Indian Journal of Agronomy **44** (4) : 754–759 (December 1999)

Effect of organic manure, fertilizer level and seed rate on yield and quality of late-sown wheat (*Triticum aestivum*)

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Received: August 1998

ABSTRACT

A fixed plot field experiment was conducted during winter during seasons of 1992–94, to study the effect of organic manure, fertilizer level and seed rate on yield and quality of late-sown wheat (*Triticum aestivum* L. emend. Fiori & Paol.). Organic manuring at 10 tonnes/ha recorded higher values of yield attributes, grain and straw yields, grain protein content, net return and net return/rupee investment than no organic manure. Application of 150% more than recommended dose of fertilizers (100:50:25 kg N : P : K/ha) recorded significantly higher grain yield, harvest index and grain protein content than the lower levels of fertilizers. However, net return and net return/rupee investment with 125% or 150% more application of fertilizers than the recommended dose were at par. The seed rate of 200 kg/ha recorded significantly higher grain and straw yields than 150 and 100 kg/ha but both net return and net return/rupee investment were at par with 150 kg seed rate. Protein content in grain was unaffected by seed rates. The seed rate of 150 kg/ha recorded significantly higher harvest index than 200 kg seed/ha. Application of 10 tonnes/ha organic manure along with the recommended dose of fertilizer resulted in the same yield as obtained with 125% higher dose of fertilizers. However, 10 tonnes organic manure together with 125% more than the recommended dose of fertilizers recorded significantly higher grain yield than the application of 150% more fertilizers alone.

Key words : Late-sown wheat, Organic manure, Fertilizer, Seed rate, yield, Quality

In rice–wheat cropping sequence, wheat sowing gets delayed and wheat grown in such a sequence requires higher quantity of fertilizer to cope up with adverse growing situations. Combined use of organic manure and chemical fertilizers plays a key role in modern agriculture for increasing the productivity of crop and the sustained management of soil fertility. Similarly, low tillering and poor plant stand are the major problems in realizing the potential yield of wheat under late-sown condition. However,

with the adoption of modern agronomic management, optimum plant population can be maintained by the use of appropriate quantity of seed. Hence an experiment was planned to find out the effect of organic manure, fertilizer levels and seed rates on yield and quality of late-sown wheat.

MATERIALS AND METHODS

A field experiment was conducted at research farm of Rajendra Agricultural University, Pusa (Samastipur), during winter seasons of 1992–94. The soil of the experimental field was clay loam and calcareous in nature, with pH 7.9. It was low in organic carbon (0.34%). Available N (225.0 kg/ha), P_2O_5 (16.8 kg/ha) and K_2O (132.0 kg/ha). The experiment was laid out in randomized block design, comprising 2 levels of organic manure (0 and 10 tonnes FYM/ha), 3 levels of fertilizer : F_1, recommended dose of fertilizers; F_2, 125% of the recommended dose of fertilizers; and F_3, 150% of the recommended dose of fertilizers and 3 seed rates (S_1, 100 kg/ha; S_2, 150 kg/ha; and S_3, 200 kg/ha) and was replicated thrice. The recommended dose of fertilizers was 100 kg N + 50 kg P_2O_5 + 25 kg K_2O/ha. Variety 'HUW 234' was sown in rows 18 cm apart on 29,25 and 25 December in 1992, 1993 and 1994 respectively. Well-decomposed farmyard manure was applied as per treatment at the time of sowing. Half dose of N and full of P and K as per treatment were applied at the time of sowing and the remaining N as per treatment was top-dressed after first irrigation at initial tillering stage (30 DAS). The N, P and K were applied through DAP, urea and muriate of potash. The crop received 3 uniform irrigations and was harvested on 16, 15 and 12 April in respective years.

RESULTS AND DISCUSSION

Yield attributes

Addition of 10 tonnes organic manure/ha resulted in significantly higher values for yield-attributing characters, i.e. ears/m row length, ear length, grains/ear and test weight, in all the years except test weight in the first year (Table 1) than no organic manure. Application of 150% of recommended dose of fertilizers recorded the maximum values of these indices which were at par with 125% of the recommended dose of fertilizers except length/ear in first year and these were significantly higher than the recommended dose of fertilizers in all the years. All the yield-attributing characters, except ears, were reduced with increasing seed rates, and significantly lower values were recorded at 200 kg/ha seed rate than 100 kg/ha. However, the number of ears was registered with the seed rate of 200 kg/ha which was at par with 150 kg/ha. Both recorded significantly higher ear/m row length than 100 kg/ha seed rate.

Grain and straw yield

Organic manure had significant influence on grain yield, straw yield and harvest index in all the years except harvest index in first year. Application of 10 tonnes organic manure/ha recorded significantly higher grain and straw yields than no organic manure and sustained the productivity of wheat. Grain and straw yields also varied significantly among different fertilizer levels (Tables 1, 2).

Table 1. Effect of organic manure, fertilizer levels and seed rates on yield attributes an yield of wheat

Treatment	Ear/m row length			Ear length (cm)			Grains/ ear			Test weight (g)			Grain yield (q/ha)			
	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3	Pooled
M_0	60.0	65.67	69.22	7.56	7.80	8.10	37.66	39.20	40.61	32.44	33.48	34.95	25.30	29.09	30.33	28.24
M_1	64.63	70.76	73.22	7.81	8.13	8.38	39.59	41.68	43.07	32.75	33.96	35.46	28.14	32.51	34.15	31.60
CD (P = 0.05)	2.76	2.95	2.29	0.22	0.27	0.24	1.26	1.48	1.67	NS	0.36	0.32	0.62	0.64	0.58	0.72
F_1	58.46	64.33	67.56	7.46	7.68	7.94	36.11	37.96	39.42	32.23	33.45	34.99	24.76	27.84	29.17	27.26
F_2	62.96	68.89	71.89	7.64	7.99	8.31	39.55	41.16	42.53	32.66	33.80	35.20	27.22	31.65	33.31	30.73
F_3	65.57	71.44	74.22	7.96	8.22	8.46	40.22	42.19	43.58	32.81	33.91	35.43	28.18	32.92	34.24	31.78
CD (P = 0.05)	3.34	3.61	2.82	0.27	0.33	0.30	1.55	1.81	2.05	0.51	0.43	0.39	0.76	0.78	0.61	0.87
S_1	51.77	64.0	66.72	7.90	8.21	8.52	40.20	41.76	43.33	32.85	33.98	35.46	23.92	28.29	29.78	27.33
S_2	65.46	68.72	72.0	7.68	7.92	8.22	38.74	40.27	41.69	32.53	33.64	35.11	27.57	31.45	32.83	30.62
S_3	69.76	71.94	74.94	7.48	7.77	7.97	36.94	39.28	40.51	32.42	33.54	35.05	28.67	32.66	34.11	31.81
CD (P = 0.05)	3.34	3.61	2.82	0.27	0.33	0.30	1.55	1.81	2.05	0.51	0.43	0.39	0.76	0.78	0.61	0.87

Y_1, 1992–93; Y_2, 1993–94; Y_3, 1994–94
Details of treatments are given under Materials and Methods

Table 2. Effect of organic manure, fertilizer levels and seed rates on economic and protein content of wheat grain

Treatment	Straw yield (q/ha)			Harvest index (%)			Net return (Rs/ha)			Net return/rupee invested (Rs/Re)			Protein content (%)		
	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3	Y_1	Y_2	Y_3
M_0	35.01	39.77	41.57	41.95	42.25	42.30	7,797	10,168	10,948	0.93	1.22	1.31	12.16	12.32	12.40
M_1	38.51	43.69	45.69	42.22	42.66	42.77	8,967	11,670	12,690	1.00	1.30	1.42	12.30	12.48	12.60
CD (P=0.05)	0.86	0.96	0.86	NS	0.24	0.31	530	550	590	0.06	0.09	0.08	0.11	0.13	0.11
F_1	34.50	38.20	39.94	41.78	42.16	42.21	7,699	9,609	10,448	0.95	1.18	1.29	12.12	12.28	12.38
F_2	37.34	42.77	44.80	42.16	42.53	42.65	8,691	11,450	12,483	1.01	1.32	1.44	12.25	12.44	12.52
F_3	38.44	44.22	45.85	42.30	42.68	42.75	8,755	11,703	12,526	0.95	1.28	1.37	12.32	12.48	12.59
CD (P=0.05)	1.05	1.20	1.01	0.36	0.30	0.39	646	672	723	0.08	0.11	0.09	0.14	0.16	0.13
S_1	32.77	38.34	40.09	42.19	42.46	42.62	6,883	9,625	10,545	0.82	1.15	1.26	12.30	12.45	12.56
S_2	37.64	42.33	44.00	42.28	42.63	42.73	8,895	11,304	12,161	1.03	1.31	1.41	12.21	12.39	12.49
S_3	39.87	44.52	46.50	41.83	42.32	42.32	9,368	11,828	12,751	1.05	1.32	1.42	12.18	12.36	12.45
CD (P = 0.05)	1.05	1.20	1.01	0.36	0.30	0.39	646	672	723	0.08	0.11	0.09	NS	NS	NS

Y_1, 1992–93; Y_2, 1993–94; Y_3, 1994–95
Details of treatments are given under Materials and Methods

Significantly higher yield was recorded at 150 recommended dose of fertilizers. This was due to favourable effect of increasing fertilizer levels on yield-attributing characters which finally resulted in higher grain yield. The increase in grain yield owing to increasing levels of fertilizer might also have been due to adequate quantities and balanced proportions of plant nutrients applied to the crop during the growth period. Similar observations were reported by Singh *et al.* (1993). Harvest index varied significantly up to 125% of recommended dose of fertilizers. Seed rate of 200 kg/ha recorded significantly higher grain and straw yields than of 150 and 100 kg/ha. The increase in ears per unit area was responsible for higher yield under high seeding rate than low seed rate. This was owing to increase in economic sink capacity. The higher plant population might have resulted in increased utilization of natural resources particularly, soil nutrients, moisture, carbondioxide and radiant energy. This finding corroborates with the result of Upadhyaya and Tiwari (1996). Addition of 10 tonnes organic manure/ha together with 125% more than the recommended dose of fertilizers resulted in significantly higher grain yield than the application of 150% more dose of fertilizers alone. Similar result was obtained by Narang and Bhandari (1992). The seed rate of 150 kg/ha also recorded significantly higher harvest index than 200 kg seed rate/ha. Excessive production of plant biomass than grain development with increased population beyond 150 kg/ha seed rate reacted in decreased harvest index.

Table 3. Interaction effect of organic manure and fertilizer levels on grain yield (pooled)

Fertilizer	Organic manure	
	M_0	M_1
F_1	25.88	28.63
F_2	28.76	32.69
F_3	30.08	33.47
CD (P = 0.05)	1.29	

Details of fertilizer/ organic manure are given under Materials and Methods

Quality

Application of 10 tonnes organic manure/ha recorded significantly higher protein content in grain than without organic manure application. Similarly, 150% of recommended dose of fertilizers recorded significantly higher protein content than recommended dose of fertilizers. Higher protein content at higher levels of fertilizer and organic manure was due to higher N content and N-uptake by the crop, resulting from balanced application of fertilizers and improved physical soil environment with the application of organic manure. Seed rates had no significant influence on protein content in grain.

Economics

Addition of 10 tonnes organic manure/ha resulted in maximum net return and net return/rupee investment than no organic manure. Among the fertilizer levels, net return increased with increasing level of fertilizer but significant difference was obtained only up to 125% recommended dose of fertilizers. Further increase in fertilizer level decreased the net return/rupee of investment. This was due to high cost of chemical fertilizers and diminishing trend of increase in grain yield. Net return

and net return/rupee investment increased significantly up to 150 kg seed rate/ha. Further increase in seed rate failed to produce any significant effect. Jain *et al.* (1991) also reported similar results.

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