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Short Note

Nutrient source management in wheat and its residual effect on paddy under mid-hill conditions of Himachal Pradesh

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Rice –wheat is the major crop sequence in India. It occupies an area of 10 m. ha and contributes about 25 % of total food grain production. It is estimated that by 2010 about 246 million tones of food grain will be needed annually and to produce this quantity, about 25 million tones of plant nutrients as mineral fertilizers would be needed (Anonymous, 2001). But long-term experiments have revealed that continuous and intensive use of chemical fertilizers has resulted in deterioration of soil health, environmental pollution and stagnation on crop productivity. So to meet out nutrient requirements and to maintain soil health, integrated nutrient management system has great promise. Moreover organic manures also result in residual effects on the next crop.

This study was conducted during the *Rabi* season of 2000-2001 on wheat crop (variety Surabhi) at the experimental farm of CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.) under rainfed conditions. Treatments comprised of *Azotobacter* treatment *i.e.* uninoculated and inoculated, FYM i.e. No FYM and FYM @ 10 t/ha and three levels of N i.e. 50 %, 75 % and 100 % of recommended N and with one absolute control. Recommended dose (RD) of N for wheat was 120 kg/ha. All the treatments were laid out in randomized block design (factorial RBD) with three replications. The pH and organic carbon content of soil were 5.6 (acidic) and 0.99 % (high), respectively. The available N, P and K were 209 (low), 17 (medium) and 224 (medium) kg/ha, respectively. Presowing inoculation of seeds was done with *Azotobacter chroococcum*. Paddy crop was taken as next crop in the same layout. No application of manures or fertilizers was done in the succeeding paddy crop so as to determine the residual effect of various treatments applied to wheat in the previous season.

Azotobacter inoculation, FYM application and increasing levels of N up to 100 per cent resulted in significantly higher grain yield of wheat (Table 1). Similar results have also been reported by Tomar *et al.* (1995).

Table 1. Effect of *Azotobacter* inoculation, FYM application and nitrogen levels on grain yield of wheat and residual effect on paddy

Treatments	Grain yield of wheat (q/ha)	Residual effect on paddy (at harvest)							
		Plant height (cm)	No. of shoots/m row length	Effective tillers/ m row length	Panicle weight (g)	1000-grain weight (g)	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index
Azotobacter									
Uninoculated	28.98	77.50	83.66	39.50	15.08	23.32	19.78	33.60	38
Inoculated	31.38	77.16	83.44	38.44	14.70	24.33	22.46	33.60	40
CD (P=0.05)	0.66	NS	NS	NS	NS	0.28	1.76	NS	NS
FYM application									
No FYM	27.45	76.16	80.06	38.11	14.54	23.34	19.55	33.13	37
FYM @10t/ha	32.91	78.50	87.06	39.83	15.24	24.32	22.69	34.06	41
CD (P=0.05)	0.66	NS	2.40	NS	0.56	0.28	1.76	NS	NS
N levels									
50% RDF	27.00	72.50	75.42	36.16	13.55	22.50	18.26	32.37	36
75% RDF	30.38	75.25	79.75	39.50	14.63	24.28	21.18	33.76	39
100% RDF	33.16	84.25	95.50	41.25	16.51	24.70	23.93	34.65	40
CD (P=0.05)	0.81	4.16	2.95	2.87	0.68	0.34	2.15	1.74	6.7
Control vs. others									
Absolute control	22.94	65.85	64.46	20.67	10.75	18.52	13.72	28.44	32
Others	30.18	77.33	83.55	38.97	14.89	23.83	21.12	33.60	39
CD (P=0.05)	1.19	6.10	4.1	4.2	0.99	0.52	3.16	2.54	9.8

The increase in grain yield due to seed inoculation was 8.81 per cent over uninoculation, 14.37 per cent with FYM application over no FYM; 10.4 per cent and 7.25 per cent due to application of 100 per cent of recommended N over 50 and 75 per cent of recommended N, respectively.

Inoculation with *Azotobacter*, application of FYM and application of 100 per cent of recommended dose of nitrogen resulted in higher grain yield and yield attributing characters in paddy crop over uninoculation, no FYM and application of 50 and 75 per cent of recommended dose of Nitrogen. Inoculation with *Azotobacter* did not significantly influence the yield attributes in paddy except 1000 grain weight.

Application of FYM resulted in significantly higher plant height, number of shoots, panicle weight and 1000 grain weight over no FYM application. Application of 100 % of recommended nitrogen showed higher residual effect than other treatments. Inoculation with *Azotobacter*, application of FYM and application of N at 100 per cent of recommended nitrogen, resulted in significantly higher residual effect in form of grain yield over uninoculated, no FYM and 50 per cent and 75 % of recommended nitrogen treatments, respectively. Similar trends have also been reported by Sharma and Mitra (1990) and Shivanker *et al.* (1993). The per cent increase in paddy yield due to *Azotobacter* inoculation was 11.9 per cent over uninoculated, due to FYM it was 13.8 per cent over no FYM and 11.5 per cent and 23.7 per cent due to 100 per cent of recommended nitrogen over 75 per cent and 50 per cent of recommended nitrogen, respectively. Increase in grain yield due to mean effects of various combinations over control was 35 per cent.

Azotobacter help in increasing crop productivity by way of increased biological nitrogen fixation and increased availability of nutrients through solubilization, which increases cell elongation, cell division, which ultimately improves growth characters like plant height and shoot number, which ultimately results in higher grain and straw yields (Lakshminarayanan *et al*(1992)).Taller plants, higher number of shoots per unit area and increased synthesis and accumulation of carbohydrates resulted in higher dry matter accumulation with the inoculation of seed, FYM application and 100 per cent of recommended dose of nitrogen, which in turn resulted in significantly higher grain yield of succeeding paddy crop. Thus it can be concluded that inoculation of wheat seed with *Azotobacter*, application of FYM and application of recommended dose of nitrogen not only results in higher grain yield in wheat but also have a significant residual effect on the yield of succeeding paddy crop.

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