

Yield, quality and nutrient removal of wheat (*Triticum aestivum*) as influenced by levels and sources of fertilizer

A.K. AUTI, S.C. WADILE AND V.S. PAWAR

Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra 413 722

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ABSTRACT

Response of 'HD 2189' wheat (*Triticum aestivum* L. emend. Fiori & Paol.) to different levels and sources of fertilizer was studied during the winter (*rabi*) season of 1993-94 and 1994-95, to investigate efficiency of 5 sources of fertilizer at 4 levels of fertilizer in relation to yield, quality and uptake of nutrients. The grain yield, straw yield and protein content were increased significantly with the increase in levels of NPK. The yield of grain was 19.73, 30.93, 39.03 and 45.62 q/ha due to application of 30, 15 and 15; 60, 30 and 30; 90, 45 and 45 and 120, 60 and 60 kg/ha N, P₂O₅ and K₂O respectively. Significant improvement due to increased levels of NPK was also noticed for uptake of nutrients. There were no significant differences between the sources tried in terms of yield, protein content and uptake of nutrient, indicating equal availability of nutrients from all sources.

Key words: Fertilizer levels and sources, Wheat, Uptake of nutrients

There has been a considerable change in the use of fertilizer products in recent years. World trend at present is for use of complex fertilizer containing more than one nutrient in chemical combination. Rashtriya Chemical and Fertilizers Ltd, Mumbai, has, therefore, taken up a developmental product of the new promising urea nitrophosphate, viz. 19 : 19 : 0 and 27 : 9 : 0 (kg/ha of N, P₂O₅ and K₂O). These are new of its kind and it is claimed that uptake of nutrients and efficiency of N and P increase resulting in increased production. The present work was thus undertaken to compare the efficiencies of important nitrophosphate with straight fertilizers for wheat.

MATERIALS AND METHODS

The field experiment was conducted at the Central campus farm of MPKV, Rahuri, during the winter (*rabi*) season of 1993-94 and 1994-95. Soil was clay in texture with pH 8.2. It was low in available nitrogen (153.53 kg/ha), medium in available phosphorus (17.92 kg/ha) and rich in available potassium (448 kg/ha). A field trial was conducted in split-plot design with 3 replications. The main plot treatment received 4 levels of fertilizer, viz. 30, 15 and 15; 60, 30 and 30; 90, 45 and 45; and 120, 60 and 60 kg of N, P₂O₅, K₂O/ha and sub-plot treatment received 5 sources of fertilizer, viz. straight fertilizers (urea, single superphosphate), 20 : 20 : 0 (Zuari), 23 : 23 : 0 (Deepak), 19 : 19 : 0 (RCF)

Table 1. Growth and yield attributes of wheat as influenced by levels and sources of fertilizers

Treatment	Plant height (cm)		Dry matter/plant at harvest (g)		Productive tillers/plant		Length of panicle (cm)		Grains/panicle		Grain weight/panicle (g)		1,000-grain weight (g)		
	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	Y ₁	Y ₂	
<i>Fertilizer (N : P₂O₅, K₂O kg/ha)</i>															
30 : 15 : 15	77.2	76.8	5.78	6.6	0.28	0.29	6.29	7.14	35.9	34.5	1.55	1.29	36.4	37.0	
60 : 30 : 30	83.6	83.1	6.26	7.42	0.39	0.42	7.21	7.96	38.0	34.4	1.76	1.46	38.0	38.1	
90 : 45 : 45	88.3	89.7	6.56	8.28	0.63	0.67	7.93	9.38	39.0	44.4	1.98	1.80	41.2	39.0	
120 : 60 : 60	93.8	93.9	6.83	9.09	0.95	0.97	8.30	9.93	42.1	48.2	2.23	1.81	44.2	39.1	
CD (P = 0.05)	1.51	2.9	0.15	0.48	0.05	0.06	0.53	0.50	1.06	1.7	0.03	0.02	1.07	0.55	
<i>Fertilizer sources</i>															
Straight fertilizers	86.8	86.9	6.47	7.84	0.58	0.59	7.39	8.65	39.8	41.5	1.9	1.6	39.5	38.6	
20 : 20 : 0 (Zuari)	85.2	85.6	6.32	7.82	0.55	0.57	7.30	8.52	38.2	40.5	1.87	1.55	40.1	38.0	
23 : 23 : 0 (Deepak)	85.5	86.2	6.28	7.85	0.56	0.59	7.37	8.59	38.7	41.1	1.87	1.57	39.9	38.3	
19 : 19 : 0 (RCF)	85.0	86.6	6.36	7.87	0.55	0.58	7.6	8.71	38.2	41.2	1.88	1.6	39.8	38.3	
27 : 9 : 0 (RCF)	86.0	86.0	6.35	7.86	0.57	0.6	7.52	8.54	39.0	41.3	1.89	1.61	40.5	38.4	
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	

Y₁, 1993-94; Y₂, 1994-95

Table 2. Grain and straw yields, protein content, uptake of nitrogen, phosphorus and potassium by wheat and residual balance in post-harvest soil as influenced by levels and sources of fertilizers

Treatment	Grain yield (q/ha)			Straw yield (q/ha)			Protein content in grains (%)		Uptake (kg/ha) (average of 2 years)			Available N, P, K after harvest (kg/ha) (average of 2 years)		
	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	Pooled	Y ₁	Y ₂	N	P	K	N	P	K
<i>Fertilizer (N : P₂O₅, K₂O kg/ha)</i>														
30 : 15 : 15	19.09	20.38	19.73	24.26	26.43	25.34	11.65	11.06	43.62	7.14	42.53	138.22	17.39	427.52
60 : 30 : 30	30.05	31.81	30.93	38.23	38.97	38.60	12.57	11.34	73.06	13.50	71.67	141.48	19.19	437.72
90 : 45 : 45	39.36	38.70	39.03	41.63	47.88	44.75	13.03	11.92	90.29	17.45	89.82	146.66	21.54	449.64
120 : 60 : 60	45.30	45.94	45.62	49.85	57.21	53.53	13.20	12.15	116.49	24.24	122.39	154.69	23.42	460.21
CD (P = 0.05)	2.32	1.00	1.79	5.38	2.91	4.32	0.16	0.07	4.20	1.12	7.15	3.34	1.41	8.57
<i>Fertilizer sources</i>														
Straight fertilizers	34.80	34.80	34.80	37.96	42.76	40.36	12.64	11.62	83.32	15.82	81.92	144.96	20.52	443.69
20 : 20 : 0 (Zuari)	31.50	33.21	32.35	38.33	41.40	39.86	12.64	11.57	77.52	15.02	79.21	145.96	20.10	444.24
23 : 23 : 0 (Deepak)	33.33	34.23	33.78	39.51	42.48	40.99	12.56	11.62	80.45	15.44	82.31	145.28	20.62	443.62
19 : 19 : 0 (RCF)	34.08	34.23	34.15	37.87	42.22	40.04	12.62	11.62	81.62	15.69	81.56	145.00	20.41	443.66
27 : 9 : 0 (RCF)	33.60	34.58	34.09	38.80	42.59	40.69	12.60	11.64	81.43	15.99	82.91	145.11	20.31	443.66
CD (P = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Y₁, 1993-94; Y₂, 1994-95

and 27 : 9 : 0 (RCF). Half dose of N and full dose of P and K were applied at sowing as per the sources and levels and remaining half dose of N was top-dressed 27 days after sowing through urea. Deficit of phosphate in 27 : 9 : 0 was adjusted through single superphosphate at sowing. All the treatments received K through muriate of potash. Mean maximum and minimum temperatures during both the years increased from ninth meteorological week onwards resulting in increased daily evapotranspiration. Because of increased temperature during later phase, the crop matured within 105 days.

RESULTS AND DISCUSSION

Grain and straw yield and protein content

Grain and straw yields and protein content increased significantly during both the seasons with the increase in fertilizer level. The grain and straw yields obtained with recommended dose of fertilizer were the highest. This was perhaps due to abundant supply of plant nutrients which increased the protoplasmic constituents and accelerated the process of cell-division and elongation. This in turn increased the values of growth and yield-contributing attributes which finally reflected in increased grain and straw yields of wheat. The sources of fertilizer were almost similar in increasing the grain and straw yields and protein content. However, grain yield was highest due to application of straight fertilizers. This might be due to ease in mineralization of urea with no residual effect and P in single superphosphate is in watersoluble form and is readily taken up by plant. The calcium sulphate content in single superphosphate also supplied other nutrients, viz. calcium and sulphur, which are reported to be essential for plant growth. Similar results were also observed by Singh (1986) and Pol *et al.* (1991).

Uptake of nutrients

The total uptake of N, P and K due to various levels of fertilizer were found significant and increased with the increase in levels

of fertilizer. The highest uptake of nutrients was noticed due to recommended dose (120, 60 and 60 kg/ha of N, P₂O₅ and K₂O) which was highly significant compared to those of the reduced levels of fertilizer. This was mainly due to the fact that better nutrient utilization by more healthy and vigorous plants under recommended level and resulting in more dry-matter accumulation, which ultimately increased the total uptake of NPK/ha. The uptake of N, P and K did not differ significantly due to various sources tried. Thus, the beneficial effects of 27 : 9 : 0 and 19 : 19 : 0 manufactured by RCF were not conspicuous as claimed in forms of yield and uptake of nutrients. The observations are in agreement with those of Jain and Jain (1993) and Ashok Kumar *et al.* (1995).

Residual NPK after harvest

Available N, P and K in the soil after harvest increased with each successive increase in fertilizer level. Maximum left-over of NPK was observed where 120, 60 and 60 kg of N, P₂O₅, K₂O/ha were applied. This might be due to addition of more N, P and K into the soil through fertilizer. The available NPK in soil after harvest was not significant due to various sources of fertilizer, indicating the equal availability of nutrients from all the sources.

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