight by 8, 8 and 6%, respectively. However the increase was not projected in the grain yield. Different levels of hall tonic to various wheat cultivars under different soil and environmental conditions are suggested for further assessment.

Key words: Irrigated wheat fertilizer-hall tonic

Introduction

Wheat (***Triticum aestivum*** L.) occupies important position among food crops in Pakistan. It is adaptable throughout the world and is used for diet, animal feed and as raw material for some products in industries.

In Pakistan, nitrogen, phosphorus and some quantities of potash are being applied through commercial fertilizers but no application of micro-nutrients is normally made. The crops are continuously missing the secondary as well as micro-nutrients from the soil reserves (Bhatti, 1977). The problems of micronutrient deficiencies are somewhat local at present and may become more serious in future. Plants absorb most of the nutrients from soil. The soil conditions in Pakistan are not much conducive to the availability of micro-nutrient (Bhatti, 1977). Increased cropping intensity coupled with high yielding varieties results in increased removal of micro-nutirents leading to possible deficiencies. In order to meet the continued demand of crops, these nutrients must be replenished through artificial fertilization. To increase the average yield of wheat in NWFP, balanced nutrition is must. Micro-nutrient are required in very small quantities by crops but cannot be ignored due to its important role in different metabolic processes.

Manganese and magnesium mixture significantly increased the number of tillers per plant number of grains and total protein contents in wheat (Sodapphal and Das, 1961). The highest

grain yields was obtained with trace elements as compared with NPK alone (Singh and Singh, 1975). Bhatti (1977) reported that Faisalabad wheat grain yield increased by more than 24% with the application of Zn, Cu, Fe and Mn. The application of trace elements like B, Mo, Zu, Mn, Cu and Fe reduced stem rust and increased grain yield (Termreshev and Ismukhamkbetova, 1976). Jumani (1983) reported that zarzameen is a mixture of micro-nutrient, plus growth factors in fretted form which improves the germination, give high yield, reduce the harvesting time, increase the size of grain and improve the taste of crop. The composition of Zarzameen is B (5.76%), Mn (5.04%), Mg (4.72%), Fe (6.47%), Zn (7.04), Cu (5.10%), Co (2.10%), Na (6%), K (14.4%), Ca (10.10%) and activated silicon (33.27%). Khan (1983) concluded that the highest 1000 grains weight was observed in combine application of Zu+Cu+Fe+B followed by Zn treatment. Grains yield and straw yield were significantly increased with Zn application followed by combine Zn+Cu+Fe+B application. Khattak and Bhatti (1983) studied that tra ce elements did not effect the grain yield, number of ear m^{-2}, 1000 grains weight and dry matter yield. Hegde and Dwivedi (1994) stated that however trace element application did not significantly affect plant growth (Naphade ***et al.***, 1990). Sharma ***et al.*** (1992) reported that mean yield without trace element application was 3.80 t ha^{-1}, while among the trace element treatments 20 kg ha^{-1} $CuSO_4$ (4.71 t) and 15 kg ha^{-1} Zn SO_4 (4.25 t) gave the highest yields. Mitra and Jana (1991) concluded that mean yield was 0.83 t ha^{-1} without application of trace elements and 1.11, 1.35 and 2.80 t with application of 15 kg Zn, 0.8 kg Mo and 20 kg B ha^{-1}, respectively yield was highest (2.93 t ha^{-1}) in wheat treated with dolomite and B. John ***et al.*** (1998) reported that effect of compost alone (2000 and 4000 kg ha^{-1}) on number of tillers, 1000-grain weight, yield and NPK uptake by rice and wheat was almost similar to control, whereas, significant improvements were observed when combination of compost and chemical fertilizers were applied. The present piece of research work was designed to find out the effect of micro-nutrient in form of hall tonic a commercial product of Pesto-chemical industry on the yield and yield components of wheat.

Materials and Methods

A field trial was conducted to study the response of wheat cultivar Inqilab to a compost fertilizer commercially known as hall tonic at the rate of 10 kg ha^{-1} applied with first irrigation at NWFP Agriculture university Peshawar, Pakistan during 1998-99. Hall tonic is natural fertilizer composed of micronutrient which include phosphorus 2%, potassium 1%, sodium 2%, magnesium 5%, calcium 5%, chloride 4%, iron 0.60%, zinc 0.20%, manganese 0.05%, Boron 0.05%, sulphur 0.10% and others 80.00%. The experiment consisted of 18 paired plots each measuring 10 × 10 m^2 with or without hall tonic. Seeds were planted in 30 cm rows and applied with 100:75 Kg NP ha^{-1} in the form of urea and single super phosphate. Nitrogen was applied as split at the time of planting and 25 days after sowing. Standard agronomic practices were used for raising the crop. Variance, standard deviation, variance of the difference between means, standard deviation of the differences and t-values were worked out for comparing the means.

Results and Discussion

The average number of days to 50% heading, the range, the variance and standard deviation did not change with or without hall tonic (Table 1) nor the differences were detected by t-value. Hall tonic did not affect the number of days to maturity. The average number of days to maturity was 162.7, Which ranged from 153 to 168 in plots with or without hall tonic. The variance, standard deviation and t-values did not detect any differences. Haque ***et al.*** (1980) reported similar results. Although the plant height ranged from 80 to 110 cm in both with and without hall tonic, yet hall tonic application reduced plant height by one centimeter. As evident from the variance (43.4) and standard deviation (6.6) plant height under hall tonic was more uniform than without hall tonic. The differences between the means were not detected by

Table 1: Effect of Hall tonic on growth and yield of wheat cultivar Inqilab-91

	Days to 50% heading		Days to maturity		Plant height (cm)		Biological^{-1}	
Plots	Control	Hall tonic	Control	Hall tonic	Control	Hall tonic	Control	Hall tonic
1	113	113	168	168	95.0	110.2	6667.0	11667.0
2	113	113	168	168	98.0	98.3	10000.0	6667.0
3	113	113	168	167	100.2	100.0	13333.0	8332.3
4	113	113	167	167	100.1	91.0	10000.0.	10000.0
5	113	110	166	166	100.2	100.3	8333.0	8332.3
6	109	110	166	166	100.0	91.0	6667.0	5333.3
7	109	109	158	158	90.3	80.7	10000.0	16667.0
8	113	113	163	163	100.7	90.4	10000.0	6667.0
9	112	112	164	164	100.1	91.0	11667.0	5000.0
10	109	109	163	158	90.3	91.0	8333.0	13333.2
11	109	109	158	158	80.7	91.0	6667.0	8332.3
12	111	111	163	163	100.3	91.0	6667.0	13333.2
13	111	110	161	161	90.2	91.0	8333.0	8333.3
14	110	109	161	161	100.0	90.3	8333.0	6667.0
15	109	109	159	159	80.6	100.5	9667.0	8332.3
16	111	111	161	161	110.0	100.0	10000.0	10000.0
17	111	111	161	161	90.1	100.2	5000.0	8332.3
18	110	110	159	159	90.3	910.0	150000.0	10000.0
Treatment Means	111.1	110.8	162.7	162.7	95.4	94.4	9148.2	9184.8
Variance	2.8	2.6	13.6	13.1	57.2	43.4	6264036.0	9075422.0
Standard deviation	1.7	1.6	3.7	3.6	7.5	6.0	2502.8	3012.5
Variance of the difference between mean		0.0363		0.0096		5.0291		901139.5
Standard deviation of the difference		0.1906		0.0981		2.2426		949.283
T - value		1.662		0.5664		0.4434		-0.0386

Table 2: Effect of Hall tonic on yield and yield components

	Spikes m^{-2} Harvest index (%)		Grains $spike^{-1}$				1000 g wt (g)		Grain yield (kg $ha)^{-1}$	
Plots	Control	Hall tonic	Control	Hall tonic	Control	Hall tonic	Control	Hall tonic	Control	Hall tonic
1	133	141	46.6	46.6	45.0	46.6	4200.0	3266.6	63.0	49.0
2	141	170	44	53.6	50.5	53.6	3266.6	2499.9	40.0	37.5
3	160	160	52	45.6	44.5	45.6	3833.2	3633.2	29.0	43.6
4	169	169	63.3	50	46.9	50.0	3333.3	2866.6	33.3	28.6
5	135	200	41	52.3	46.6	52.3	2833.3	2633.3	34.0	32.0
6	150	199	44.3	65.3	41.2	65.3	2833.3	3166.6	43.0	59.6
7	160	133	44	43.3	49.0	43.3	3999.9	3933.2	40.0	24.0
8	121	149	44	47	51.5	47.0	2799.9	2933.3	28.0	44.0
9	165	149	51	36	41.7	36.0	3333.3	2466.6	29.0	49.3
10	215	158	55	44	40.5	44.0	3166.6	3499.9	38.0	26.3
11	144	180	44	51.6	49.5	51.6	2666.6	3199.9	40.0	38.4
12	158	212	45	61.6	45.9	61.6	3166.6	3933.2	48.0	30.0
13	138	171	37	50.6	45.8	50.6	3333.3	2999.9	40.0	36.0
14	181	184	52	55	51.6	55.0	2866.6	2333.3	34.4	35.0
15	164	198	36.3	59.3	45	59.3	2466.6	2299.9	26.0	28.0
16	143	136	36.3	45.6	48.4	45.6	2733.3	2833.3	27.3	28.3
17	150	180	59.3	50	58.3	50.0	2866.6	3333.3	57.3	40.0
18	200	174	57	55	47.3	55.0	2799.9	2666.6	56	27.0
Treatment Mean	157.1	170.2	47.31	50.88	47.18	50.14	3138.83	3027.7	39.24	36.46
Variance	558.9	540.9	62.1	49.7	18.48	12.63	228529.9	258443.4	118.0	92.9
Standard deviation	23.6	23.3	7.9	7.1	4.3	3.55	478.05	508.37	10.8	9.6
Variance of the difference between mean		57.3391		7.433		1.3509		13304.54		10.18
Standard deviation Of the different		7.5723		2.7264		1.1623		1153453.0		3.19
T - value		-1.7315		-1.2838		-2.5524		0.9634		0.87

t-test values. These findings agree with those of Naphde ***et al.*** (1990). The average biological yield was slightly higher with hall tonic (9184 kg ha^{-1}) as compared with no hall tonic (9148 kg ha^{-1}) however, there was no difference in the range i.e. 5000 to 13333 kg ha^{-1}. The variance and standard deviation shows that values under hall tonic were much scattered from the mean than without hall tonic. Similarly Naphde (1990) and Khattak and Bhatti (1983) agreed that trace elements had no effect on biological yield. Although there was not much difference in the range of values, yet the harvest index for control (39.2) was higher than with hall tonic (36.5) (Table 2). However, the differences among the means were not significant because the calculated t-value was much smaller than the tabulated value. According to the variance and standard deviation, the values under hall tonic were much closer to the means. The average number of days to 50% with heading, the range, the variance and standard deviation did not

change with or without hall tonic nor differences were detected by t-value.

The average number of spikes m^{-2} with (170.2) and without (157.1) hall tonic ranged from 133 to 212 and 121 to 215, respectively (Table 2). Inspite of this numerical difference, t-test was not able to detect the differences and the variance and standard deviation exhibited similar uniformity for both the values under both treatments. The average number of grains $spike^{-1}$ increased from 47.3 in control to 50.9 with hall tonic application. The number of grains $spike^{-1}$ ranged from 121 to 215 without and 133 to 212 with hall tonic application. Although there were numerical difference in variance, the standard deviation for both the treatments was almost the same. The calculated t-value was smaller than tabulated t-value. The findings of SodaPhal and Das (1961) and Khan (1983) do not support the present results. The 1000-grains weight significantly increased (50.1 g) with the application of hall tonic, clearly exhibited by t-value. The values ranged from 36 to 65.3 and 45 to 58.3 in plots with and without hall tonic application. The deviation from the means was smaller in plots with hall tonic than with no hall tonic. These results are strongly supported by Khan (1983) and Trusova and Arnautova (1998). Grain yield ranged from 2667 to 4200 kg ha^{-1} in control and 2667 to 3933 kg ha^{-1} with hall tonic, respectively. The average grain yield in plots with and without hall tonic was 3028 and 3139, respectively with no significant difference detected by t-value. Although there were numerical differences in variance and standard deviation, yet the numerical differences were not enough to warrant statistical differences. It is concluded that hall tonic application to wheat CV. Inqilab-91 exhibited slightly increasing tendency in some of the reproductive traits, yet the increase was not projected in grain yield.

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