

Effects of N, P and K on productivity and soil fertility in maize (*Zea mays*)- wheat (*Triticum aestivum*) cropping system

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ABSTRACT

A field experiment was conducted on cultivators' field for two years i.e. during *kharif* and *Rabi* seasons of 2004 to 2006 on medium black soils in the plain zone area of Nasik district of Maharashtra in order to study the effect of fertilizer levels on yield and uptake of nutrients in Maize (*Zea mays*) + Wheat (*Triticum aestivum*) cropping sequence. The field experiment was laid out on permanent site in Randomized Block Design with six replications and five treatments. The fertility level increased the yield and up take of nutrients by Maize-Wheat cropping sequence. The grain yields of Maize and wheat with combined use of fertilizers were high during both years. The maximum productivity and net returns, improvement in fertility status and chemical properties of soil could be possible from Maize + Wheat cropping with application of 100 % RDF in the respective crops. A significant increase in the grain yield of Maize-Wheat cropping sequence was observed with increase in nitrogen level from 0 to 120 kg /ha., whereas an increase was significant up to 120kg N/ha. Level in maize + wheat yield. The highest net return was brought about with 120,60 and 40 N, P₂O₅, and K₂O kg/ha respectively with adequate supply of irrigation water. The productivity and net monetary returns were recorded highest with the application of recommended dose of nutrients (N, P & K) to Maize – wheat cropping sequence.

Key words: Soil fertility, Productivity, Levels of NPK

INTRODUCTION

Maize-Wheat cropping sequence has gained popularity in semi-arid agro climatic condition of plain zone area of Maharashtra with high yielding and fertilizer responsive cultivators of these two staple food crops. There has been growing interest in cropping sequence as a potential tool in improving and sustaining soil health as well as productivity. Cropping sequence is traditionally a low cost input agriculture system. Information on nutrient management on individual crops is available, while cropping system, it is lacking. Moreover, the single nutrient approach has been replaced by multinutrient to provide balanced nutrients to boost up crop productivity and nutrient use efficiency. Beside nutrient management in cropping system is more efficient and judicious than individual crop, as following crop take care of the residual effects of nutrients, N, P and to some extent K. Keeping these considerations in view, the present field investigation was undertaken.

MATERIALS AND METHODS

A field experiment was conducted for three consecutive seasons (2004-05 to 2005-06) on medium black soil in plain zone area of Maharashtra. The soil low in organic carbon (0.59) and nitrogen (223.60 kg/ha) low to medium in available phosphorus (14.56 kg/ha) and high in available potassium (548.60kg/ha). The field

experiment was laid out on permanent site in Randomized Block Design with six replications and five treatments as detailed in Table 2. The treatment consisted equal levels, each of N (120Kg/ha.) and P₂O₅ (60Kg/ha.) and K₂O (40kg/ha.) along with control. half dose of N and full dose of P and k were applied as basal to both the crop at the time of sowing. The remaining half dose of N was applied at top dressing 25-30 days after sowing to both the crops. Maize variety cv. " Super 900 M" was sown at the onset of monsoon in the second week of July followed by Wheat variety cv. "NIAW-301" in the third week of November during each season. Dibbling was carried out at 75x25-cm row spacing of maize and wheat of 22.5cm by drilling. The recommended dose for maize and wheat was 120.60.40 and 120.60.40kg N: P: K/ha, respectively. Biofertilizers viz. Azotobacter and PSB were used for seed treatment wherever applicable as per treatments.

RESULTS AND DISCUSSION

Response of maize to N, P and K

The grain yield of maize increased significantly with increasing levels of N up to 120kg/ha. In 2004-05 and 2005-06 on an average, application of 120kg/ha N increased the grain yield by 9.65 q/ha. over absolute control. These findings were confirmed with the results of Patel *et al.* (1991) and Varma *et al.* (1999). Application of P was effective however marked response was

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observed up to 60 kg P₂O₅/ha. only (Table-1). This might be attributed to more P fixing capacity of soil of experimental plot. These results are in conformity with the findings of maize remained unaffected by potash application in all the three seasons. This might be due to

and wheat (44.09 q/ha) followed by the treatment involving application of N&K RDF + biofertilizers to both the crops. (Table 1) However, these two treatments were at par with each other for both the crops. Similar results were obtained in case of stalk/fodder yield of maize and wheat,

Table 1 : Nutrient uptake pooled data for the year 2004-06

| S. No. | Maize | | | Wheat | | |
|----------------|--------|-------|--------|--------|-------|--------|
| | N | P | K | N | P | K |
| T ₁ | 74.77 | 11.23 | 73.26 | 80.19 | 11.94 | 76.02 |
| T ₂ | 112.00 | 17.08 | 109.80 | 109.60 | 16.62 | 104.30 |
| T ₃ | 137.70 | 21.59 | 132.60 | 126.90 | 20.01 | 121.00 |
| T ₄ | 156.40 | 25.88 | 155.4 | 134.30 | 22.76 | 127.70 |
| T ₅ | 183.10 | 30.74 | 177.80 | 165.90 | 28.97 | 158.70 |
| SE ± | 2.54 | 0.86 | 3.21 | 3.36 | 0.96 | 3.49 |
| CD at 5 % | 6.97 | 2.16 | 8.91 | 9.60 | 2.42 | 9.79 |

sufficient potash reserve and high potash buffering capacity of experimental plot. Similar results were also reported by Patel *et.al.* (1991).

Response of wheat to N, P and K

The yield of wheat increased significantly with increasing levels of N (Table 1), and a linear response to N was observed up to 120kg/ha. in all the seasons. On an

respectively.

Soil Fertility Status:

The two years pooled data on soil fertility status after harvest of the crop are presented in Table 2. The highest available nitrogen (159.70 kg/ha), phosphorus (33.43 kg/ha) and organic carbon (0.61 %) content was observed due to application of 100 % RDF + biofertilizers followed

Table 2 : Pooled mean of yield, gross & net monetary returns and B: C Ratio of Maize-Wheat cropping systems

| Treatment Details | Kharif Maize yield (q/ha.) | | Rabi Wheat Grain Yield (q/ha.) | | Gross Monetary returns (Rs.ooo/ha.) | Net Monetary returns (Rs.ooo/ha.) | B: C Ratio |
|--|----------------------------|-------|--------------------------------|-------|-------------------------------------|-----------------------------------|------------|
| | Grain | Straw | Grain | Straw | | | |
| T ₁ , Control (No fertilizers) | 21.18 | 30.47 | 21.23 | 30.65 | 33.18 | 7.67 | 1.29 |
| T ₂ , N | 30.83 | 44.38 | 29.53 | 40.55 | 47.16 | 18.00 | 1.61 |
| T ₃ , N&P | 38.32 | 55.13 | 35.26 | 46.65 | 56.59 | 25.22 | 1.79 |
| T ₄ , N&K | 42.32 | 61.88 | 37.56 | 47.74 | 61.63 | 30.73 | 1.98 |
| T ₅ , N,P&K | 49.03 | 69.89 | 44.09 | 57.70 | 71.64 | 39.09 | 2.19 |
| S.E. m. ± | 0.69 | 1.34 | 0.80 | 1.71 | 0.94 | 1.81 | 0.29 |
| C.D. at 5 % | 2.04 | 3.96 | 2.36 | 3.79 | 2.78 | 5.08 | 0.13 |

Rates: -Rs./Qtls. Maize -500/-, Wheat-800/-, Straw-40/-

average N kg/ha. Increased yields by .8.30q/ha. respectively over absolute control. These findings were confirmed with the results of Patel *et al.* (1991) and Varma *et al.* (1999).

Grain and fodder yield:

The application of N, P&K, RDF + biofertilizers recorded significantly higher grain yield of maize (49.03)

by N & K RDF + biofertilizers. The treatment effects were significant for available N, K and organic carbon content, while, non-significant for available P, pH and EC. In general, wherever there was inclusion of organic source either biofertilizer, the improvement in the chemical properties of soil was observed more pronouncedly as compared to use of only inorganic source. This trend is in conformity with the findings of Patel (1994). It is

interesting to note that even in treatment 'absolute control', the EC as well as available nitrogen and potassium content of soil was improved as compared to initial status. This was because of beneficial effects of FYM and biofertilizers. This is in conformity with the research findings of Varma *et al.* (1999).

Economics:

The pooled data on economic studies of maize - wheat cropping system under all recommended package of practices (Table 2) revealed that gross monetary returns were significantly higher due to application of 100 %RDF + biofertilizers (Rs. 71,640/ha) and followed by treatment T₄. However, Treatment T₅ has highest net returns and B: C ratio occurred due to 100% RDF + to both the crops were (Rs 39090 and 2.19) followed by other treatment.

Thus, it could be possible to achieve maximum productivity and monetary returns from maize + wheat

cropping system with the application of RDF + biofertilizers to both the crops.

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