International Journal of Botany Studies
www.botanyjournals.com
ISSN: 2455-541X
Received: 21-07-2021, Accepted: 06-08-2021, Published: 21-08-2021
Volume 6, Issue 4, 2021, Page No. 830-833

Studies on impact and economics of various sources of nitrogen on wheat, *Triticum aestivum* L. under the sandy loam soil conditions

R S Kalasare[1*], Manish Kumar Yadav[2], Gaikwad D J[3]

[1] Associate Professor, Department of Agronomy and Agroforestry, M S Swaminathan School of Agriculture, Centurion University of Technology and Management Paralakhemundi, Odisha, India

[2] Assistant Professor, Agricultural Entomology, M S Swaminathan School of Agriculture, Centurion University of Technology and Management Paralakhemundi, Odisha, India

[3] Assistant Professor, Crop Physiology, M S Swaminathan School of Agriculture, Centurion University of Technology and Management Paralakhemundi, Odisha, India

Abstract

An experiment has been conducted during the *Rabi* of 2020-21 with following objectives, to study the growth behaviour of wheat under different organic and inorganic sources of Nitrogen and to assess the economics of each the treatments. The following treatments namely Recommended dose of fertilizer (RDF) 120:60:40, RDF 100 % + FYM 2.5 t ha-1, RDF 100 % + FYM 5 t ha-1, RDF 100 % + FYM 7.5 t ha-1, RDF 100 % +FYM 10 t ha-1, RDF 100 % + FYM 15 t ha-1, 125 % of RDF and 150 % of RDF have been used under this experiment. The studies revealed that the initial population of plants, height and various other morphological parameters were superior in case of RDF 100 % + FYM 15 t ha^{-1} followed by Recommended dose of fertilizer (RDF) 120:60:40 and RDF 100 % +FYM 10 t $ha^{-1.}$ The greater economics was recorded in recommended dose of fertilizer (RDF) 120:60:40 followed by RDF 100 % + FYM 5 t ha-1 and RDF 100 % + FYM 2.5 t ha-1.

Keywords: wheat, economics, fertilizer, FYM, manure, compost

Introduction

In the Indian subcontinent, wheat is grown in 26.6 million hectares area with the production of 73.0 m tonnes. In eastern Uttar Pradesh, wheat is cultivated on an area of about 2.3 m hectares with an annual production of 6.41 million tonnes having an average yield of 27.93 kg ha-1. The productivity and yield of wheat is significantly influenced by selection of suitable varieties, soil and environmental conditions as well as the management factors (Kashyap and Agarwal, 2021) [6]. The environmental stresses like water stress (water logging and drought), temperature (heat and chilling) and salinity are the major problems of wheat growing areas which substantially reduce the yield and quality of wheat (Gill *et. al*., 2001) [4]. Each genotype within a plant species has an optimum range of temperature for its normal growth and development. The specific temperature would depend not only on the genotype but also on the stage of growth and development of a given genotype. When temperature moves beyond this optimal range, it generates temperature stress, i.e., temperature interferes with the performance. (Kashyap and Agarwal, 2021) [6]. The environmental stresses like water stress (water logging and drought), temperature (heat and chilling) and salinity are the major problems of wheat growing areas which substantially reduce the yield and quality of wheat (Devi *et. al*., 2021) [2]. Each genotype within a plant species has an optimum range of temperature for its normal growth and development. The specific temperature would depend not only on the genotype but also on the stage of growth and development of a given genotype. When temperature moves beyond this optimal range, it generates temperature stress, i.e., temperature interferes with the performance. There are several physiological traits that are associated with heat tolerance. Photo assimilation, chlorophyll retention, chlorophyll a: b ratio, canopy temperature depression, stomatal conductance, membrane stability is some of the examples (Devi *et. al*., 2021) [2]. At biochemical level, enzymes involved in grain filling like soluble starch synthase (SSS) are deactivated at high temperature. This may lead to reduce the convention of sucrose to starch, which results in the accumulation of carbohydrates in vegetative tissue of wheat, when grain filling is limited by heat stress (Kashyap and Agarwal, 2021) [6]. The effect of heat stress on grain weight were found to associated with reduced levels of starch synthetase activity**.** Wheat is a sink limited crop and high temperature during grain filling causes the production of sbrivelled grains due to forced maturity (Sheoran *et al*., 2021) [11].

Late planting of wheat in India is common due to the intensive cropping system which so often delays the sowing of wheat up to the middle of January, particularly in North West India where it is generally sown after harvest of paddy, sugarcane, pigeon pea. As a result, a portion of maturity period of the crop pushed forward and thus has to face higher temperature of the summer with hot spells often occurring at the time of maturity. The late sown wheat is more affected by high temperature stress leading to reduced yield and quality (Devi *et. al*., 2021) [2]. The steady expansion of the environmental changes encompassed by cereals both temperature extremes and water availability have become important factors limiting the production of the cereals in many parts of the world. An added complication is the projected rise in both global mean temperature and frequency of periods of very high

temperature (heat shock), as part of the greenhouse climate change, which may further increase the pressure of heat stress in many cereals growing regions (Sheoran *et al*., 2021) [11].

Materials and Methods

The whole experimentations have been conducted at College of Agriculture Selu, Parbhani, Maharashtra, during the *Rabi* season of the year 2020-21 with wheat crop. For this field experimentation, CRBD has been utilized with a total number of three replications under the selected three treatments.

The following treatments namely

Recommended dose of fertilizer (RDF) 120:60:40,
RDF 100 % + FYM 2.5 t ha-1
RDF 100 % + FYM 5 t ha-1
RDF 100 % + FYM 7.5 t ha-1
RDF 100 % +FYM 10 t ha-1
RDF 100 % + FYM 15 t ha-1
125 % of RDF
150 % of RDF

The field has been prepared by all the recommended practices for sowing of wheat. The field has been prepared by ploughing 2-3 time with the tractor operated cultivators and a levelling device namely leveller has been used to make the soil suitable for sowing. The following configuration of sowing for wheat has been done. The sowing of wheat has been done with the seed drill and all the observations related to the crop has been taken under their respective objectives as follow:

1. Plant Height
2. Plant Population Per Unit Area
3. Number of Effective Tillers
4. Panicle Length
5. Grain Yield
6. Biological Yield

Results and Discussion

The maximum plant height was recorded in RDF 100 % + FYM 2.5 t ha-1 with 40.00 cm followed by RDF 100 % + FYM 15 t ha^{-1} with 36.83 and Recommended dose of fertilizer (RDF) 120:60:40 with 36.34 cm of plant height. The minimum height was noted in RDF 100 % + FYM 7.5 t ha-1 and 150 % of RDF with 31.00 cm of plant height, while minimum plant height was recorded in RDF 100 % + FYM 7.5 t ha-1 and 150 % of RDF with 36.34 of plant height.

Table 1: Effect of Various Combinations of Nutrients on Growth and Yield Parameters of Wheat Crop

Name of Treatments	Plants Morphological and Yield Attributes					
	Plant Height	Plant Population m^2	Number of Effective Tillers	Panicle Length	Grain Yield	Biological Yield
Recommended dose of fertilizer (RDF) 120:60:40	36.34	221.34	8.34	5.33	2891.34	8136.95
RDF 100 % + FYM 2.5 t ha-1	40.00	223.00	7.67	5.34	2784.66	7714.66
RDF 100 % + FYM 5 t ha-1	32.34	219.00	7.34	6.00	3266.34	8717.00
RDF 100 % + FYM 7.5 t ha-1	31.00	221.00	8.34	5.66	2934.34	7134.00
RDF 100 % +FYM 10 t ha^{-1}	32.63	223.34	7.67	4.34	2790.66	7934.66
RDF 100 % + FYM 15 t ha^{-1}	36.83	224.63	8.00	5.00	2697.66	7891.00
125 % of RDF	32.34	223.00	7.67	6.67	3094.34	8434.67
150 % of RDF	31.00	220.34	6.67	6.00	2907.66	8136.95
SEm±	1.21	1.63	0.46	0.37	1.08	1.34
CD @ 0.05% (p=0.05)	3.34	4.07	1.37	1.07	3.04	3.97

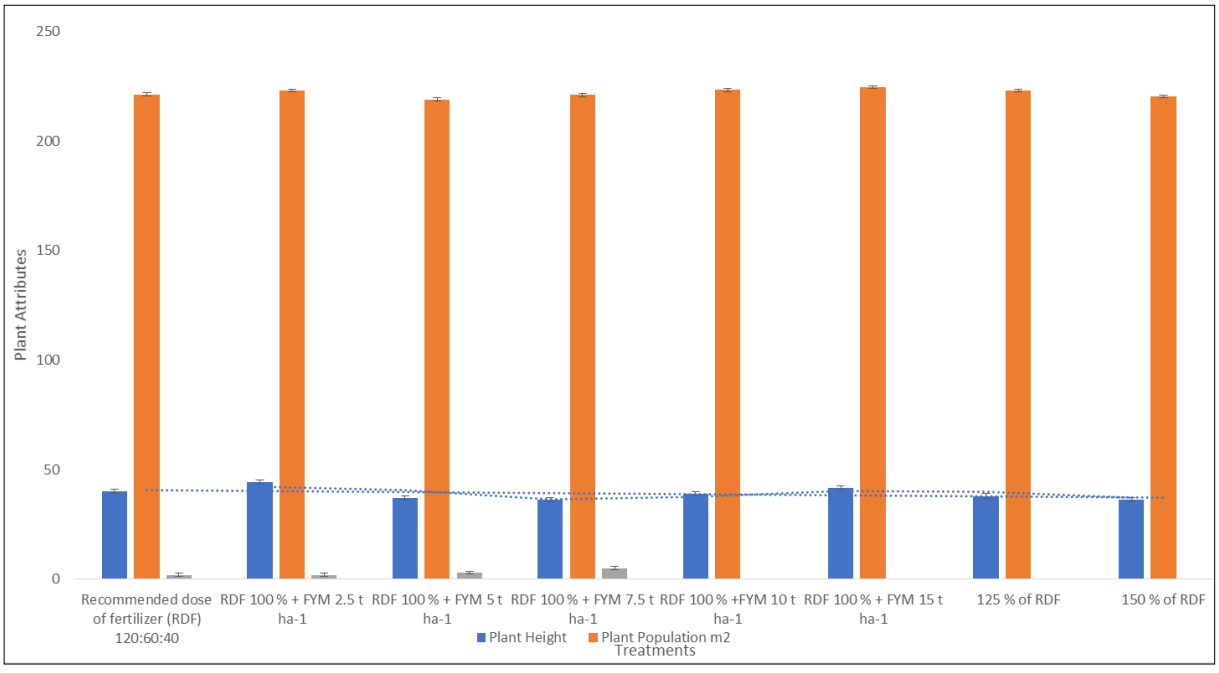

Fig 1: Effect of Various Combinations of Nutrients on Plant Height and Plant Population of Wheat Crop

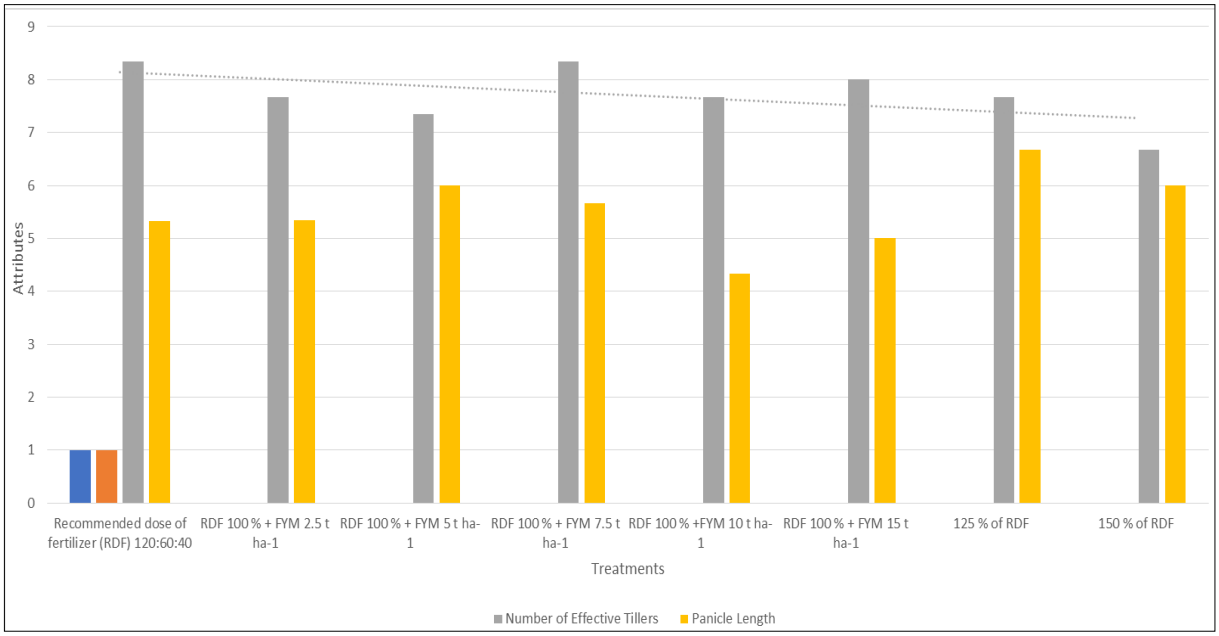

Fig 2: Effect of Various Combinations of Nutrients on Effective Tillers and Panicle Length of Wheat Crop

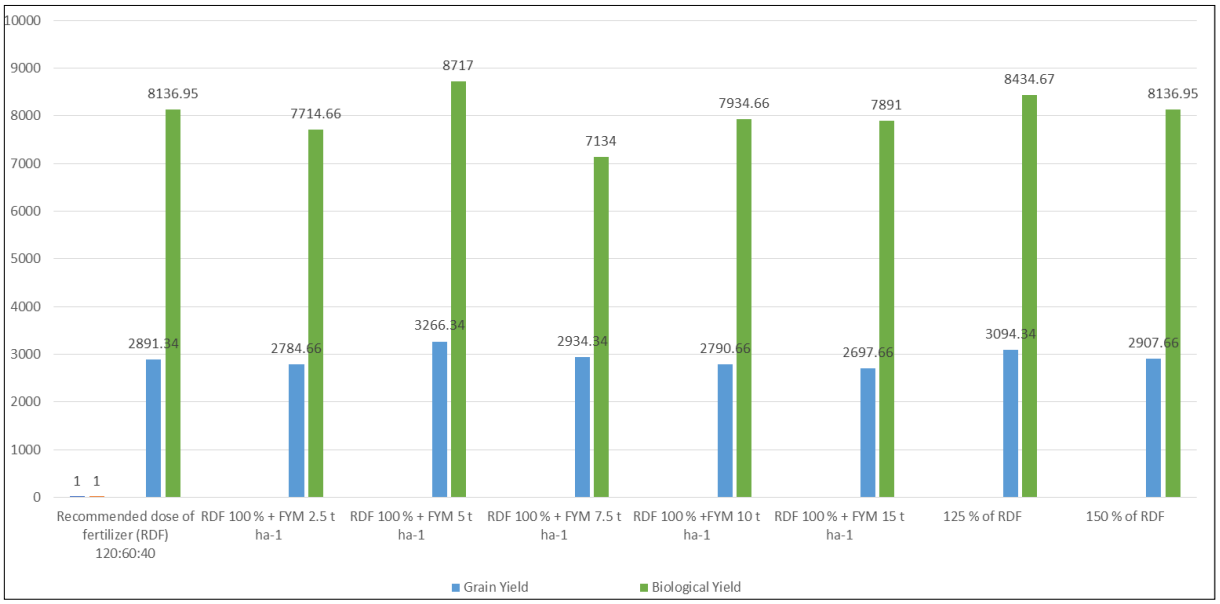

Fig 3: Effect of Various Combinations of Nutrients on Grain Yield and Biological Yield of Wheat Crop

The Data presented in Table 1 showing population of plants per unit area. The maximum initial plant population was recorded in RDF 100 % + FYM 15 t ha^{-1} with 224.63 followed by Recommended dose of fertilizer (RDF) 120:60:40 and RDF 100 % +FYM 10 t ha^{-1} with 223.34 plants per meter squire while minimum plant population was observed in RDF 100 % + FYM 5 t ha-1 with 219.00 and 150 % of RDF with 220.34 plants/m^2. Gill *et al*., (2000) [3]; Wang *et al*., (2007) [12]; Claudia *et al*., (1997) [1] and many other authors have concluded the similar findings by using the various chemicals with recommended doses of nitrogen and reported similar findings.

The Table 1 also showing Yield Attributes of Wheat under Different Fertilizer Treatments in which maximum number of effective tillers per plant were recorded in RDF 100 % + FYM 7.5 t ha-1 and Recommended dose of fertilizer (RDF) 120:60:40 with 3.34 number of effective tillers per plant while minimum effective tillers per plant was noted in 150 % of RDF with 6.67 followed by RDF 100 % + FYM 5 t ha-1 with 7.34 effective tillers per plant. Panicle length was recorded maximum in 125 % of RDF with 6.67 followed by RDF 100 % + FYM 5 t ha-1 with 6.00 and RDF 100 % + FYM 7.5 t ha-1 with 5.67 while minimum Panicle length was recorded in RDF 100 % +FYM 10 t ha^{-1} with 4.34 and RDF 100 % + FYM 15 t ha^{-1} with 5.00 cm of Panicle length. It was noted that the growth of plants is directly proportional to the dose of nitrogen given to the plants. The more amount of used nitrogen in the studies of Kerstin *et al*., 2015 [7]; Zhu Xin-Kai *et al*., (2012) [13]; Kumar *et al*., (2005) [8]; Sana *et al*., (2009) [10] showed the maximum growth of plants at various stages and these findings are similar to our findings regarding to the growth of plants and various nitrogen and fertilizer combinations.

The Table 1 also showing Yield Attributes of Wheat under Different Fertilizer in which maximum grain yield was recorded in RDF 100 % + FYM 5 t ha-1 with 3266.34 kg followed by 125 % of RDF with 3094.34 and RDF 100 % + FYM 7.5 t ha-1 with 2934.34 kg of grain yield per ha while

minimum was recorded in RDF 100 % + FYM 15 t ha^{-1} with 2697.66 kg and RDF 100 % + FYM 2.5 t ha-1 with 2784.66 kg of grain yield per ha. The maximum biological yield was recorded in RDF 100 % + FYM 5 t ha-1with 8717.00 kg followed by 125 % of RDF with 8434.67 and RDF 100 % + FYM 5 t ha-1 with 8136.95 kg per ha while minimum biological yield was recorded in RDF 100 % + FYM 7.5 t ha-1 with 7134.00 and RDF 100 % + FYM 2.5 t ha-1 with 7714.66 kg of biological yield. Gunes *et al*., (2007) [5]; Moore *et al.*, (1999) [9]; Kerstin *et al*., (2015) [7] and many other authors have concluded the similar findings by using the various chemicals with recommended doses of nitrogen and reported similar findings.

Conclusion

In the case of crops including wheat, the environmental stresses like water stress (water logging and drought), temperature (heat and chilling) and salinity are the major problems of wheat growing areas which substantially reduce the yield and quality of wheat. Each genotype within a plant species has an optimum range of temperature for its normal growth and development. The whole experiment presented under this paper has been conducted during the *Rabi* of 2020-21 with following treatments namely Recommended dose of fertilizer (RDF) 120:60:40, RDF 100 % + FYM 2.5 t ha-1, RDF 100 % + FYM 5 t ha-1, RDF 100 % + FYM 7.5 t ha-1, RDF 100 % +FYM 10 t ha-1, RDF 100 % + FYM 15 t ha-1, 125 % of RDF and 150 % of RDF. The studies revealed that the initial population of plants, height and various other morphological parameters were superior in case of RDF 100 % + FYM 15 t ha^{-1} followed by Recommended dose of fertilizer (RDF) 120:60:40 and RDF 100 % +FYM 10 t ha$^{-1.}$ The greater economics was recorded in recommended dose of fertilizer (RDF) 120:60:40 followed by RDF 100 % + FYM 5 t ha-1 and RDF 100 % + FYM 2.5 t ha-1. The more amount of used nitrogen in this study showed the maximum growth of plants at various stages

References

1. Claudia A, Jacob H, Werner A. Effects on growth of wheat plants of isolates of Gaeumannomyces/Phialophora-complex fungi in different conditions of soil moisture, temperature, and photoperiod. European Journal of Plant Pathology,1997:103(5):417-426.
2. Devi M, Kumar J, Malik DP, Mishra P. Forecasting of wheat production in Haryana using hybrid time series model. Journal of Agriculture and Food Research, 2021, 100175.
3. Gill J, Sivasithamparam K, Smettem K. Soil types with different texture affects development of Rhizoctonia root rot of wheat seedlings. Plant & Soil,2000:221(2):113-120.
4. Gill J, Sivasithamparam K, Smettem K. Effect of soil moisture at different temperatures on Rhizoctonia root rot of wheat seedlings. Plant & Soil,2001:231(1):91-96.
5. Gunes Aydin, Inal Ali, Adak Mehmet, Alpaslan Mehmet, Bagci Esra, Erol Taskin. Mineral nutrition of wheat, chickpea and lentil as affected by mixed cropping and soil moisture. Nutrient Cycling in Agroecosystems,2007:78(1):83-96.
6. Kashyap D, Agarwal T. Carbon footprint and water footprint of rice and wheat production in Punjab, India. Agricultural Systems,2021:186:102959.
7. Kerstin N, Bonnett David F, Robert M. Simultaneous effects of leaf irradiance and soil moisture on growth and root system architecture of novel wheat genotypes: implications for phenotyping. Journal of Experimental Botany,2015:66:5441-5452. https://doi.org/10.1093/jxb/erv290
8. Kumar Virender, Brainard Daniel, Bellinder Robin, Hahn Russell. Buckwheat Residue Effects on Emergence and Growth of Weeds in Winter-Wheat (Triticum aestivum) Cropping Systems. Weed Science,2011:59:567-573. https://doi.org/10.1614/WS-D-11-00006.1
9. Moore Graham, Tyndale J. Estimation of the Importance of Spatially Variable Nitrogen Application and Soil Moisture Holding Capacity to Wheat Production. Precision Agriculture,1999:1(1):27-38.
10. Sana S, Youness O, Ghazali E, Issam O, Brahim B, Lahcen C. Physiological changes in *Triticum durum*, *Zea mays*, *Pisum sativum* and *Lens esculenta* cultivars, caused by irrigation with water contaminated with microcystins: A laboratory experimental approach. Toxicon,2009:53(7-8):786-796.
11. Sheoran P, Basak N, Kumar A, Yadav RK, Singh R, Sharma R *et al*. Ameliorants and salt tolerant varieties improve rice-wheat production in soils undergoing sodification with alkali water irrigation in Indo–Gangetic Plains of India. Agricultural Water Management,2021:243:106492.
12. Wang T, Zhang X, Li C. Growth, abscisic acid content, and carbon isotope composition in wheat cultivars grown under different soil moisture. Biologia Plantarum,2007:51(1):181-184.
13. Xue Q, Zhu Z, Musick JT, Stewart BA, Dusek DA. Root growth and water uptake in winter wheat under deficit irrigation. Plant & Soil,2003:257(1):151-161.