RESEARCH ARTICLE

EFFECT OF INTEGRATED NITROGEN MANAGEMENT ON ECONOMICS OF *DESI* WHEAT

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Abstract: To explore the extent of substitution of nitrogen fertilizer in wheat to find out the suitable combination of fertilizers and organic manures for higher economic return present study entitled, "Compensating nitrogen fertilizer requirement of *desi* wheat through *Azotobacter* and vermicompost" was conducted at the Agronomy Research Farm of Chaudhary Charan Singh Haryana Agricultural University, Hisar during the *rabi* season of 2017-2018 to study the effect of *Azotobacter* and vermicompost on economics of *desi* wheat. The soil of the experimental field is sandy loam in texture, slightly alkaline in reaction, low in organic carbon and nitrogen, medium in available phosphorus and potassium. The experiment consisted of 10 treatments viz., T_1 (Control) , T_2 (Vermicompost @ 6 t ha^{-1}) , T_3 (*Azotobacter* + Vermicompost @ 6 t ha^{-1}), T_4 (30 kg N ha^{-1} + *Vermicompost* @ 3 t ha^{-1}), T_5 (40 kg N ha^{-1} + *Vermicompost* @ 2 t ha^{-1}), T_6 (50 kg N ha^{-1} + *Vermicompost* @ 1 t ha^{-1}), T_7 (30 kg N ha^{-1} + *Azotobacter* + Vermicompost @ 3 t ha^{-1}), T_8 (40 kg N ha^{-1} + *Azotobacter* + Vermicompost @ 2 t ha^{-1}), T_9 (50 kg N ha^{-1} + *Azotobacter* + Vermicompost @ 1 t ha^{-1}) and T_{10} (60 kg N ha^{-1}). Among various combinations of nitrogen fertilizer, vermicompost and *Azotobacter* treatments, T_{10} recorded significantly higher gross returns, net returns and benefit: cost ratio of *desi* wheat.

Keywords: Wheat, B:C, Economics, *Azotobacter*, Vermicompost, Fertilizer

INTRODUCTION

Due to spiraling price of chemical fertilizer and continuing world energy crisis, the use of various organic manure like vermicompost and biofertilizers as a renewable source of plant nutrients is assuming importance. In this endeavor proper combination of organic and inorganic fertilizer is important not only for increasing crop yield but also for sustaining soil health (Weber et al., 2007 and Pullicinoa et al., 2009). The vermicomposting is bio-oxidation and stabilization of organic material involving the joint action of earthworm and microorganisms. Although, microbes are responsible for the biological degradation of the organic matter, earthworms are the important drivers of the process, conditioning the substrate and altering biological activity (Aira et al., 2002). Suthar (2008) reported that vermicompost may be potential sources of nutrients for field crops if applied in suitable ratios with synthetic fertilizers. Under current situation application of organic and inorganic fertilizer is a better approach for supplying nutrition to the crop. Integrated nutrient management particularly nitrogen provides balanced nutrition to crops and minimizes the antagonistic effects resulting from hidden deficiencies and nutrient imbalance.

Continuous imbalanced use of chemical fertilizers led to the decline in soil productivity and deterioration in the soil fertility. Integrated plant nutrient supply system could help in meeting the goals of balanced fertilization and reducing cost of cultivation. Moreover, application of fertilizer alone is quite expensive and the small marginal farmers are unable to use chemical fertilizers in required quantity. Chemical fertilizers also do not support optimal microbial activities. The role of biofertilizers is perceived as growth regulators besides biological nitrogen fixation collectively leading to much higher response on various growth and yield attributing characters (Saiyad, 2014). Thus judicious use of organic manure, biofertilizer and organic fertilizer helps in sustain production of wheat. In developing countries like India, where there is an obvious need to rely increasingly on organic fertilization of soil, the biofertilizers may play an important role.

Keeping above-stated aspects in the view, present study "Compensating nitrogen fertilizer requirement of desi wheat through *Azotobacter* and vermicompost" has been planned with the objectives to study the effect of *Azotobacter* and vermicompost on economics of desi wheat.

MATERIALS AND METHODS

A field experiment was conducted during *rabi* season of 2017-2018 at the Research Farm of department of Agronomy, CCS Haryana Agricultural University, Hisar which is situated at latitude of 29°10' North, longitude of 75°46' East and elevation of 215.2 m above mean sea level in the semi-arid, subtropical climate zone of India. The experiment was laid out in Randomized Block on sandy loam (63.5% sand, 17.3% silt and 19.2% clay) soil which is slightly alkaline in reaction, low in organic carbon and nitrogen, medium in available phosphorus and potassium. The treatment were comprised of ten treatments viz. T_1 (Control) , T_2 (Vermicompost @ 6 t ha^{-1}) , T_3 (*Azotobacter* + Vermicompost @ 6 t ha^{-1}), T_4 (30 kg N ha^{-1} + *Vermicompost* @ 3 t ha^{-1}), T_5

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(40 kg N ha^{-1} + *Vermicompost* @ 2 t ha^{-1}), T_6 (50 kg N ha^{-1} + *Vermicompost* @ 1 t ha^{-1}) , T_7 (30 kg N ha^{-1} + *Azotobacter* + Vermicompost @ 3 t ha^{-1}) , T_8 (40 kg N ha^{-1} + *Azotobacter* + Vermicompost @ 2 t ha^{-1}), T_9 (50 kg N ha^{-1} + *Azotobacter* + Vermicompost @ 1 t ha^{-1}) and T_{10} (60 kg N ha^{-1}). *Azotobacter* was. Prior to sowing, the seed pertaining to inoculated plots was treated with *Azotobacter* culture obtained from Department of Microbiology, CCS Haryana Agricultural University, Hisar, as per treatment. The seed was wetted with sugar solution and 50 ml of bio inoculants was used as per the recommendation. The treated seed was kept in shade for the completion of inoculation. Both treated and untreated seeds were sown as per the treatments. Sowing of *Desi* wheat C 306 was done on 10th November 2017 at about 5.0 cm depth by drilling in rows using 120 kg seed ha^{-1}and spacing of 20 cm between rows.Pre-sown irrigation of 5 cm depth was applied on 3th November 2017. Three post sown irrigations were applied on 04.12.2017, 27.02.2018 and 13.03.2018. Harvesting was done with the help of sickles manually by cutting the plants from the net area of each plot separately on 11th April 2018. Full dose of phosphorus (62.5 kg P_2O_5 ha^{-1}) and half nitrogen as per treatments were applied at the time of sowing and remaining half of the nitrogen was top dressed at 23 DAS.

Full dose of P and half dose of N as per treatments were applied to the field before sowing and rest of N was top dressed after first irrigation. Urea (46%), Diammonium phosphate (18% N, 46% P_2O_5), and *Azotobacter* were used as source of N and P. Five representative plants from each plot were selected randomly and tagged for recording the effect of different treatments on yield attributes. The cost of field preparation, sowing of seeds, thinning, weeding, plant protection, harvesting and cleaning contributed to fixed cost. The variable cost included the cost of irrigation charges and labour for application of fertilizer and irrigation. The gross income of crop was worked out from average grain yield produced under different planting and irrigation treatments. To find out the net income, the cost of each treatment was subtracted from the total gross income. The expenditure incurred on individual treatments was worked out from the detail assessment of the fixed and variable costs involved such as land preparation, seed, plant protection, chemicals and labour engaged in different operations. Gross income for all treatment was calculated separately taking into consideration grain and straw yield of individual crop. Thereafter, net returns were calculated after subtracting expenditure incurred on the individual treatment from the gross income of the same treatment.

The benefit: cost ratio was calculated as follows.

$$B:C=\frac{\text{Gross return (Rs. ha}^{-1}\text{)}}{\text{Cost of cultivation (Rs. ha}^{-1}\text{)}}$$

RESULTS AND DISCUSSION

The maximum net return per hectare after deduction of cost of cultivation is the ultimate goal of any farm owner or grain producer. A critical examination of data in Table 1 fig 1 revealed that in the present investigation among various combinations of nitrogen fertilizer, vermicompost and *Azotobacter* gross returns was highest in treatment T_{10} (97600 Rs ha^{-1}), were significantly higher than all other treatments. Highest net returns were recorded in treatment T_{10} (65011Rs ha^{-1}) which was significantly higher than all other treatments. The net return of *desi* wheat varied from 12246 Rs ha^{-1} to 65011 Rs ha^{-1}. Singh *et al.* (2008) reported that the highest net return and benefit: cost of crop was recorded with combined application with fertilizer + FYM + bio-fertilizer. Rather and Sharma (2009) also reported that the highest net return and benefit: cost of crop was recorded with combined application with fertilizer + FYM. Sharma *et al.* (2007) also reported that by integration of FYM and *Azotobacter* with N through chemical fertilizers, productivity and monetary returns of wheat can be increased by maintaining or improving soil fertility.

The overall picture, based on one year mean values, reflects the fact that highest benefit: cost ratio was obtained in treatment T_{10} (2.99) while treatment T_2 (1.22) recorded significantly lowest benefit: cost ratio than rest of the treatments. But, the differences in benefit: cost ratio in treatments T_2 (1.22) and T_3 (1.26) were not significant. In general benefit: cost ratio varied from 1.22 (T_2) to 2.99 (T_9). Corroborative findings were also reported by Suthar (2006) who stated that integrated application of NPK fertilizers along with vermicompost in field crops not only influences growth and production of plant but at the same time also reduces the production budget. Economics Net return and benefit: cost ratio increased with supplementation of recommended dose of fertilizer with vermicompost and phosphate solubilizing bacteria.

Table 1. Effect of various combinations of nitrogen fertilizer, vermicompost and *Azotobacter* on economics of *desi* wheat

Treatments	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B C ratio
T_1 : Control	50,695	18,886	1.59

T_2 : Vermicompost @ 6 t/ha	68,055	12,246	1.22
T_3 : *Azotobacter* + Vermicompost @ 6 t/ha	70,335	14,476	1.26
T_4 : 30 kg N /ha + Vermicompost @ 3 t/ha	79,020	34,821	1.79
T_5 : 40 kg N /ha + Vermicompost @ 2 t/ha	85,875	45,546	2.13
T_6 : 50 kg N /ha + Vermicompost @ 1 t/ha	89,240	52,781	2.45
T_7 : 30 kg N /ha + *Azotobacter* + Vermicompost @ 3t/ha	86,475	42,276	1.96
T_8 : 40 kg N /ha + *Azotobacter*+ Vermicompost @ 2 t/ha	90,990	50,661	2.26
T_9 : 50 kg N /ha + *Azotobacter*+ Vermicompost @ 1 t/ha	95,750	59,291	2.63
T_{10} : RDN (60 kg N ha^{-1})	97,600	65,011	2.99
SEm ±	408	408	0.03
CD at 5 %	1226	1226	0.09

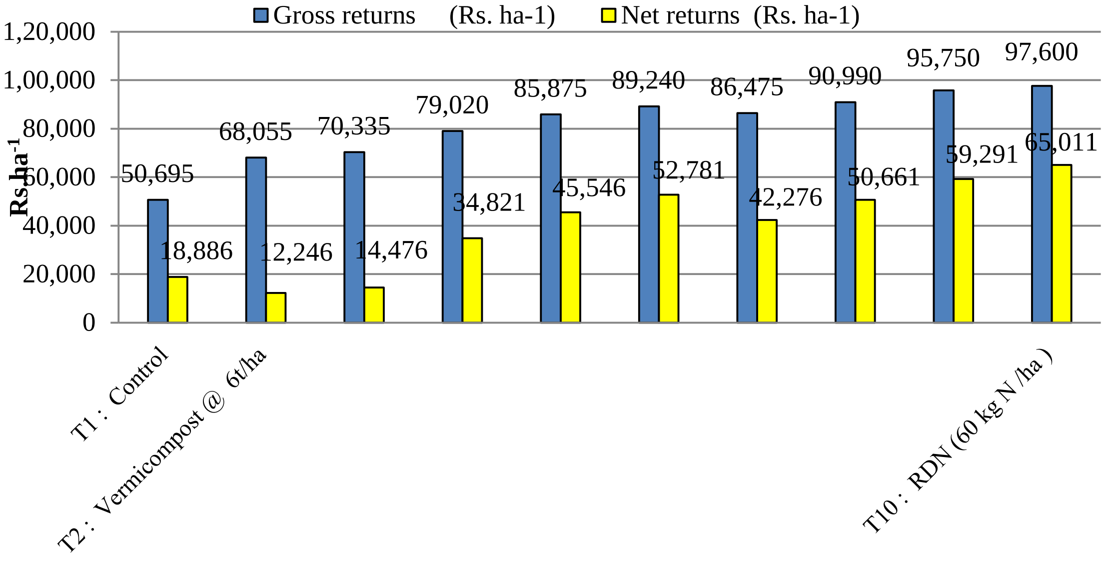

Figure 1: Economics of various treatments under study

CONCLUSION

Among various combinations of nitrogen fertilizer and vermicompost, gross and net returns were highest in T_{10} and highest benefit: cost ratio was obtained in treatment T_{10} while treatment T_2 recorded significantly lowest benefit: cost ratio than rest of the treatments. However, the difference in benefit: cost ratio in treatment T_2 and T_3 was not significant.

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