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## Comparison of Different Methods of Fertilizer (NPK) Application

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**Abstract:** To compare the different methods of fertilizer application viz. broadcast, banding and placement, two research trials were conducted the results indicated that in the autumn, 1998 trial, highest yield (18.56 t ha<sup>-1</sup>) was recorded in T<sub>3</sub> (placement) followed by 15.94 t ha<sup>-1</sup> in T<sub>2</sub> (banding) and lowest (12.22 t ha<sup>-1</sup>) in T<sub>1</sub> (broadcast). It was noted that 52% yield was increased with placement and 30% with banding over broadcast method of fertilizer application. Similarly in autumn 1999, maximum yield (15.67 t ha<sup>-1</sup>) was recorded in T<sub>3</sub> (placement) followed by 13.9 t ha<sup>-1</sup> in T<sub>2</sub> (banding) and minimum (11.56 t ha<sup>-1</sup>) in T<sub>1</sub> (broadcast). Using banding and placement method of fertilizer application, 20.24 and 35.55% increase in potato yield was recorded over broadcasting of fertilizer, respectively. A significant difference was found in the three methods of fertilizer application.

**Key words:** Broadcast, banding, placement methods of fertilizer (NPK) application, Pakistan

### Introduction

For optimum growth and development of the potato crop all essential nutrients should be available in sufficient amount. In Pakistan most of the potato growers still apply NPK through broadcasting. They are not aware with the other methods. Fertilizer application by banding or placing near tubers is rarely used. In farmer practice fertilizer is broadcast "on the flat", i.e., before the land has been ridged and the crop planted. Fertilizer applied in this way is more likely to be localized around and above the seed tubers. The broadcast of fertilizer does not ensure its proper utilization by the potato plant having limited root system. Therefore it is important to place the fertilizer where it would be intercepted greatly by the active roots.

Grewal *et al.* (1979) reported that in acidic brown hill soil of Simla, placement of fertilizer either in furrow or inside bands was significantly superior to broadcasting with respect to yield and nitrogen uptake by tubers. Sharma *et al.* (1978) also reported that placement of phosphorus fertilizer near the active root zone of the plant is recommended because most of the applied phosphorus is fixed by the soil and is not mobile. Mahmood *et al.* (2000) proved through experiments that with banding and placement method of fertilizer application potato yield could be increased upto 15 and 30% over broadcast, respectively. Malik (1995) reported that by broadcasting, fertilizer is less concentrated in the root zone of the plant. Using the banding or placement method will reduce the amount of fertilizer used. He also reported that if the soil fertility is low and fixation may occur, the placement method is advantageous. This study was planned to evaluate the different methods of fertilizer application.

### Materials and Methods

To compare the different methods of fertilizer application viz. broadcast, banding and placement, two research trials were conducted at NARC, Islamabad during autumn, 1998 and 1999. Experiments were laid out in Randomized Complete Block Design (RCBD) and three treatments, i.e., broadcast as control, banding and placement. Tubers of cultivar Desiree were planted on 22-09-1998 and 20-09-1999. The plot size was kept 12 m<sup>2</sup>. The doses of fertilizers were NPK @ 250 - 125 - 125 Kg ha<sup>-1</sup>. The half dose of nitrogen (N), full dose of phosphorus (P) and potassium (K) were applied at planting and remaining half dose of nitrogen was applied at the time of earthing up of the crop.

Burton (1989) described two main methods of fertilizer application in potato crop either broadcast before planting or placed in bands to the side of and or below the seed tubers. He further reported that latter method gives a higher concentration of nutrients near the plant and at low level of application may give better results.

Cultural practices were equally applied in all the treatments. Tubers of 1998 trial were harvested on 22-02-1999 and the other on 26-01-2000. Data regarding emergence (%), number of stems/plant, soil coverage (%), yield (t ha<sup>-1</sup>) and increase in yield (%) was recorded (Table 1 and 2) and was analyzed statistically through variance (based on randomized complete block design) and correlation was calculated using MSTAT micro computer programme, version 4.0 (Freed *et al.*, 1987).

### Results and Discussion

Data (Table 1, 2) showed that maximum emergence (84.75 %) was recorded in T<sub>1</sub> (broadcast) followed by 78 % in T<sub>3</sub>. This year emergence was comparatively low because seed was stored at high temperature during the month of August in the cold storage and had long sprouts at planting time. However, in autumn 1999 more than 90% emergence was recorded in all treatments. Maximum (94%) was noted in T<sub>2</sub> (banding) followed by 91 % in T<sub>1</sub> (broadcast).

Soil coverage was affected by fertilizer application methods, as it was maximum (89.75%) in T<sub>3</sub> (placement) followed by 85.50 % in T<sub>2</sub> and minimum (75.25%) in broadcast. Yield was significantly affected by fertilizer application methods. In autumn, 1998, highest yield (18.56 t ha<sup>-1</sup>) was recorded when fertilizer was applied through placement followed by 15.94 t ha<sup>-1</sup> in T<sub>2</sub> (banding) and lowest (12.22 t ha<sup>-1</sup>) in broadcast. Similarly, in autumn 1999 maximum yield (15.67 t ha<sup>-1</sup>) was noted when fertilizer was applied through placement followed by 13.90 t ha<sup>-1</sup> in T<sub>2</sub> (banding) and minimum (11.56 t ha<sup>-1</sup>) in T<sub>1</sub> (broadcast). This clearly depicts the overall positive response of potato crop to fertilizer and specifically highlights the importance of banding and placement method of fertilizer application. However, overall yield in the trials was comparatively low due to early frost in both the years.

Best result of placement is attributed to the fact that no fertilizer is wasted as all nutrients come in close contact with the feeding roots and plants use these nutrients efficiently. A little bit wastage of fertilizer may take place in

Table 1: Comparison of different methods of fertilizer (NPK) application, autumn 1998

Treatment	Germination (%)	Soil coverage (%)			No. of stems/plant	Yield t ha <sup>-1</sup>	% increase in yield
		45 DAP	60 DAP	75 DAP			
T <sub>1</sub> (Broadcast)	84.75A	40.0A	53.75A	72.5B	2.53	12.22B	
T <sub>2</sub> (Banding)	77.00B	40.50A	56.0A	80.25A	2.65	15.94AB	30
T <sub>3</sub> (Placement)	78.00B	40.50A	57.50A	81.75A	2.67	18.56A	52
LSD	5.504	5.927	4.139	3.817	NS	3.899	

Level of significance = 0.05, NS = Non significant

Mahmood *et al.*: Comparison of different methods of fertilizer (NPK) application

Table 2: Comparison of different methods of fertilizer (NPK) application, autumn 1999

Treatment	Germination%	Soil coverage (%)			No. of stems/plant	Yield t ha <sup>-1</sup>	% increase in yield
		45 DAP	60 DAP	75 DAP			
T <sub>1</sub> (Broadcast)	91.00	37.50 B	53.00 C	75.25 C	4.13 A	11.56 B	
T <sub>2</sub> (Banding)	94.00	41.25 A	61.25 B	85.5 B	4.235 A	13.90 A	20.24
T <sub>3</sub> (Placement)	90.25	42.25 A	66.75 A	89.75 A	3.193 B	15.67 A	35.55
LSD	7.291	3.043	4.463	3.028	0.42	2.136	

Level of significance = 0.05

banding and so % increase in yield is lower than that in the placement method. These results support the report of Prugar and Hadacova (1996). They recommended localized (banded) placement of fertilizer for crops grown with wide row spacing (> 35 cm) and for crops with long growing seasons. Nitrogen volatilization from soil was 1.5- to 3- fold lower with banded placement and plant N uptake increased by 10-30%.

Westermann (1993) reported that broadcasting before planting is satisfactory, if soil fertility is high and no appreciable soil fixation is expected. Banding during planting is a common fertilization practice. An efficient and safe band placement is about 2 inches to the side and 2 inches below the seed piece. The bands should be placed close enough to the seed pieces to provide benefits for early growth, but they must not be in direct contact with the seed pieces, or else injury may result. Nitrogen, phosphorus, potassium, magnesium and zinc were applied to study their effect on potato yield and specific gravity. There was high positive response to the application of nitrogen, phosphorus and zinc when applied in combination and banded. Banding the fertilizers also showed positive response as compared to broadcast (Amin *et al.*, 1983). Soltanpour *et al.* (1970) obtained significantly higher tuber yield due to application of granular zinc EDTA and granular zinc sulfate. The fertilizer gave better results when banded.

The results indicated that banding and placement methods are more useful than broadcast method of fertilizer application. The overall increase in yield with banding method was 25% and with placement 44%. In the plains of Punjab and NWFP where potato is planted with machines (potato planter, ridger etc), banding method is recommended, whereas in hilly areas where manual planting is still going on, placement method is more beneficial.

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