

Reponse of wheat (*Triticum aestivum*) to top-dressing of diammonium phosphate in rainfed areas of Shivalik foothills

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ABSTRACT

A field experiment was carried out during 1997–98 and 1998–99 to find out the response of wheat (*Triticum aestivum* L. emend. Fiori & Paol.) variety 'PBW 175' to top-dressing of diammonium phosphate (DAP) fertilizer under rainfed Shivalik foothills of Jammu, Jammu and Kashmir. Basal application of recommended dose of DAP produced significantly taller plants, more number of effective tillers/m row length, ear length and number of grains/ear which ultimately increased the grain and straw yields. An adverse effect on the yield attributes and yield was observed with the delayed application of DAP from 10 to 50 days after sowing and the reduction in grain yield was from 3.9 to 26.1% and 3.5 to 28.9% during the first and second year respectively. However, the differences in yield attributes and yield with DAP application as basal and its top-dressing 10 DAS were at par. The uptake of nutrients, viz. NPK was influenced significantly by the application of DAP at different intervals. Available phosphorus content in soil showed positive balance at the end of 2 years of experimentation.

Key words: Wheat, *Triticum aestivum*, Grain yield, Top-dressing, Phosphorus balance

Wheat is a major winter season crop of rainfed sub-tropical Shivalik foothills, covering more than 50% of the area under different winter crops. Diammonium phosphate (DAP) is generally applied basal in all the rainfed crops. But it has been observed in Kandi areas that during sowing season of wheat which coincides with winter rains, many times the diammonium phosphate is not available in adequate quantity in the market due to its abrupt and huge demands. Therefore, sometimes round about 25–30% of the area under rainfed wheat is sown without the basal application of DAP. It has also been observed that some farmers top-dress DAP in wheat crop as and when the winter rains are received. Since the information on the response of wheat to top-dressing of DAP in this region is lacking, the present investigation was carried out.

MATERIALS AND METHODS

An experiment was conducted at Dryland Agriculture Research Station, Rakh-Dhiansar, Jammu, during the winter season of 1997–98 and 1998–99. The experimental soil was sandy loam in texture and low in available N (229 kg/ha) and P (16 kg/ha) and medium in K (176 kg/ha), having pH 7.3.

The experiment was laid out in randomized block design with 3 replications. Wheat variety 'PBW 175' was sown by *pora* (funnel) method in the second week of No-

vember during both the years. The treatments consisted of: T₁, control (no P); T₂, 66 kg diammonium phosphate (DAP) as basal; T₃, 66 kg DAP top-dressed at 10 DAS; T₄, 66 kg DAP top-dressed at 20 DAS; T₅, 66 kg DAP top-dressed at 30 DAS; T₆, 66 kg DAP top-dressed at 40 DAS; and T₇, 66 kg DAP top-dressed at 50 DAS.

Application of 46 kg N/ha through urea and 20 kg K₂O/ha through muriate of potash was common to all the treatments. Full muriate of potash and 2/3rd urea were applied as basal and the remaining 1/3rd urea was top-dressed in January when winter rains were received during both the years. A total rainfall of 372.3 mm in 34 rainy days and 208.5 mm in 20 rainy days was received during the winter seasons of 1997–98 and 1998–99 respectively. In case of top-dressing of DAP, the fertilizer was broadcast in standing wheat crop and then mixed with the soil using a hand-operated medium cultivator.

RESULTS AND DISCUSSION

Basal application of DAP significantly improved the growth of wheat, as the taller wheat plants (95.9 cm) were recorded with diammonium phosphate (DAP) application as compared with the control (92.2 cm) (Table 1). Delayed application of DAP from 10 to 50 days after sowing resulted in lowering the plant height (95.4 to 92.7 cm). Similarly, values of number of effective tillers/m row

Table 1. Yield and yield-attributing characters of wheat as influenced by diammonium phosphate (DAP) application at different intervals

Treatment	Grain yield (q/ha)		Straw yield (q/ha)		Effective tillers/m row length*	Grains/ear*	1,000-grain weight (g)*	Plant height (cm)*	Ear length (cm)*
	1997-98	1998-99	1997-98	1998-99					
Control	26.85	25.92	27.78	26.37	59	33	36.1	92.2	7.7
DAP as basal practice	43.45	42.21	46.31	45.00	85	40	41.8	95.9	9.3
DAP top-dressing 10 DAS	41.82	70.79	43.21	43.20	83	40	41.3	95.4	9.1
DAP top-dressing 20 DAS	37.96	36.77	40.74	40.21	79	37	40.2	94.6	9.1
DAP top-dressing 30 DAS	36.11	34.81	39.20	37.56	74	36	39.0	93.9	8.8
DAP top-dressing 40 DAS	35.18	32.58	37.0	34.60	72	36	38.1	93.2	8.5
DAP top-dressing 50 DAS	32.10	29.99	34.26	31.33	69	43	37.2	92.7	8.2
CD (P = 0.05)	5.52	5.51	3.14	4.85	2.1	1.4	0.5	1.4	0.35

DAP, Diammonium phosphate; DAS, days after sowing; *mean data of 2 years

Table 2. Nutrient uptake of wheat, phosphorus balance in the soil after experimentation and economics of different treatments (mean data of 2 years)

Treatment	Nitrogen uptake (kg/ha)	Phosphorus uptake (kg/ha)	Potassium uptake (kg/ha)	Available soil phosphorus balance after experiment (kg/ha)	Benefit over control (%)
Control	57.85	11.8	63.11	8.03	
DAP as basal practice	95.89	19.10	103.5	10.12	63
DAP top-dressing 10 DAS	92.48	17.74	98.18	12.08	57
DAP top-dressing 20 DAS	84.76	16.86	92.11	13.09	43
DAP top-dressing 30 DAS	79.67	16.10	87.36	13.83	35
DAP top-dressing 40 DAS	67.13	15.42	82.14	14.90	29
DAP top-dressing 50 DAS	68.01	14.12	76.93	15.30	18
CD (P = 0.05)	3.55	0.89	5.25	0.46	

DAP, Diammonium phosphate; DAS, days after sowing

length, number of grains/ear and 1,000-grain weight were the highest with the basal application of DAP compared to its application 10, 20, 30, 40 and 50 days after sowing. However, there were no significant differences in these yield-attributing characters due to top-dressing of DAP at 10 days and that applied as basal. This might be due to the availability of required amounts of phosphorus to wheat plants. The values of yield-attributing characters were lowest in the control plots and with the application of DAP at 50 days, which might be due to inadequate availability of phosphorus for the growth and development of wheat plants.

Grain and straw yield

Slightly higher grain yield of wheat during 1997-98 was due to adequate and well-distributed rainfall. Significant increase in grain yield of wheat was observed with basal application of DAP in both the years (Table 1). Highest grain yield of 43.45 and 42.21 q/ha was recorded with the basal application of DAP compared to top dressing of DAP during 1997-98 and 1998-99 respectively.

However, basal application of DAP and its top-dressing 10 days were statistically at par with each other in this respect. The reason of higher grain yield being timely availability of phosphorus to crop plants. The results are in accordance with Verma *et al.* (1984). There was substantial reduction in grain yield with further delayed application of DAP by an interval of 10 days beyond 10 days after sowing during both the years. The lowest grain yield of 32.10 and 29.99 q/ha due to top-dressing of DAP was recorded with its application at 50 days and it was 35.3 and 40.7% less compared to basal application of DAP but 19.5 and 15.7% higher than the control during 1997-98 and 1998-99 respectively. Overall, the lowest grain yield of 26.85 and 25.92 q/ha was recorded under the control plots during both the corresponding years. The reason being short supply of phosphorus in absence of DAP application.

Almost similar trend was noted in case of straw yield while recording higher yield of 46.31 and 45.0 q/ha when DAP was applied basal during the respective years (Table 1). Lowest straw yield of 34.26 and 31.33 q/ha was ob-

served in the plots where DAP was applied at 50 days and it was 36.9 and 43.6% less as compared to basal application of DAP during 1997–98 and 1998–99 respectively. The grain and straw yields were also supported by yield attributes, viz. plant height, grains/ear and test weight.

Nutrient uptake

There were significant differences in the uptake of nitrogen, phosphorus and potassium due to the application of DAP at different intervals or times in wheat (Table 2). The highest uptake of 95.89, 19.10 and 103.5 kg/ha of N, P and K, respectively, was recorded with the basal application of DAP and it was statistically at par with that observed with the application of DAP at 10 days, which might be attributed to the adequate availability of these nutrients to the wheat plants. The lowest uptake of these nutrients was recorded in the control plots (N 57.85, P 11.18 and K 63.11 kg/ha) which might be due to inadequate availability of these nutrients to the crop plants.

Phosphorus balance in soil

A positive balance of phosphorus was observed in the soil after 2 years of experimentation (Table 2). The basal application of DAP recorded a balance of 10.12 kg/ha compared to 15.30 kg/ha with the application of DAP at

50 days, indicating more depletion of soil phosphorus when it was applied basal compared to DAP application at later stage of crop growth. The lowest balance of 8.03 kg/ha was recorded in the control plots. Timely application of DAP also resulted in the improvement of growth parameters (plant height, tillers/m row length) owing to improved fertility levels. Improved fertility status of the soil also resulted in superior yield-attributing characters which ultimately resulted in higher yields.

Economics

The highest benefit of 63% over the control was recorded with the recommended practice of DAP application as basal, followed by its application 10 days after sowing (DAS) (57%). The benefit over the control decreased progressively with the delayed application of DAP and it was the least when DAP was applied at 50 DAS (18%) indicating that the DAP application in wheat could safely be delayed up to 10 DAS (Table 2).

REFERENCE

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