

Original Research Article

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Quality Parameters and LAI of *desi* Wheat as Influenced by Various Combination of Nitrogen Fertilizer, Vermicompost and *Azotobacter*

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ABSTRACT

The present study entitled, Compensating nitrogen fertilizer requirement of *desi* wheat through *Azotobacter* and vermicompost was conducted during the *rabi* season of 2017-2018 at the Agronomy Research Farm of Chaudhary Charan Singh Haryana Agricultural University, Hisar to study the effect of *Azotobacter* and vermicompost on quality parameters 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 was laid out in Randomized Block *Design* replicated thrice with ten treatments viz. T₁ (Control), T₂ (Vermicompost @ 6 t ha⁻¹), T₃ (*Azotobacter* + Vermicompost @ 6 t ha⁻¹), T₄ (30 kg N ha⁻¹ + Vermicompost @ 3 t ha⁻¹), T₅ (40 kg N ha⁻¹ + Vermicompost @ 2 t ha⁻¹), T₆ (50 kg N ha⁻¹ + Vermicompost @ 1 t ha⁻¹), T₇ (30 kg N ha⁻¹ + *Azotobacter* + Vermicompost @ 3 t ha⁻¹), T₈ (40 kg N ha⁻¹ + *Azotobacter* + Vermicompost @ 2 t ha⁻¹), T₉ (50 kg N ha⁻¹ + *Azotobacter* + Vermicompost @ 1 t ha⁻¹) and T₁₀ (60 kg N ha⁻¹). Among various combinations of nitrogen fertilizer, vermicompost and *Azotobacter* treatments, highest LAI, protein content and protein yield of *desi* wheat was recorded in treatment receiving 100 % RDN (60 kg N ha⁻¹). However, in terms of quality treatment T₉ and T₈ were at par with treatment T₁₀. But various treatments failed to produce any significant variation in harvest index of *desi* wheat.

Keywords

Desi wheat,
Nitrogen, Quality,
Protein,
Vermicompost,
Azotobacter

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Introduction

The positive effect of nitrogen on growth characters of wheat is proved beyond doubt (Sharma *et al.*, 1980). Nitrogen, being an important constituent of protoplasts, amino acids and proteins, directly influences growth and development of plant through better utilization of photosynthates. Wheat (*Triticum aestivum* L.) is the second most important

food crop and strategic cereal crop for the majority of the world's population. It is known as '*King of cereals*' and India is the second largest producer of wheat in the world next to China. It is the most important staple food of about 2 billion people (around 36% of the world population). Wheat grains are comparatively better source of protein consumed in India. About 10-12% protein requirement of the country is met by

consuming wheat. Maneuvering the application of different fertilizers could increase the productivity of the wheat crop and protein content. On account of ever increasing world energy crisis and spiraling prices of various chemical fertilizer, the use of organic manures as a renewable source of plant nutrients is gaining importance. In this endeavor proper combination of organic manure and inorganic fertilizer is important not only for increasing yield but also for sustaining soil health (Kumar *et al.*, 2013). The use of organic manures largely excludes the use of synthetic fertilizers, pesticides, growth regulators and livestock feed additives, enriches the soil, encourages bio-diversity, reduce the toxic bodies, improves water quality, creates a safe environment for people and wild life, produces nutritious food of high quality, supply micronutrients in soil and maintains soil fertility and crop productivity (Sawrup, 2010). Keeping the above aspects in view, the present investigation “Compensating nitrogen fertilizer requirement of *desi* wheat by vermicompost and *Azotobacter*” has been planned with the objective to study the effect of vermicompost and *Azotobacter* on yield of *desi* wheat.

Materials and Methods

Field experiment was conducted during *rabi* 2017-2018 at the Agronomy Research Farm of Chaudhary Charan Singh 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. T₁ (Control), T₂ (Vermicompost @ 6

t ha⁻¹), T₃ (*Azotobacter* + Vermicompost @ 6 t ha⁻¹), T₄ (30 kg N ha⁻¹ + Vermicompost @ 3 t ha⁻¹), T₅ (40 kg N ha⁻¹ + Vermicompost @ 2 t ha⁻¹), T₆ (50 kg N ha⁻¹ + Vermicompost @ 1 t ha⁻¹), T₇ (30 kg N ha⁻¹ + *Azotobacter* + Vermicompost @ 3 t ha⁻¹), T₈ (40 kg N ha⁻¹ + *Azotobacter* + Vermicompost @ 2 t ha⁻¹), T₉ (50 kg N ha⁻¹ + *Azotobacter* + Vermicompost @ 1 t ha⁻¹) and T₁₀ (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 P₂O₅ 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% P₂O₅), 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. All yield attributes were recorded

periodically on these randomly selected and tagged plants. Protein content of grain and straw was worked out by multiplying percent nitrogen in grain and straw respectively with a conversion factor of 6.25. Harvest index (%) was calculated for each plot by using following formula:

$$\text{Harvest Index} = \frac{\text{Grain yield}}{\text{Biological yield}} \times 100$$

Leaves separated from the plants harvested for dry matter accumulation were used to measure leaf area with the help of LI 3000 area meter (LICOR LTD., Nabaska, USA):. The leaf area index was worked out with the help of following formula:

$$\text{Leaf area index} = \frac{\text{Total leaf area}}{\text{Total land area}}$$

Results and Discussion

The overall picture, based on one year data reflects the fact that among various combinations of nitrogen fertilizer, *Azotobacter* and vermicompost highest protein content was recorded in treatment T₁₀ which was significantly higher than treatment T₁, T₂, T₃ and T₄. Further protein content (%) in treatment T₅ to T₁₀ was statistically at par with each other and significantly higher as compared to T₁, T₂, T₃ and T₄. Similar findings were also reported by Malik (2017) (Table 1). Similarly protein yield was highest in treatment T₁₀ (368.4 kg ha⁻¹), which was significantly higher than other treatments but statically at par with treatment T₉ (361.4 kg ha⁻¹). Lowest protein yield of *desi* wheat was obtained in treatment T₁ (158.55 kg ha⁻¹). The difference in protein yield in treatment T₅ (305.0 kg ha⁻¹) and T₇ (313.6 kg ha⁻¹) were not significant. Similarly, the differences in protein yield of *desi* wheat in treatments T₂

(244.4 kg ha⁻¹) and T₃ (255.6 kg ha⁻¹) were not significant. Optimum nitrogen levels were effective in producing better yield and quality of wheat grain. A proper supply of nitrogen through chemical fertilizer, *Azotobacter* and vermicompost helped to accumulate protein in grains and increase in grain weight. Similar results were recorded by Alghabari and Al-Solaimani (2015). Malik (2017) also reported that barley grain protein content increased with increasing rates of N application and seed inoculation with *Biomix* produced highest protein content followed by seed inoculation with *Azospirillum* + *PSB* and *Azotobacter* + *PSB* in barley at Hisar. These results were in unison with Mehrvarz and Chaichi (2008). Various combinations of nitrogen fertilizer and vermicompost failed to influence harvest index of *desi* wheat. The range of harvest index was between 26.3 (T₅ and T₇) to 29.2 % (T₂). Leaf area index is an important parameter of photosynthesizing surface of plant and has pronounced effect on crop growth and yield. Leaf area ratio indicates the size of assimilatory surface area in relation to total dry matter accumulation. The increase in LAI of *desi* wheat was highest from 30 to 60 DAS (Table 2). Leaf area index was significantly higher with treatment T₁₀ (100% RDN) at all the stages of crop growth and lowest value of leaf area index was obtained with treatment T₁ (0.62). However, the difference in leaf area index value between the treatments T₁ and T₂ at 30 DAS and between T₉ and T₁₀ at 60 DAS were at par with each. The findings confirmed with the results found by Rathore and Gautam (2003) and Kumar (2005).

On the basis of above findings, integrated application of 50 kg N ha⁻¹ + *Azotobacter* + Vermicompost @ 1 t ha⁻¹ or 40 kg N ha⁻¹ + *Azotobacter* + vermicompost @ 2 t ha⁻¹ or 100% RDN in *desi* wheat to sandy loam, low in available N, medium in available P soils can be practiced for higher profitability.

Table.1 Effect of various combinations of nitrogen fertilizer, vermicompost and *Azotobacter* on protein content (%) and protein yield (kg ha⁻¹) of *desi* wheat

Treatments	Protein content (%)	Protein yield (kg ha ⁻¹)	Harvest index (%)
T ₁ : Control	10.50	158.55	28.17
T ₂ : Vermicompost @ 6 t/ha	11.75	244.40	29.20
T ₃ : <i>Azotobacter</i> + Vermicompost @ 6 t/ha	12.00	255.60	28.80
T ₄ : 30 kg N /ha + Vermicompost @ 3 t/ha	12.25	278.08	26.70
T ₅ : 40 kg N /ha + Vermicompost @ 2 t/ha	12.50	305.00	26.30
T ₆ : 50 kg N /ha + Vermicompost @ 1 t/ha	12.63	321.94	26.50
T ₇ : 30 kg N /ha + <i>Azotobacter</i> + Vermicompost @ 3 t/ha	12.75	313.65	26.30
T ₈ : 40 kg N /ha + <i>Azotobacter</i> + Vermicompost @ 2 t/ha	12.81	336.97	26.90
T ₉ : 50 kg N /ha + <i>Azotobacter</i> + Vermicompost @ 1 t/ha	13.00	361.40	27.10
T ₁₀ : RDN (60 kg N ha ⁻¹)	13.06	368.36	26.90
SEm ±	0.21	5.41	0.88
CD at 5 %	0.64	16.52	N.S.

Table.2 Leaf Area Index of *desi* wheat as influenced by various combinations of nitrogen fertilizer, vermicompost and *Azotobacter*

Treatments	Leaf Area Index			
	30 DAS	60 DAS	90 DAS	At Maturity
T ₁ : Control	0.62	2.30	3.65	0.81
T ₂ : Vermicompost @ 6 t/ha	0.65	2.41	5.12	0.85
T ₃ : <i>Azotobacter</i> + Vermicompost @ 6 t/ha	0.69	2.48	5.22	0.90
T ₄ : 30 kg N /ha + Vermicompost @ 3 t/ha	0.75	2.30	4.95	0.98
T ₅ : 40 kg N /ha + Vermicompost @ 2 t/ha	0.79	2.41	5.12	1.03
T ₆ : 50 kg N /ha + Vermicompost @ 1 t/ha	0.80	2.48	5.22	1.04
T ₇ : 30 kg N /ha + <i>Azotobacter</i> + Vermicompost @ 3 t/ha	0.85	2.30	5.06	1.11
T ₈ : 40 kg N /ha + <i>Azotobacter</i> + Vermicompost @ 2 t/ha	0.80	2.41	5.12	1.04
T ₉ : 50 kg N /ha + <i>Azotobacter</i> + Vermicompost @ 1 t/ha	0.85	2.48	5.22	1.11
T ₁₀ : RDN (60 kg N ha ⁻¹)	0.95	3.20	6.30	1.24
SEm ±	0.02	0.31	0.30	0.03
CD at 5 %	0.06	0.94	1.01	0.09

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