

## Nutrient management in urdbean-wheat crop sequence

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### ABSTRACT

A field experiment was conducted during 2002-03 and 2003-04 at G.B.Pant University of Agriculture and Technology, Pantnagar to study the effect of farmyard manure and phosphorus on urdbean and their residual effects on wheat under urdbean-wheat cropping system. The results revealed that yield attributes viz., pods per plant, grains per pod, 1000-grain weight and grain yield per ha in urdbean increased significantly due to direct application of 5 t ha<sup>-1</sup> farmyard manure and/or 40 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> over control. The 75% of recommended level, being at par with 100% of recommended fertilizer level, produced significantly higher yield attributes and grain yield as compared to 50% of recommended fertilizer level in wheat during both the years. Grain yield of wheat also increased significantly with 40 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> applied to urdbean (residual) over control during 2003-04.

**Key words:** Farmyard manure, Fertilizer levels, Phosphorus, Urdbean, Wheat, Crop sequence, *Vigna mungo*

Fertilizer is one of the most critical and expensive inputs in agriculture and has played a key role in increasing food grain production. Further increase in yield would require judicious use of manures along with chemical fertilizers to maintain soil health and crop productivity. Pulses are known to add significant amount of organic matter to the soil through leaf drop and root biomass (1). Hence, the need to reduce on and off site impact of non-legume rotations will probably provide one of the strongest incentives for introducing pulses into crop rotations. Most of the studies on nutrient application

and their use in pulses are on individual crop basis and thus, their results have limited application in cropping systems involving cereals, oilseeds and other crops (2). The present investigation was undertaken to study the organic and inorganic fertilizer management in urdbean-wheat crop sequence.

### MATERIALS AND METHODS

A field experiment was conducted during 2002-03 and 2003-04 on a fixed site at Crop Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar (U.S.Nagar) with combinations of two levels of farmyard manure (0 and 5 t ha<sup>-1</sup>) and three levels of phosphorus (0, 20 and 40 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>) applied to urdbean in main plots and three levels of fertilizer (50, 75 and 100% of recommended dose) to wheat in sub-plots. Experiment was laid out in a split plot design with four replications. The soil of the experimental field was sandy loam in texture with neutral in reaction (7.2 pH) and medium in organic carbon (0.64%), available P (15.9 kg P ha<sup>-1</sup>) and available K (236.9 kg K ha<sup>-1</sup>) but low in available N (186.4 kg N ha<sup>-1</sup>). Planting of urdbean (PU 35) was done in rows, 30 cm apart, using a seed rate of 15 kg ha<sup>-1</sup> on 09.08.02 and 07.08.03, whereas wheat (HD 2687) was planted in rows (22.5 cm apart @ 100 kg ha<sup>-1</sup>) on 14.12.02 and 22.12.03. The urdbean was harvested on 15.11.02 and 25.11.03 and wheat on 05.05.03 and 17.04.04. The phosphorus was applied as per treatment in the form of SSP and no application of nitrogen was done in urdbean during both the years. The recommended

**Table 1.** Yield attributes and grain yield of urdbean as influenced by levels of farmyard manure and phosphorus

| Treatment   | Number of pods plant <sup>-1</sup> |      | Number of grains pod <sup>-1</sup> |      | 1000-grain weight (g) |       | Grain yield (kg ha <sup>-1</sup> ) |      |
|---|------------------------------------|------|------------------------------------|------|-----------------------|-------|------------------------------------|------|
|   | 2002                               | 2003 | 2002                               | 2003 | 2002                  | 2003  | 2002                               | 2003 |
| <b>Farmyard manure (t ha<sup>-1</sup>)</b>                        |                                    |      |                                    |      |                       |       |                                    |      |
| 0   | 33.0                               | 36.7 | 6.20                               | 5.92 | 42.58                 | 42.30 | 1614                               | 1117 |
| 5   | 37.8                               | 40.4 | 6.62                               | 6.23 | 44.86                 | 44.01 | 1719                               | 1266 |
| S.Em ±  | 1.3                                | 1.5  | 0.07                               | 0.10 | 0.40                  | 0.54  | 28                                 | 23   |
| C.D. (P=0.05)   | 3.9                                | NS   | 0.22                               | 0.31 | 1.21                  | 1.64  | 84                                 | 69   |
| <b>Phosphorus (P<sub>2</sub>O<sub>5</sub> kg ha<sup>-1</sup>)</b> |                                    |      |                                    |      |                       |       |                                    |      |
| 0   | 33.6                               | 36.9 | 6.11                               | 5.93 | 42.71                 | 41.71 | 1587                               | 1114 |
| 20  | 34.7                               | 38.9 | 6.43                               | 6.09 | 43.80                 | 43.48 | 1694                               | 1209 |
| 40  | 37.8                               | 39.9 | 6.69                               | 6.21 | 44.54                 | 44.28 | 1716                               | 1252 |
| S.Em ±  | 1.6                                | 1.8  | 0.09                               | 0.13 | 0.49                  | 0.67  | 36                                 | 28   |
| C.D. (P=0.05)   | NS                                 | NS   | 0.27                               | NS   | 1.48                  | 2.01  | 107                                | 84   |

Table 2. Yield attributes and grain yield of wheat as influenced by levels of farmyard manure and phosphorus applied to urdbean and fertilizer levels applied to wheat

| Treatment   | Spike length (cm) |         | Grains spike <sup>-1</sup> |         | Grain weight spike <sup>-1</sup> (g) |         | 1000-grain weight (g) |         | Grain yield (kg ha <sup>-1</sup> ) |         |
|---|-------------------|---------|----------------------------|---------|--------------------------------------|---------|-----------------------|---------|------------------------------------|---------|
|   | 2002-03           | 2003-04 | 2002-03                    | 2003-04 | 2002-03                              | 2003-04 | 2002-03               | 2003-04 | 2002-03                            | 2003-04 |
| <b>Farmyard manure (t ha<sup>-1</sup>)</b>                        |                   |         |                            |         |                                      |         |                       |         |                                    |         |
| 0   | 8.55              | 10.96   | 47.38                      | 32.78   | 1.56                                 | 1.58    | 34.19                 | 47.32   | 4295                               | 3055    |
| 5   | 8.59              | 11.01   | 47.92                      | 32.75   | 1.58                                 | 1.60    | 34.23                 | 47.50   | 4304                               | 3126    |
| S.Em±   | 0.06              | 0.10    | 0.48                       | 0.36    | 0.02                                 | 0.01    | 0.25                  | 0.33    | 47                                 | 30      |
| C.D.(P=0.05)  | NS                | NS      | NS                         | NS      | NS                                   | NS      | NS                    | NS      | NS                                 | NS      |
| <b>Phosphorus (P<sub>2</sub>O<sub>5</sub> kg ha<sup>-1</sup>)</b> |                   |         |                            |         |                                      |         |                       |         |                                    |         |
| 0   | 8.52              | 10.96   | 46.90                      | 32.32   | 1.56                                 | 1.57    | 33.96                 | 47.29   | 4226                               | 3031    |
| 20  | 8.58              | 10.97   | 47.67                      | 32.99   | 1.57                                 | 1.59    | 33.95                 | 47.42   | 4321                               | 3068    |
| 40  | 8.61              | 11.03   | 48.38                      | 33.00   | 1.58                                 | 1.62    | 34.72                 | 47.52   | 4353                               | 3176    |
| S.Em±   | 0.07              | 0.12    | 0.59                       | 0.44    | 0.03                                 | 0.02    | 0.31                  | 0.41    | 57                                 | 37      |
| C.D.(P=0.05)  | NS                | NS      | NS                         | NS      | NS                                   | NS      | NS                    | NS      | NS                                 | 110     |
| <b>Fertilizer to wheat (% of recommended dose)</b>                |                   |         |                            |         |                                      |         |                       |         |                                    |         |
| 50  | 8.24              | 10.67   | 45.44                      | 31.59   | 1.51                                 | 1.52    | 33.03                 | 45.90   | 4098                               | 2798    |
| 75  | 8.65              | 10.97   | 48.53                      | 33.21   | 1.59                                 | 1.61    | 34.53                 | 48.13   | 4412                               | 3206    |
| 100   | 8.82              | 11.33   | 48.98                      | 33.50   | 1.61                                 | 1.64    | 35.07                 | 48.19   | 4390                               | 3268    |
| S.Em±   | 0.05              | 0.13    | 0.27                       | 0.25    | 0.01                                 | 0.01    | 0.16                  | 0.28    | 55                                 | 43      |
| C.D.(P=0.05)  | 0.15              | 0.37    | 0.79                       | 0.71    | 0.02                                 | 0.03    | 0.45                  | 0.81    | 157                                | 125     |

dose of fertilizer to wheat (150 kg N +60 kg P<sub>2</sub>O<sub>5</sub> +60 kg K<sub>2</sub>O ha<sup>-1</sup>) was applied as urea, SSP and MOP. Half of the nitrogen and full P and K were applied as basal and remaining half nitrogen was top-dressed at the time of tillering during both the years. The data on urdbean were analyzed in randomized block design and wheat in split plot design. The rainfalls received during the crop seasons were 774.0 and 1084.8 mm in 2002-03 and 2003-04, respectively.

## RESULTS AND DISCUSSION

Application of farmyard manure @ 5 t ha<sup>-1</sup> produced significantly higher number of pods per plant during 2002 and number of grains per pod, 1000-grain weight and grain yield per ha during both the years as compared to control (Table 1). The per cent increase in grain yield over control was 6.5 and 13.3 during 2002 and 2003. The increase in yield attributes might be due to better translocation of photosynthates towards sink, which ultimately increased the grain yield. Similar results were also reported by Rao *et al.* (4).

A perusal of Table 1 showed that application of 40 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, which was at par with 20 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, resulted in significantly higher 1000-grain weight and yield per ha as compared to control during both the years. Increases in grain

yield at 20 and 40 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> over control were to the tune of 6.7 and 8.1% during 2002, and 8.5 and 12.4% during 2003, respectively. These results are in close conformity with the findings of Shrivastava *et al.* (5) and Singh (6).

Grain yield of wheat was higher during 2002-03 than 2003-04 (Table 2). This reduction in yield was probably due to late planting, less grain filling period and poor sink development in 2003-04 as compared to 2002-03. All yield attributes *viz.*, number of grains per spike, grain weight per spike and 1000-grain weight and grain yield of wheat increased due to residual effect of farmyard manure @ 5 t ha<sup>-1</sup> and phosphorus upto 40 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> though the difference was significant only in grain yield during 2003-04. This increase was probably due to the fact that farmyard manure and phosphorus applied to preceding urdbean crop was not fully utilized by that crop and a sizeable amount was left in soil which might have been utilized by succeeding wheat crop. These results are parallel to the findings of Arya *et al.* (3).

A level of 75% of recommended dose which was at par with 100% of recommended fertilizer level, recorded significantly higher grains per spike and grain yield per ha during both the years and spike length and 1000-grain weight during 2003-04 as compared to 50% of recommended fertilizer

to wheat. However, Each successive increment in fertilizer level to 100% of recommended produced significantly higher fertile grain weight per spike during both years. *Yadav et al.* (7) also reported similar observations under mungbean-wheat cropping sequence. It may be concluded from the present study that a net saving of about 25% fertilizer can be made to wheat when preceded by urdbean.

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