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Comparative Analysis of Organic and Inorganic Fertilizers on Wheat (Triticum aestivum L.) Yield Attributes

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Abstracts:

The present investigation entitled "Effect of organic and inorganic sources on yield attributing traits of wheat (*Triticum aestivum* L.)" was conducted at Agronomy Research Farm of Career Point University, Kota, Rajasthan during Rabi 2023-24. The 15 treatment combinations comprised with three fertility sources [50+50% inorganic +organic (F_1), 100% organic (F_2), and 100% inorganic (F_3)] with five varieties (Raj 3765 (V_1), Raj 1482 (V_2), Raj 3777 (V_3), Raj 4037 (V_4) and Raj 4120 (V_5) were arranged in Randomized Block Design (RBD) with three replications. Yield contributing characters like number of ear heads m^{-1}, length of ear (cm), number of spikelet ear^{-1}, number of grain ear^{-1} etc. were increased significantly with 100% inorganic fertilizers (F_3). Application of 100% inorganic fertilizers (F_3) significantly increased the grain and straw yield over 100% organic sources of nutrients (F_2). The highest value with 100% inorganic fertilizers (F_3). Raj 4120 increased the grain and straw yield significantly 32.77 q ha^{-1} and 42.67 q ha^{-1}, respectively over rest of varieties. All the yield contributing characters like number of ear heads m^{-1}, Length of ear (cm), number of spikelet's ear^{-1} and number of grain ear^{-1} were also higher in Raj 4120 and lowest were recorded in Raj 4037 (V_4).

Key Word: Wheat, Organic, Inorganic, Variety, Growth, Quality

I Introduction:

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Wheat (Triticum aestivum L.) is one of the most vital cereal crops worldwide, playing a crucial role in global food security and nutrition. Enhancing wheat production is essential to meet the demands of a growing population and to ensure a stable food supply. Among the various agronomic factors influencing wheat productivity, nutrient management is particularly significant. The sources of nutrients—whether organic or inorganic—can profoundly impact the growth, yield, and overall performance of wheat crops. Organic nutrient sources, such as compost, manure, and bio-fertilizers, are derived from natural materials and contribute to improving soil health, structure, and microbial activity. These sources often release nutrients slowly, providing a sustained supply over time and enhancing the long-term fertility of the soil. On the other hand, inorganic nutrient sources, primarily synthetic fertilizers, are designed to deliver precise and immediate nutrient availability, which can lead to quick and substantial improvements in crop growth and yield.

Balancing the use of organic and inorganic nutrient sources is crucial for optimizing wheat production. Organic sources can improve soil quality and sustainability, while inorganic fertilizers can provide the necessary nutrients at critical growth stages to boost yield. Understanding the effects of these different nutrient sources on yield-attributing traits of wheat, such as grain number, grain weight, and overall biomass, is essential for developing integrated nutrient management strategies. This study aims to evaluate the impact of organic and inorganic nutrient sources on the yield-attributing traits of wheat. By examining various combinations of organic and inorganic treatments, the research seeks to identify the most effective nutrient management practices that enhance wheat yield and contribute to sustainable agriculture. The findings of this study will offer valuable insights for farmers, agronomists, and policymakers to implement balanced and efficient nutrient management strategies for wheat cultivation.

II Literature Review:

Wheat (*Triticum aestivum* L.) is the world's most important cereal crop both the respect of acreage (215 m ha) and production (584 mt). It is the second most important grain crop after rice in India. Anonymous, 2022. Balance fertilization through organic & inorganic sources collectively improves the quality of grain and boosts the productivity of wheat as well as improves the soil health. Organic matter is the substrate for a large number of soil, beneficial organisms that are essential to keep the plant healthy, improves nutrient availability and

increases crop yield. Organic matter improves physical condition of the soil for better performance of microorganisms Zhou *et al*., 2022.

Although increased level of production can be achieved by increased use of fertilizers but continuous use of chemical fertilizers alone may lead to some detrimental effect on physico-chemical properties of soil and also may not be so remunerative unless the fertility of soil is maintained at sustainable level by the application of organic manure. Therefore, to maintain fertility and productivity of soil at sustainable level for long duration, use of organic manure is quite essential. Organic manures are considered to be an integral component of sustainable system, as they improve soil fertility and physical properties of the soil. Soil physical problems such as surface hardening and crusting are also removed due to ameliorative effect of organic manures. Among organic manures, FYM is a well-known source, which contains Macro and Micronutrients in appropriate proportion, and its use helps in improving the physical condition and moisture retentive capacity of soil. It also serves as a source of energy for the development of beneficial microorganisms in the soil. However, organic manures cannot substitute total N requirement of crop since the nitrogen requirement is very high and the availability of organic manure (FYM etc.) is not sufficient. Therefore, there is need to evaluate the utilization of both organic as well as inorganic sources in a rational way to achieve suitable production of wheat.

Fertilizer use has become a key factor for increasing agricultural production. Amongst various agricultural inputs considered necessary for higher crop yields, fertilizer has been and will continue to be king input in achieving the food production targets in the country (Patra *et al.* (1999). Though fertilizer doses estimated on the basis of soil test are usually considered enough but the results obtained from All India Coordinated Research Project on Long Term Fertilizer Experiment have indicated that the yields under 1.5 times of the optimum rates of NPK fertilization were substantially higher than the yields under soil test based 100% NPK as optimum dose. Hence there is a need for the application of higher dose of fertilizers to obtain higher yields.

Almost the organic manures, FYM are a traditional to the soil such as, farmyard manure help in maintaining soil fertility and productivity. It increases soil microbiological activities, plays key role in transformation, recycling and availability of nutrients to the crop (Chouhan *et al.*, 2001). It also improves the physical properties like soil structure, porosity, reduces compaction and crusting and increases water-holding capacity of the soil. The

availability of phosphorus and micronutrients from native source are also increased with incorporation of organic matter, which might be due to release of organic acids (Singh *et al.*, 1990). Because of aforesaid positive impact of organic matter and ever increasing cost of chemical fertilizers coupled with their limited availability, organic manuring through locally available source is again regaining importance in crop production and for maintenance of soil productivity on sustainable basis. As the nutrient needs of the crops to keep pace with nutrient removed by crop cannot be met either through mineral fertilizers or through organics, efficient and judicious use of all the major sources of plant nutrients viz. Soil mineral organic and biological material in an integrated manner would be essential and inevitable. From the results of the long term fertilizer experiments conducted in different part of the country, it has been well established that under high input production system where crop productivity cannot be further increased with incremental use of fertilizer alone, addition of organic sources could again increase the yield through increased soil productivity and fertilizer use efficiency. Thus sustainable agriculture in years to come should ideally be based on integrated plant nutrient supply.

Land degradation and environmental pollution can be minimized for sustainable agriculture. It will reduce the use of inorganic fertilizers increasing their use efficiency, saves farmers money, increases organic matter in soil, enhances the quality of environment and increases the crop yield and profitability. Integrated nutrient management is an old age concept but its importance was not realized earlier due to low nutrient turn over in soil plant system and almost all the required nutrients were met through organic sources. Integrated nutrient management has now assumed great significance mainly because of two reasons firstly the need for continuous increase in per hectare yield requires growing application on nutrients and the present level of fertilizer production in India is not enough to meet the requirement of total plant nutrients. Secondly the results of a large number of experiments on manures and fertilizers conducted in the country revealed that neither the chemical fertilizer alone nor the organic sources exclusively can achieve the sustainability in production of wheat under intensive cropping system.

III Methodology:

Experimental site:

The experiment was conducted at Agronomy Research Farm of Agronomy Research Farm, Career Point University, Kota, Rajasthan. The experimental site was situated about on

Faizabad-Raibareilly road at 26.47^{0}N latitude, 82.12 ^{0}E longitude and on altitude of 113 meters above mean sea level.

Weather conditions:

Geographically Kota falls under semi-arid sub-tropical climate of Indo-Gangetic plains having alluvial calcareous soil. The average annual precipitation is about 1194 mm. of which 80-90 per cent received during monsoon period i.e. between June to September. The temperatures reach to its peak (40-45^{0}C) during May and June while the mercury is quite low during December and January (5-8^{0}C).

Field preparation:

The field was ploughed once with tractor drawn soil turning plough after receiving a pre-sowing irrigation, followed by subsequent two cultivators. The planking was in variably done after each ploughing and also after sowing of the seeds. After the preparation of field the lay out was done in the field.

Application of FYM:

FYM 12 and 24 t ha^{-1} as per treatment was applied one week prior to pre-sowing irrigation. Quantity was calculated on oven dry basis.

Application of fertilizers:

Fertilizer nitrogen, phosphorus and potassium were applied in the form of urea, SSP and muriate of potash at @ 120, 60 and 60 kg ha^{-1}, respectively. Full dose of phosphorus and potassium and half dose of nitrogen was applied at the time of sowing and rest half dose of nitrogen was applied as two split doses @ time of first irrigation and second irrigation.

IV Results and Discussion:

The observations recorded on growth, development, yield attributes, yield, quality of grain etc and economics of different treatments have been subjected to statistical analysis and presented in tables depictions wherever necessary. The treatment effects have been described in the light of statistical interpretations.

Result and Discussion

Days taken to 50% flowering and Maturity:

Data pertaining to days taken to 50% flowering have been presented in Table 1. It shows that RAJ 4120 (V_5) took 80.60 days to flowering, days taken to maturity (122 days) was maximum in which was application of 100% inorganic fertilizer (F_3), delayed 50 per cent

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flowering by 2-3 days as compared to 100% organic (F_2) and 50 +50% inorganic + organic (F_1) plots.

Economically Characters:

An analysis of data presented in Table-1 reveal that number of ear heads increased significantly by the application of 100% inorganic fertilizer (F_3). Treatment (F_3) recorded highest number of ear heads which was significantly superior over 100% organic (F_2) and 50% +50% inorganic +organic sources.

Among varieties, the highest number of ear heads (116.67 m^{-1}), Length of panicle (8.20), cm, Number of spikelets per ear (29.67), Numbers of grain per ear (51.89), grain yield (32.77) g. and straw yield (42.67) g were recorded in RAJ 4120 (V_5) being at par with RAJ 3765 and Raj 3777 and significantly superior over RAJ 4037 (V_4) RAJ 1482 (V_2) . Saharan *et al*. (2023) Reported that the application of 75 % RDF+5 t FYM ha^{-1}+*Azotobacter*+PSB in wheat, significantly enhanced all growth (dry matter, total tillers, CGR, RGR and others) & yield attributes (Effective tillers, test weight and others), Tiwari *et al*. (2022) Observed that the treatment combination 50% RDF + FYM 6 ton /ha + 1.875 ton / ha. was registered significantly superior in terms of number of tillers, dry weight, test weight, grain yield, straw yield, respectively over rest of the treatments.

The interaction effect of fertility sources and varieties was found to be non-significant. The values of yield contributing characters like number of ear heads per running meter, Length of ear cm, number of spiklets ear^{-1}, number of grain ear^{-1} (Table 1) were increased with 100 % inorganic fertilizer (F_3) followed by 50+50% inorganic +organic (F_1). This might be due to the better development of source and sink capacity of the plant, which ultimately resulted in the higher yield contributing characters with inorganic fertility sources. Similar results were also obtained by Mauriya and Yadav (1997), Bajpati (1987), and Premi and Kalia (2003).

Grain and straw yields of wheat were affected significantly due to different fertility sources (Table 1). The highest grain (35.74 q ha^{-1}) and straw yields (46.84 q ha^{-1}) were recorded with 100% inorganic (F_3) followed by 50+50% inorganic +organic (F_1). Increase in yield with application of 100% inorganic fertilizers might be attributed to more number of ear heads m^{-1}, number of grains ear^{-1} and also test weight. Higher yield under 100% inorganic fertilizer was due to adequate nutrients supply which contributed to increased dry matter production. Better vegetative growth coupled with higher yield attributes resulted in higher grain and

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straw yield of wheat. Similar result were also reported by Bajpai (1997), Nayak and Gupta (2000), Siddique *et al*. (1999) and Raju and Devi (2005).

Table 1. Yield attributes as influenced by fertility sources and wheat varieties

Treatments	Days taken to 50% flowering	Days taken to maturity	No. of ear heads (m^{1})	Length of ear (cm)	No. of spikelets (ear^{-1})	No. of grain (ear^{-1})	Yield	
Fertility sources							Grain	Straw
F_1	80.0	117.00	114.40	7.58	27.13	51.67	29.77	37.56
F_2	79.60	115.30	94.0	6.28	18.13	39.67	26.84	33.02
F_3	82.90	118.60	129.20	9.51	37.67	56.63	35.74	46.84
SEm±	**1.86**	**2.13**	**1.585**	**0.136**	**1.085**	**1.240**	**0.60**	**0.79**
CD (P=0.05)	**3.13**	**4.63**	**4.589**	**0.395**	**3.144**	**3.590**	**1.75**	**2.30**
Varieties								
V_1	74.34	113.60	114.67	8.03	28.67	51.22	31.62	40.38
V_2	78.00	118.30	110.33	7.56	26.89	48.83	29.57	37.30
V_3	78.30	120.10	112.67	7.79	28.00	50.00	30.71	38.58
V_4	75.00	114.26	108.33	7.37	25.00	46.67	29.25	36.77
V_5	80.60	122.00	116.67	8.20	29.67	51.89	32.77	42.67
SEm±	**2.06**	**2.34**	**2.046**	**1.176**	**1.401**	**1.600**	**0.77**	**1.03**
CD (P=0.05)	**3.46**	**4.78**	**5.925**	**0.510**	**NS**	**NS**	**2.25**	**2.98**

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Table 2 Effect of tillage and nitrogen management practices on yield and economics of wheat

Treatments	Seed yield (kg/ha)	Straw yield (kg/ha)	Biological yield (kg/ha)	Net return (ha.)	B:C ratio
Tillage practices					
Zero tillage	2935	4660	7595	41929	1.94
Minimum tillage	3520	5525	9045	53857	1.83
FIRB	3907	5995	9902	57275	1.91
Conventional tillage	4220	6380	10600	60595	1.95
SEm±	**101.7**	**143.3**	**245**	**1121.7**	**0.09**
CD (P=0.05)	**305**	**430**	**735.1**	**3365**	**0.27**
Nitrogen management practices					
Control	2920	4630	7568	50160	1.63
RND (120:80:55 kg/ha NPK)	4185	6326	10511	60715	1.93
SPAD (80:60:50 kg/ha NPK)	3480	5465	8945	53834	1.81
Targeted yield 5t/ha (150:80:65 kg/ha)	3890	5975	9865	57630	1.89
SEm±	**99.3**	**138.7**	**237.9**	**1091.7**	**0.08**
CD (P=0.05)	**298**	**416**	**713.9**	**3275**	**0.24**

V Conclusion:

Wheat remains a crucial cereal crop globally and in India, where it holds the second position after rice. Effective fertilization strategies, integrating both organic and inorganic sources, are essential to enhance wheat productivity, grain quality, and soil health. While chemical fertilizers alone can increase yields, their continuous use may degrade soil properties. Organic manures, such as farmyard manure (FYM), play a vital role in maintaining soil fertility and physical properties, contributing to sustainable agricultural practices. Long-term studies highlight that a combination of organic and inorganic fertilizers can lead to better crop yields and improved soil conditions. FYM, in particular, improves soil structure, enhances nutrient availability, and supports beneficial microorganisms. However, organic

sources alone cannot meet the high nitrogen demands of wheat crops, necessitating a balanced approach to fertilization. Integrated nutrient management (INM) emerges as a sustainable solution, combining soil mineral, organic, and biological materials to optimize nutrient supply. This approach not only boosts crop yields but also enhances fertilizer use efficiency and reduces environmental impact. As the demand for higher per hectare yields increases and fertilizer production remains insufficient, INM offers a viable path forward. Experimental results demonstrate that 100% inorganic fertilization yields the highest grain and straw outputs, but integrating organic sources also significantly improves various yield attributes. Therefore, the adoption of INM practices, leveraging both organic and inorganic fertilizers, is crucial for achieving sustainable wheat production and long-term soil health.

References:

1. Bajpai, R. (1987). Comparative performance of now agro-techniques of transplanted paddy under increasing rates of fertility. M.Sc. (Ag) Thesis, C.S.A.U&T., Kanpur.
2. Bajpai, R.K.; Upadhyay, S.K.; Joshi, B.S. and Tripathi, R.S. (2002). Productivity and economics of rice-wheat cropping system. Under integrated nutrient supply system. *Indian J. Agron.* **47** (1) : 20-25.
3. Chauhan, R.P.S. (2001). Integrated use of nitrogen sources in wheat grown in partially reclaimed sodic s*oil. Ann. PI. Soil. Res*. **3** (1): 17-25.
4. Maurya, D.M. and Yadav, M.P. (1987). Performance of averaged seedling at different N levels, INT, *Rice Res. News letter*. **12** (4):9
5. Nayak, A.K. and Gupta, M.P. (2000). Influence of phosphorus Zinc and organic mater interaction on yield prediction in wheat. *J. Indian Soc. Soil Sci*. **49** (4): 194-196.
6. Patra, A.P.; Panda, D.; Patra, B.C. and Karnakar, A.J. (1999). Effect of FYM, Zinc and NPK fertilizer on yield components and yield of wheat after winter rice in West Bengal. *J. Interacdemicia* 1-6.
7. Premi, O.P. and Kalia, B.D. (2003).Effect of organic and inorganic sources of nutrient on yield, yield attributes and quality of rice. *Agric. Sci. Digest* **23** (2): 152-154.
8. Raju, M.S. and Suneetha, Devi, K.B. (2005). Performance of rice hybrids at different levels of nitrogen and phosphorus applications. *Oryza.* **42** (1): 27-30.
9. Saharan, B., Yadav , R. S., & Kantwa , S. R. (2023). Response of Organic and Inorganic Nutrient Sources on Growth, Productivity and Nutrient Content of Wheat . *International Journal of Environment and Climate Change*, *13*(11), 1081–1090.

10. Singh, K. and Verma, H.D. (1990). Response of wheat varieties to sowing data and fertility levels. *Indian J. Agron.* **35** (4): 424-425.
11. Tiwari, D.K, Chaturvedi, P.K, Kumar, R. and Yadav, D.S. 2022. Effect of integrated nutrient management on growth and yield of wheat (*Triticum aestivum* L.) *The Pharma Innovation Journal*, 11(12): 5032-5034.
12. Zhou Z, Zhang S, Jiang N, Xiu W, Zhao J and Yang D (2022) Effects of organic fertilizer incorporation practices on crops yield, soil quality, and soil fauna feeding activity in the wheat-maize rotation system. *Front. Environ. Sci.* 10:1058071.