Influence of Natural Farming, Organic and Inorganic Systems of Nutrition on Wheat (*Triticum aestivum* L.)

.

ABSTRACT

A field experiment entitled "influence of natural farming, organic and inorganic systems of nutrition on wheat (*Triticum aestivum* L.)" was conducted at Research Farm of School of Agriculture, Abhilashi University, Mandi (H.P.) during *Rabi*season (2021-2022). The experiment was laid out in randomized block design with three replications, consisting of six nutrient management treatments.Results of study revealed that inorganic and integrated nutrient management (FYM @ 5 ton ha^{-1} + 50 percent recommended dose of fertilizers) treatments behaving alike resulted in better crop growth (plant height, shoot number and dry matter accumulation), yield attributes (number of effective tillers, spike length, number of grains per spike and 1000-grain weight) and higher yield (grain and straw) compared to treatments comprised of farmer's practice (FYM @ 2.5ton ha^{-1} + 50 percent recommended dose of fertilizers), organic (FYM @ 10 ton ha^{-1} + *Jeevamrit)* and natural farming (*Beejamrit* +*Jeevamrit* + mulching) systems of nutrition.

Keywords: Nutrient management, natural farming, jeevamrit, inorganic

1. INTRODUCTION

"Wheat (*Triticumaestivum* L.) is the second most important cereal crop next to rice play an important role in global agricultural economy. Wheat is a staple food for over eight billion people of world. Worldwide, wheat is cultivated on an area of about 220 million hectares with an annual production of 781 million metric tonnes and average productivity of 3470 kg ha^{-1}" (USDA, 2023). "India is second largest producer of wheat in the world after China. In India, wheat occupies an area of 31.61 million hectares with a production of 109.52 million tonnes and productivity of 3464 kgha^{-1}" (Anonymous, 2021). "In Himachal Pradesh, wheat ranks first in acreage and covers 320 thousand hectares with production of 564 thousand metric tonnes and productivity of 968 kg ha^{-1}" (Anonymous, 2020).

"Chemical fertilizers are able to boost crop yield as well as produce sufficient biomass as they are potential sources of high amount of nutrients in easily available forms. But now the indiscriminate use of chemical fertilizers alone has led to the environmental pollution and deterioration of soil physical, chemical and biological properties" (Loura et al. 2020). "Under such condition, there is need to look for alternative and renewable sources of plant nutrition. In recent years, organic farming is gaining importance due to increased demand for organic food. The use of organic sources of nutrients in the form of Farm Yard Manure (FYM) has resulted in considerable increase in crop yield and significant improvement in soil physical, chemical and biological properties" (Pathak et al. 2017).

Due to limited availability and low nutrient content of farm yard manure, the use of FYM alone as a substitute to inorganic fertilizer is not enough to maintain the present level of crop productivity of high yielding varieties. Under such condition, integrated nutrient management which involve the use of organic manures along with chemical fertilizers is the most effective method to maintain soil fertility and crop productivity. Recently, a new concept of "Subhash

Palekar Natural Farming (SPNF)" proposed by Padamshri Subhash Palekar has come up. In SPNF, soil is supplemented with the inoculums like *Beejamrit* and *Jeevamrit* to accelerate the propagation of soil existing micro flora and ultimately ensures the availability of nutrients to the crops. Keeping in view the above facts and to compare natural farming, organic and inorganic systems of nutrition in wheat crop, the present study was undertaken

2. MATERIALS AND METHODS

A field experiment was conducted at the Research Farm of the School of Agriculture, Abhilashi University, Mandi (H.P.) during *Rabi*season (2021-2022). Soil of the experimental field was acidic in reaction (5.5), medium in organic carbon (0.72%), low in available nitrogen (238 kg ha^{-1}), medium in available phosphorus (15.52kg ha^{-1}) and available potassium (206 kg ha^{-1}). The experiment was laid out in randomized block design with three replications, consisting of six nutrient management treatments *i.e.* absolute control (T_1), natural farming nutrient management (seed treatment with *Beejamrit* + soil treatment with *Jeevamrit* as basal and at 21 days interval + mulching) (T_2), organic nutrient management(FYM @ 10 ton ha^{-1} + 3 sprays of *Jeevamrit*) (T_3), farmer's practice (FYM @ 2.5 ton ha^{-1} + 25 percent recommended dose of fertilizers) (T_4), integrated nutrient management (FYM @ 5 ton ha^{-1} + 50 percent recommended dose of fertilizers) (T_5) and inorganic nutrient management (100 percent recommended dose of fertilizers) (T_6).

Wheat variety 'HS 507' was sown at 20 cm row to row spacing using seed rate of 100 kgha^{-1}. Before sowing of wheat, full dose of FYM on dry weight basis was applied as per treatment and thoroughly mixed with the soil. The crop was fertilized with recommended dose of nitrogen, phosphorus and potassium *i.e.* 120, 60 and 40 kg ha^{-1}through urea, single super phosphate and murate of potash as per treatments at the time of sowing. Half dose of N, whole of P and K as per treatments was applied at the time of sowing of crop. The remaining half dose of N was top dressed after 30 days of sowing of crop. *Beejamrit* was prepared on the farm itself as per the seed requirement. The ingredients for treating 100 kg of seeds @ 25 liters of *beejamrit* were local cow dung (5kg), local cow urine (5 liters), lime (50 g), soil (200 g) and water (20 liters). *Jeevamrit*, fermented liquid organic manure was prepared on the farm itself. The ingredients for 2 liters of *Jeevamrit* were cow dung (100 g), cow urine (100 ml), jaggery (20 g), pulse floor (20 g), soil (2 g) and water (2 liters). *Jeevamrit* was kept for 48 hours in the shadow for fermentation. Thereafter, dilution of 10 per cent from the concentrated *Jeevamrit* were prepared and used at the rate of 500 L/ha in the respective treatments. The inputs of natural farming were prepared as per the procedure proposed by Subhash Palekar (Palekar 2006). In natural farming treatment, paddy straw was used as mulching material. Mulching was applied at 30 days after sowing and it was maintained till the maturity of crop.

The growth parameters were recorded at monthly interval of crop growth period. The crop was harvested treatment wise at maturity and grain yield per hectare was computed. The data recorded on various aspects in the present study was subjected to the statistical analysis using analysis of variance as per procedure suggested by Gomez and Gomez (1984).

3. RESULTS AND DISCUSSION

Growth attributes

Growth parameters of wheat *viz.* plant height, shoot number and dry matter accumulation of wheat were significantly influenced by different nutrient management treatments at 120 days after sowing(DAS). Inorganic nutrient management remaining at par with integrated nutrient management (FYM @ 5ton ha^{-1}+ 50 percent recommended dose of fertilizers) resulted in

significantly taller plants, higher shoot number and dry matter accumulation of wheat crop. Following to, farmer's practice of FYM @ 2.5ton ha^{-1}+ 25 percent recommended dose of fertilizers resulted in significantly higher values of growth parameters, however remained statistically at par with organic nutrient management (FYM @ 10 ton ha^{-1}+ *Jeevamrit*) treatment, which further behaved statistically similar to natural farming nutrient management (*Beejamrit* + *Jeevamrit* + mulching) treatment with respect to plant height and shoot number. Significantly lowest plant height, shoot number and dry matter accumulation of wheat crop were observed under absolute control, which was at par with natural farming nutrient management treatment.

Increase in plant height, shoot number and dry matter accumulation under inorganic and integrated nutrient management practices might be ascribed to increased supply of plant nutrients particularly nitrogen in the growth medium and their uptake by plant (Singh et al. 2018). The effect on dry matter accumulation of crop obtained in different treatments can be ascribed to growth attributes *viz.* plant height (cm) and number of tillers (per m^2) under the present study. Similar results were also reported by Verma et al. (2018), Singh et al. (2018) and Tomar et al. (2018).

Table 1. Effect of nutrient management practices on growth parameters of wheat

Treatments	120 days after sowing		
	Plant height (cm)	Shoot number (per m^2)	Dry matter accumulation (g/m^2)
Absolute control	61.1	217	274.25
Natural farming nutrient management	65.5	231	289.25
Organic nutrient management	70.5	253	339.20
Farmer's practice	78.6	270	390.80
Integrated nutrient management	87.7	306	440.10
Inorganic nutrient management	89.5	311	448.17
SEm±	3.00	11.78	16.08
CD(P)=0.05	9.02	35.36	48.24

Yield attributes

Number of effective tillers per meter square, spike length (cm) and number of grains per spike were significantly higher with inorganic nutrient management treatment, which remained statistically at par with integrated nutrient management treatment comprised of FYM @ 5 ton ha^{-1} + 50 percent of recommended dose of fertilizers. Significantly lower number of effective tillers, spike length and number of grains per spike were recorded under control condition where no manure or fertilizers were applied, but remained at par with natural farming nutrient management treatment of *Beejamrit* + *Jeevamrit* + mulching. Treatments did not have any significant effect on 1000 grain weight of wheat.

Inorganic and integrated nutrient management practices resulted in higher yield attributes. This might be ascribed to rapid supply of nitrogen from chemical fertilizers at the initial crop growth stages and steady supply of nitrogen from the mineralization of FYM throughout the growing season leading to higher yield and yield components (Bindia et al. 2005).

Yield

Perusal of data in table 2 revealed that inorganic nutrient management resulted in significantly higher grain and straw yields, which remained statistically at par with integrated nutrient management treatment comprised of FYM @ 5 ton ha^{-1}+ 50 percent recommended dose of fertilizers. Farmer's practice of FYM @ 2.5 ton ha^{-1}+ 25 percent recommended

doseof fertilizers was next in place to inorganic and integrated nutrient management treatments.Among organic and natural farming nutrient management treatments, organic nutrient management treatment *i.e.* FYM @10 ton ha^{-1} + *Jeevamrit* produced more grain and straw yields, but remained statistically at par with natural farming nutrient management treatment comprised of *Beejamrit* + *Jeevamrit* + mulching. Further observation of data indicated that absolute control resulted in lowest grain and straw yields, but remained statistically at par with natural farming nutrient management treatment.

Inorganic nutrient management treatment resulted in 47.4, 38.9, 26.5, 15.74 and 3.93 per cent more grain yield and 45.47, 36.90, 26.01, 15.10 and 2.90 percent more straw yield over absolute control, natural farming nutrient management, organic nutrient management, farmer's practice and integrated nutrient management, respectively.

Table 2. Effect of nutrient management practices on yield attributes and yield of wheat

Treatments	Number of effective tillers (m^2)	Number of grains per spike	1000-grain weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{1})
Absolute control	178	39.42	39.05	1843	3716
Natural farming nutrient management	194	42.16	39.25	2141	4160
Organic nutrient management	205	45.21	39.57	2575	5042
Farmer's practice	218	49.16	41.41	2953	5780
Integrated nutrient management	242	51.56	41.62	3367	6612
Inorganic nutrient management	247	53.03	41.76	3505	6815
SEm±	10.51	2.49	1.67	123.09	244.95
CD(P)=0.05	23.41	5.56	NS	369.09	734.85

The results manifestly revealed that inorganic and integrated nutrient management resulted in better yield attributes *viz.* effective tillers, spike length, number of grains per spike and 1000 grain weight (Table 2)which ultimately resulted in better grain and straw yields compared to treatments of farmer's practice, organic and natural farming nutrient management. Similar results regarding grain yield with inorganic and integrated nutrient management was reported by Devi et al. 2011. The increase in yield under inorganic and integrated nutrient management might be ascribed to sufficient availability of nutrients, which resulted in grater assimilation production and partitioning of dry matter thereby increase the yield. Incorporating organic manure (FYM) with inorganic fertilizers might have increased the availability of major and micro nutrients as well as the activities of heterotrophic bacteria and fungi in soil. This in turn, increased the activity of enzymes that convert unavailable forms of nutrients to available forms, resulting in higher nutrient uptake and an increase in crop yield (Rana and Verma 2020).

4. CONCLUSION

The study conclusively indicated that inorganic and integrated nutrient management proved superior to farmer's practice, organic and natural farming nutrient management in terms of increasing growth attributes, yield attributes and yield of wheat.

REFERENCES

1. Anonymous 2020. Statistical abstract of Himachal Pradesh 2019-2020. Government of Himachal Pradesh. Pp 31-33
2. Anonymous 2021. Agriculture Statistics 2021. Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture and Farmers Welfare, Government of India, New Delhi. Pp 38
3. Anonymous 2023. World agricultural production. United State Department of Agriculture office of global analysis. pp. 1-37
4. Bindia, Kalia B and Mankotia B. 2005. Effect of integrated nutrient management on growth and productivity of wheat crop. *Agricultural Science Digest* 25 (4): 235 – 239
5. Devi KN, Singh MS, Singh NG and Athokpam HS. 2011. Effect of integrated nutrient management on growth and yield of wheat (*Triticum aestivum* L.). *Journal of Crop and Weed* 7(2): 23-27
6. Gomez GA and Gomez AA. 1984. Statistical Procedures for Agricultural Research (2nd ed.). John Wiley and sons, New York. p 680
7. Loura D, Kumar S, Kumar P, Sunil, Akshit and Dhankar A. 2020. Response of different organic and inorganic sources of nutrients on growth and yield of wheat (*Triticum aestivum* L.). *Indian Journal of Pure and Applied Biosciences* 8(2): 370-376
8. Palekar S. 2006. *Shoonya Bandovalada Naisargika Krushi*. Agri Prakashana, Bengaluru, India. pp 210.
9. Pathak A, Gupta A, Tiwari A and Kumar V. 2017. Direct and residual effect of zinc and FYM on quality and uptake of N, P and K in pearl millet – wheat cropping system. *International Journal of Chemical Studies* 5(6): 1352-1358
10. Rana B and Verma H. 2020. Assessment of different nutrient management approaches for grain yield, gluten content and net income of common bread wheat (*Triticum aestivum* l.) in Western Himalayan region of Uttarakhand. *Pantnagar Journal of Research*19(3): 359
11. Singh T, Singh NB, Kumar P and Singh S. 2018. Effect of different irrigation and fertility levels on dynamic growth and yield of late sown wheat (*Triticum aestivum* L.). *International Journal of Chemical Studies* 6(1): 1523-1528
12. Tomar R, Singh N, Singh V and Kumar D. 2018. Effect of planting methods and integrated nutrient management on growth parameters, yield and economics of rice. *Journal of Pharmacognosy and Phytochemistry* 7(2): 520-527
13. Verma K, Bindra A, Singh J, Negi S, Datt N, Rana U and Manuja S. 2018. Effect of Integrated Nutrient Management on Growth, Yield Attributes and Yield of Maize and Wheat in Maize-Wheat Cropping System in Mid Hills of Himachal Pradesh. *International Journal of Pure and AppliedBioscience 6(3): 282-301*