

Effect of fertilizer and *Azospirillum* on grain yield of rainfed wheat (*Triticum aestivum*)

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ABSTRACT

An experiment was conducted during the winter season (*rabi*) of 1992–93 and 1993–94 on the effect of levels of fertilizer and biofertilizer (*Azospirillum*) inoculation on grain yield of rainfed wheat (*Triticum aestivum* L. emend. Fiori & Paol.). Number of tillers and yield attributes were improved on application of fertilizers and *Azospirillum*. Highest mean grain yield of 14.43 q/ha and cost: benefit ratio of 1 : 1.79 was found with full dose of N, P and K @ 30, 8.73 and 8.33 kg/ha. However, it was on par with 50% dose of NPK + biofertilizer giving 12.59 q/ha yield with a cost: benefit ratio of 1 : 1.54.

Wheat (*Triticum aestivum* L. emend. Fiori & Paol.) crop is largely grown as rainfed during the winter season, (*rabi*) in Satpur Plateau zone of Madhya Pradesh. The yield of rainfed wheat is much lower not only due to less moisture availability in soil but also on account of poor nutrient management. In view of hike in chemical fertilizer, it is imperative to popularize use of bio-fertilizer which is a low-cost input technology to reduce the dependence of fertilizers and to contribute in pollution-free atmosphere which is the greatest need of the day. Surprisingly even with easy availability of biofertilizer for cereals, the use of *Azospirillum* as organic fertilizer in wheat is not so popular, perhaps owing to lack of information on location-specific area. Hence an experiment was conducted to study the effect of fertilizer and *Azospirillum* on grain yield of rainfed wheat.

MATERIALS AND METHODS

The experiment was carried out under

rainfed condition at ZARS, JNKVV Chhindwara, during the winter season (*rabi*) 1992–93 and 1993–94 in clay-loam soil. The available nutrients N, P and K in soil were 240, 16 and 560 kg/ha, respectively, with pH 7.6. It was conducted in randomized block design replicated 4 times. 'HI 617' ('Sujata') wheat was sown on 20 October in both the years. There were total 6 treatments, viz. control, (30, 8.73 and 8.33 N, P and K kg/ha, (full package dose) 30, 8.73 and 0 N, P and K kg/ha along with *Azospirillum* inoculation with 100, 75 and 50% NPK level of package dose. Seed @ 100 kg/ha was sown at a row-to-row spacing of 30 cm in 6 m x 3.6 m, plot using country plough as fertilizer-cum-seed drill, fertilizer through the front bowl and seed through the rear. *Azospirillum* culture inoculated @ 5 g/kg seed by sprinkling *gur* emulsion (1 part *gur* : 10 part water) after monosan treatment @ 2.5 g/kg seed and thoroughly mixed with seed. The available moisture in the soil before sowing was 10.83% and therefore 1 ir-

Table 1. Effect of treatments on yield-attributing characters and yield of rainfed wheat

Treatment	Tillers/plant		Length of ear (cm)		Grains/ear		1,000-grain weight (g)		Grain yield (q/ha)	
	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94	1992-93	1993-94
	93	94	93	94	93	94	93	94	93	94
Control	2.80	3.00	2.90	6.00	6.30	6.15	30.00	31.60	30.80	36.40
N ₃₀ P _{8.73} K _{8.33}	3.25	3.77	3.51	6.93	6.30	6.62	32.00	36.70	34.35	39.55
N ₃₀ P _{8.73} K ₀	3.15	3.4	3.27	6.82	6.42	6.62	31.20	33.15	32.17	37.25
Recommended fertilizer	4.05	4.2	4.12	7.12	6.40	6.76	32.20	36.45	34.32	38.60
dose + <i>Azospirillum</i>										
75% recommended fertilizer	3.40	3.20	3.30	7.08	6.30	6.69	31.35	36.72	32.53	37.30
dose + <i>Azospirillum</i>										
50% recommended fertilizer	3.00	3.30	3.15	6.90	6.80	6.85	33.15	34.55	33.85	39.25
dose + <i>Azospirillum</i>										
CD (P = 0.05)	NS	0.29	0.41	0.69	0.50	0.40	NS	4.13	3.55	2.29
									3.64	2.71
									2.31	1.13
									2.17	2.17

rigation was given to prepare the land in 1992, whereas in 1993 there was adequate moisture in the soil (18.5%). The mean maximum and minimum temperatures were 18–29°C and 5–6°C in both the years. The average rainfall was 634 and 850 mm during 1992–93 and 1993–94. However, 27 mm, rains were recorded in October 1993 and winter rains of 5 mm in January and February 1994. The crop was harvested on 25 February in 1993 and 8 March in 1994.

RESULTS AND DISCUSSION

Yield-attributing characters and yield

Yield-attributing characters were significantly improved by application of fertilizer and *Azospirillum* inoculation (Table 1). The highest number of tillers (4.12) were recorded with recommended dose and biofertilizer over sole compared with recommended dose and other treatments. Maximum length of ear was found with 50% recommended dose and biofertilizer, followed by recommended dose and biofertilizer over rest of the treatments. Grains/ear were the highest with recommended dose being on a par with recommended dose and biofertilizer, followed by 50% recommended dose and biofertilizer. Test weight was maximum with recommended dose followed by its application with *Azospirillum* and 50% recommended dose.

The grain yield of rainfed wheat was significantly affected due to application of fertilizer and *Azospirillum* inoculation in both the years (Table 1). The treatment receiving N, P and K @ 30, 8.73, 8.33 kg/ha gave higher grain yield of 11.6 and 17.80 q/ha in 1992–93 and 1993–94. It was on a par with 50% recommended dose + *Azospirillum* thereby indicating that at lower level (50% chemical fertilizer dose is as good as 100%). This could be due to biofertilizer inoculation

Table 2. Economics of treatments included in the experiment (mean data of 2 years)

Treatment	Response of additional produce (kg/ha)	Cost of additional produce (Rs/ha)	Cost of fertilizer + culture	Profit (Rs/ha)	Benefit: cost ratio
N ₃₀ P _{8.73} K _{8.33}	369	1,660.50	595.10	1,065.40	1 : 1.79
N ₃₀ P _{8.73} K0	57	256.50	545.10	-288.60	1 : 0.52
Recommended fertilizer dose + <i>Azospirillum</i>	212	954.00	625.10	328.90	1 : 0.53
75% recommended fertilizer dose + <i>Azospirillum</i>	31	139.50	476.25	-336.75	1 : 0.70
50% recommended fertilizer dose + <i>Azospirillum</i>	185	832.50	327.55	504.95	1 : 1.54

Price (Rs/kg) : wheat grain 4.50; N 6.17, P 41.24 and K, 6.00

which helped meet nitrogen requirement besides chemical nitrogen of rainfed wheat resulting in good yield. Significant by higher yields of sugarcane, finger millet and niger owing to *Azospirillum* were reported by Banger *et al.* (1992), Patel *et al.* (1993) and Sachidanand (1989) respectively.

Economics

Full dose of NPK (30, 8.73, 8.33 kg/ha) gave the highest benefit : cost ratio of 1 : 1.79 over other treatments, followed 50% recommended with *Azospirillum*. Thus 50% of recommended dose of fertilizer with *Azospirillum* may successfully be used as

low-cost-input technology to raise the yield of rainfed wheat. The yield response was more prominent in good winter rainfall year.

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