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Effect of Integrated Nutrient Management on Growth and Yield of Wheat (Triticum aesytivum)

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Abstract

The present investigation entitled "Effect of Integrated Nutrient Management on Growth and Yield of Wheat (Triticum aesytivum) was carried out in Ravi season during 2021-2022 at the cropresearch centre of School of Agriculture, ITM University, Gwalior, and M.P.The experiment was laiddown in Factorial randomized block design with twelve treatments viz., variety (RAJ 4033) and levels of Nitrogen phosphorus Potash (120, 60, 40 kg ha^{-1}). The growth attributes viz.,Number of shoots (m2), Leaf area index, Plant hight (cm), Dry matter accumulation. Yield attributes: Number of effective shoot (M2), Length of spike (cm), Test weight (1000-grain weight), Grain yield (kg ha-1), Straw yield (kg ha-1), Harvest index, Weight of spike.Economic studies:Cost of cultivation (Rs. h-1), Gross return (Rs. h-1), Net return (Rs. h-1), Benefit - cost ratio (Rs. re-1 invested). The maximumyield and yield attributes were recorded under the application of100%RDF, 12.5% FYM and 12.5% VC gavemaximum net return and BC ratio.

Keywords : Wheat, Effect of Integrated Nutrient Management on Growth and Yield of Wheat, Triticum aestivum.

Introduction

Wheat (*Triticum aestivum* L.) is the most important grain crop in the World, meeting 20% of the total food requirement of the World population from the cultivated area of about 218.54 million hectares with a production of 771.72 million tonnes (Agricultural Statistics at a Glance 2020). In India, it is the second most important crop after rice and ranks as the second-largest wheat producing nation at the global level contributing approximately 12.77 per cent to the world's wheat production from 14.00 per cent of the global area. Wheat contributes about 35 per cent to the total food grain basket of our country from about 30.60 million hectares with a production of 98.51 million tonnes and productivity of 3.19 tonnes ha-1 (Agricultural Statistics at a Glance 2020). This may seem a landmark but it's not the summit as more wheat must be produced to feed the increasing human population and meet the industrial requirements as well.

The World population is expected to reach more than 8 billion by 2030. It has been projected that a 55 per cent enhancement in the demand for food shall be caused by population increase and income gains by 2030. The projected food demand by 2030 in terms of per capita energy is 3000 Kcal. Thus, wheat production must be geared up to meet the increasing demand for food and nutritional security. In India, approximately 100 million tonnes of wheat would be required to be produced to cover an estimated demand for 345 million tonnes of food grains in 2030 (DWR, Karnal), to feed its ever-expanding population with the possibility of horizontal expansion of putting more land under cultivation being remote, further augmentation in yield would have to be harnessed from a unit area through judicious management of all inputs.

In India, Uttar Pradesh has the largest area (9.75 m ha) under wheat cultivation and it is the highest producer (31.88 mt) as well. The area under wheat in Madhya Pradesh has successively grown each year doubling from 4.1 million hectares in 2007-08 to around 7.72 million hectares in 2018-19. In the financial year 2020, over 19.61 million metric tons of wheat were produced in Madhya Pradesh. According to the office of the Director of the Department of Agriculture Madhya Pradesh, there was a huge jump in the wheat area in MP in the 2019-20 Rabi season when it increased by 2.5 million hectares and reached over 10.02 million hectares. According to the state's Agriculture Department, an increase of 32.4 per cent in the wheat area was witnessed in MP in just one year. (Chaba, A.A. 2022). The major area under wheat falls in the Indo-Gangetic Plains (IGP) which accounts for roughly 20 million hectares covering the states of Punjab, Haryana, Uttar Pradesh, Bihar and West Bengal. The states of Punjab and Haryana provide maximum contribution to the wheat buffer stock, an essential component of food security in our country.

Wheat is a staple food of approximately 23 per cent population of the world. Twenty per cent of energy is achieved through wheat at the global level. Among food grains, wheat is the richest source of protein and it stands in second place after pulses. In general wheat contains carbohydrate (70%), protein (12%), lipid (2%), vitamins & minerals (2% each) and crude fibre (2%). Besides staple food for human beings, wheat straw is a good source of feed for a large population of cattle in our country. In addition to household uses wheat is consumed in industrial uses in different forms viz., starch, gluten, bran, vitamins, binders and filters, food thickeners, cardboard etc.

Wheat is subjected to many biotic and abiotic pressures regardless of its poor productivity. In addition, there is inconsistency and improper use of fertilizers, lack of information on variants, edaphic features, mismanagement of farmers (Ali *et al.,* 2018). The requirement for wheat fertilizer depends on the accessibility of the crops to the soil. Before using fertilizer, it is essential to recognize the condition of the soil's nutritional condition and plant nutrient uptake.

Material and Methods

The present Field experiment entitled, "Effect of Integrated Nutrient Management on Growth and Yield of Wheat (*Triticum aestivum*)" was conducted at Research Farm, of School of Agriculture, ITM University during Rabi season of 2021-22, to evaluate the influence of organic, inorganic source of nutrients along with micronutrients on growth, yield attributes and yield of wheat as well as the economic viability of different treatments.

The experimental material used, experimental techniques and methodology adopted during investigation have been described in this chapter.

Location of Experimental SiteThe research farm is located at latitude of $26^0$14' N and longitude of $78^0$14' E with an elevation of 206 m above the mean sea level. The field at Research Farm, of School of Agriculture, ITM University, Gwalior having homogenous fertility and uniform textural make up was selected for the field experimentation. The soil of experimental field was sandy loam and was well drained. To determine the fertility status and other physico chemical properties of soil of experimental area a composite soil sample from 15-30 cm depth was taken just before layout and was subjected to mechanical analysis. Gwalior has a sub-tropical climate with hot summers from late March to early July, the humid monsoon season from late June to early October, and a cool dry winter from early November to late February. The city has a humid subtropical climate. The highest recorded temperature was 48 °C and the lowest was −1 °C. Summers start in late March and among the hottest in India and the world. Control (T_1), 100% RDF (T_2), 100% RDF+ Micronutrient (T_3), 75% RDF+12.5%FYM+12.5% Vermicompost (T_4), 50% RDF + 25%FYM+25%Vermi compost (T_5), 50% RDF + 25%FYM+25% Vermicompost +Micronutrient (T_6), 125% RDF (T_7), 125% RDF+ Micronutrient (T_8), 100%RDF+12.5%FYM+12.5%+ Vermicompost (T_9), 75% RDF+25%FYM + 25% Vermi compost (T_{10}).

Result and discussion

In the preceding chapter, the results of the field experimentation entitled "Effect of integrated nutrient management on growth and yield of wheat (*Triticum aestivum*)" have been presented in the foregoing pages. The results so obtained were considered of practical importance and therefore, have been discussed in detail along with the repercussions of weather parameters on growth and development, yield and yield attributes and economics of the treatments. During the discussion, the potential findings of other researchers have been cited to provide further support for the results obtained in the presented investigation. For convenience and categorized under suitable heads and each head has been discussed with the scientific reasons with cause and effect of treatments.

Experimental Details: To fulfill the requirement of objectives of the investigation, field experiment was laid out as detailed below:

T_1	:	Control
T_2	:	100% RDF
T_3	:	100% RDF+ Micronutrient
T_4	:	75% RDF+12.5%FYM+12.5% Vermicompost
T_5	:	50% RDF + 25%FYM+25%Vermi compost
T_6	:	50% RDF + 25%FYM+25% Vermicompost +Micronutrient
T_7	:	125% RDF
T_8	:	125% RDF+ Micronutrient
T_9	:	100%RDF+12.5%FYM+12.5%+ Vermicompost
T_{10}	:	75% RDF+25%FYM+25%Vermi compost

Yield contributing characters of wheat as influenced by integrated nutrient management practices.

INM practices	No of spike metre^{-1} row length	Length of spike (cm)	No. of grains spike^{-1}	Weight of grains spike^{-1} (g)	1000 grain weight (g)
T_1	86.85	6.75	40.35	1.23	34.25
T_2	94.42	7.62	44.58	1.45	36.52

T_3	95.12	7.65	44.62	1.46	36.58
T_4	110.58	8.65	52.68	1.80	39.02
T_5	96.65	7.58	44.35	1.42	36.50
T_6	94.26	7.42	44.16	1.40	36.48
T_7	102.35	7.78	48.42	1.62	37.28
T_8	103.18	7.82	48.68	1.64	37.32
T_9	118.85	9.12	56.52	2.00	40.78
T_{10}	111.62	8.78	52.70	1.82	39.05
SEm±	2.28	0.20	1.20	0.05	0.53
CD (P = 0.05)	7.20	0.64	3.78	0.15	1.68

Biological, grain and straw yields, and harvest index as influenced by integrated nutrient management practices.

INM practices	**Biological yield ($q\ ha^{-1}$)**	**Grain yield ($q\ ha^{-1}$)**	**Straw yield ($q\ ha^{-1}$)**	**Harvest index (%)**
Control **T_1**	95.74	34.02	61.72	35.53
100% RDF **T_2**	105.67	38.15	67.52	36.10
100% RDF+ Micronutrient **T_3**	105.93	38.28	67.65	36.14
75 % RDF+12.5% FYM+12.5 % VC **T_4**	119.97	45.05	74.32	37.74
50 % RDF + 25%FYM+25%VC **T_5**	104.80	37.96	66.84	36.22
50 % RDF + 25%FYM+25% VC + Micronutrient **T_6**	103.93	37.38	66.55	35.97
125% RDF **T_7**	114.18	41.62	72.56	36.28
125% RDF+ Micronutrient **T_8**	114.35	41.70	72.65	36.47
100%RDF+12.5% FYM+12.5%VC **T_9**	123.53	48.45	75.08	39.22
75 % RDF+25%FYM+25%VC **T_{10}**	119.48	45.08	74.35	37.75
SEm±	2.17	1.05	1.53	0.46
CD (P = 0.05)	6.82	3.32	4.81	1.46

Conclusion

Based on one year's results, it may be concluded that the application of 100% RDF + 12.5% FYM + 12.5% Vermicompost resulted in significantly higher grain yield and net profit ha^{-1} in the agro-climatic conditions of Gwalior (MP).

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