



Effect of integrated nutrient management on growth and yield of wheat

Kantilal jat¹, Meenakshi Seth²

¹ Master of Science in Agronomy, University Institute of Agricultural Sciences, Chandigarh University, Punjab, India

² Assistant Professor, University Institute of Agricultural Sciences, Chandigarh University, Punjab, India

Abstract

A field experiment was conducted during *Rabi* season 2020-2021 at Experimental farm of University Institute of Agricultural Sciences, Chandigarh University, Gharuan (Mohali) to study the effect of integrated nutrient management on productivity of wheat. The experiment consisted of 7 treatments comprising of different nutrient management practices *i.e.* RDF (100%), FYM @4 t ha⁻¹, FYM @2 t ha⁻¹ + 50% RDF, FYM @1 t ha⁻¹ + 25% RDF, VC @ 1.4 t ha⁻¹, VC @0.7 t ha⁻¹ + 50% RDF and VC @0.35 t ha⁻¹ + 25% RDF. The experimental design was conducted in RBD (Randomized block design) with three replications. Results revealed that yield attributes, grain yield and straw yield of wheat was significantly influenced by the application of RDF (100%). The yield attributes and yield of the crop was highest with the application of RDF (100%). However, grain yield was statistically at par with VC @0.7 t ha⁻¹ + 50% RDF as compared to other treatments. The grain yield was 35.91% more in RDF (100%) than that of FYM @4 t ha⁻¹. Maximum cost of cultivation was recorded under FYM @2 t ha⁻¹ + 50% RDF. RDF (100%) gave significantly higher net returns per rupee invested as compared to FYM @4 t ha⁻¹. However, it was also statistically at par with VC @0.35 t ha⁻¹ + 25% RDF.

Keywords: economics, FYM, nutrients, yield, wheat

Introduction

Wheat (*Triticum aestivum* L.) is second most important cereal crop in the world after rice and is one of the most important staple food crop. Wheat is cereal grain, originated from the Levant region but now cultivated in at least 43 countries of the world. Nutrient schedule along with balanced fertilization using organic manures is considered as promising agro-technique to maintain yield, increase fertilizer use efficiency and to restore soil fertility. The strength of the combined use system also lies in its ability to meet the short-term as well as long-term nutrient requirements of crops through the fast releasing fertilizer nutrient pool and the slow releasing organic nutrient pool, respectively. The integrated nutrient supply including the use of chemical fertilizers, organic manures like FYM along with bio-fertilizers helps not only in bridging the existing gap between the nutrient removal and addition but also in ensuring balanced nutrient proportion as well as boost the productivity of wheat. Through the application of bio-fertilizers, vermicompost and FYM, the use of fertilizers in field crops has been made important efforts for the Economize. Integration of various sources of nutrients (biological, inorganic and bio fertilizers) is more suitable because it reduces the cost of chemical fertilizer and cost of cultivation, in addition to eco-friendly approach (Ram and Mir, 2006) [5].

The application of FYM in the soil helps in increasing the fertility of the soil as physical condition including its water holding capacity. Organic manures, which were perhaps the major sources of plant nutrients in traditional agriculture, receive less emphasis with the advent of high analysis chemical fertilizers. Intensive farming has decreased soil nutrients to a great extent, thus nutrient requirement of crops has increased quite during previous years. The use of

organic manures has assumed greater significance in the present set up of agriculture.

Integrated nutrient management (INM) is a better approach for supplying nutrition to the crop by including organic and inorganic sources of nutrients. INM enhances the availability of applied as well as native soil nutrients. INM provides balanced nutrition to crops and minimizes the antagonistic effects resulting from hidden deficiencies and nutrient imbalance. INM means judicious and efficient use of mineral fertilizers, organic manures and bio-fertilizers in an integrated manner, to get the maximum productivity and maintain soil fertility. Addition of organic manures along with chemical fertilizers sustained the yield through increased nutrients availability and nutrient use efficiency. Use of organic manures in INM helps in mitigating multiple nutrient deficiencies (Satyanayarana *et al.*, 2002) [7]. Therefore, an experiment was undertaken during *Rabi* 2020-21 to study the effect of integrated nutrient management on growth and yield of wheat.

Materials and Methods

A field experiment was conducted during the *Rabi* season of 2020-21 at the Experimental farm of University Institute of Agricultural Sciences, Chandigarh University, Gharuan, Mohali (Punjab). The experiment consisted of seven treatments comprising of different nutrient management practices *i.e.* RDF (100%), FYM @4 t ha⁻¹, FYM @2 t ha⁻¹ + 50% RDF, FYM @1 t ha⁻¹ + 25% RDF, VC @1.4 t ha⁻¹, VC @0.7 t ha⁻¹ + 50% RDF and VC @0.35 t ha⁻¹ + 25% RDF. The experiment was laid out in randomized block design with three replications. The soil of the experimental site was clay loam in texture and nearly neutral in reaction. The soil was rated as low in organic carbon and available nitrogen, medium in available phosphorus and available potassium. The layout of the experiment was done manually

and the plots were drawn and then flattened with the help of labour. Wheat variety “Unnat PBW-343” was sown using seed rate of 100 kg ha⁻¹ in first week on well prepared seed bed in December, 2020. The different fertilizer rate of nitrogen ha⁻¹ was used as basal and top dressing. The FYM and vermicompost was incorporated in soil at the time of sowing of crop as per the treatment with nutrient composition of 0.5% nitrogen, 0.2% phosphorus & 0.5% potassium (FYM) and 1.5% nitrogen, 1% phosphorus & 0.60% potassium (vermicompost). The recommended dose of NPK in wheat crop used was 120 kg N, 60 kg P₂O₅ and 40 kg K₂O ha⁻¹ in irrigated condition, respectively. Half dose of nitrogen and whole P₂O₅ and K₂O were incorporated in soil, as per the treatments, as basal dose and remaining half dose of nitrogen was top dressed at tillering stage of the wheat crop. All the plots were equally irrigated four times during the cropping duration so that hand weeding was done easily to keep the wheat crop free from weeds plants.

Results and discussion

Yield attributes of wheat

Different yield attributes of wheat presented in Table 1 revealed that different yield attributes *viz.* number effective tillers m⁻², number of grains per spike and 1000 grain weight were significantly influenced by the nutrient management treatments. Among different nutrient management treatments, application of RDF (100%) recorded significantly more number of effective tillers per meter square, number of grains per spike as and 1000 grain weight as compared to other treatments. Spike length did not vary significantly with the application of various nutrient management treatments. The beneficial effect of nitrogen on crop growth influenced the yield attributes characters positively. The number of effective tillers might be increased in the particular combination as it provides the optimum amount of nutrients required for the crop. The application of fertilizers in over dose or less than the recommended dose might not result in optimum growth and yield of the crop. Katyal (2000) [2] also reported that application of 100% NPK significantly affect the number of effective tillers m⁻² in wheat.

Yield of wheat crop

The data on grain yield of wheat as influenced by nutrient management practices have been presented in Table 2. The highest grain yield was recorded by the application of RDF (100%) however, it was statistically at par with VC @0.7 t ha⁻¹ + 50% RDF as compared to other treatments. The grain yield was 35.91% more in RDF (100%) + crop residue than that of FYM @4 t ha⁻¹ + crop residue. The application of 100% RDF affect the crop yield as it readily releases the nutrients in an absorbable form by the plants. Hashim *et al.* (2015) [1] reported that the application of recommended dose of fertilizers would positively influence the growth and

yield of the crop because of the optimal use of the fertilizers. Roberts *et al.* (2007) [6] also reported that the application of VC in combination with fertilizers results in higher yield of the crop. The data on straw yield presented in Table 2 revealed that the highest straw yield was recorded with the application of RDF (100%). The lowest yield was found with FYM @ 4 t ha⁻¹ + crop residue. The chemical fertilizers applied to the crop had a great impact on straw yield over other combination of treatments. The straw yield was 23.15% more in RDF (100%) + crop residue than that of FYM @4 t ha⁻¹ + crop residue. The increase in growth and yield owing to the application of N-fertilizer may be attributed to the fact that this nutrient being important constituents of nucleotides, proteins, chlorophyll and enzymes, involves in various metabolic processes which have direct impact on vegetative and reproductive phase of plants. Similar results were also reported by Mengel and Kirkby (1996) [4]. Application of RDF (100%) significantly increased the biological yield of wheat crop as compared to other treatments. Similar findings were also reported by Kumar *et al.* (2016) [3] who had reported that highest biological yield was recorded when NPK alone was applied in 100 per cent recommendation in comparison with remaining treatments. Different nutrient management practices did not significantly influence the harvest index of the wheat crop.

Economics of wheat

In order to evaluate the economic feasibility of different treatments, cost of cultivation, gross returns, net returns and net returns per rupee invested were worked out and the results have been presented in Table 3. Maximum cost of cultivation was incurred under FYM @2 t ha⁻¹ + 50% RDF as compared to the lowest cost of cultivation incurred under VC @1.4 t ha⁻¹. RDF (100%) gave significantly higher gross returns, net returns and net returns per rupee invested as compared to FYM @4 t ha⁻¹. However, it was also statistically at par with VC @0.35 t ha⁻¹ + 25% RDF. Suthar *et al.*, (2006) [8] reported that integrated application of NPK fertilizers along with vermicompost in field crops not only influences growth and production of a plant but at the same time also reduces the production budget.

Conclusion

From the current study it was concluded that yield attributes and yield of the crop was highest with the application of RDF (100%). However, grain yield was statistically at par with VC @0.7 t ha⁻¹ + 50% RDF as compared to other treatments. Maximum cost of cultivation was recorded under FYM @2 t ha⁻¹ + 50% RDF. RDF (100%) gave significantly higher net returns per rupee invested as compared to FYM @4 t ha⁻¹. However, it was also statistically at par with VC @0.35 t ha⁻¹ + 25% RDF.

Table 1: Effect of treatments on yield contributing characters of wheat

Treatments	No. of effective tillers m ⁻²	Spike length (cm)	No. of grains spike ⁻¹	1000 grain weight (g)
RDF (100%)	256.32	11.69	56.26	44.52
FYM @4 t ha ⁻¹	231.48	8.06	46.48	37.13
FYM @2 t ha ⁻¹ + 50% RDF	245.19	10.18	49.97	40.84
FYM @1 t ha ⁻¹ + 25% RDF	240.61	9.49	48.75	38.43
VC @1.4 t ha ⁻¹	235.72	8.65	46.80	37.76
VC @0.7 t ha ⁻¹ + 50% RDF	248.69	10.54	51.53	42.37
VC @0.35 t ha ⁻¹ + 25% RDF	243.12	9.76	49.50	39.15
SEm (±)	1.13	0.86	0.90	0.66
CD (P=0.05)	3.50	NS	2.77	2.02

Table 2: Effect of treatments on yield of wheat

Treatments	Grain yield (kg ha ⁻¹)	Straw yield (kg ha ⁻¹)	Biological yield (kg ha ⁻¹)	Harvest index
RDF (100%)	4209	6532	10741	0.39
FYM @4 t ha ⁻¹	3097	5304	8401	0.37
FYM @2 t ha ⁻¹ + 50% RDF	3941	6138	10079	0.39
FYM @1 t ha ⁻¹ + 25% RDF	3882	6018	9901	0.39
VC @1.4 t ha ⁻¹	3266	5449	8715	0.37
VC @0.7 t ha ⁻¹ + 50% RDF	3984	6245	10229	0.39
VC @0.35 t ha ⁻¹ + 25% RDF	3917	6105	10021	0.39
SEm (±)	77	87	90	0.01
CD (P=0.05)	237	270	276	NS

Table 3: Effect of treatments on economics of wheat

Treatments	Cost of Cultivation (Rs ha ⁻¹)	Gross returns (Rs ha ⁻¹)	Net returns (Rs ha ⁻¹)	Net returns per rupee invested
RDF (100%)	47838	119054	71216	1.49
FYM @4 t ha ⁻¹	43850	90343	46493	1.06
FYM @2 t ha ⁻¹ + 50% RDF	51497	111596	60099	1.17
FYM @1 t ha ⁻¹ + 25% RDF	47424	109777	62353	1.31
VC @1.4 t ha ⁻¹	40850	94466	53616	1.31
VC @0.7 t ha ⁻¹ + 50% RDF	49647	113032	63385	1.28
VC @0.35 t ha ⁻¹ + 25% RDF	46499	110930	64431	1.39
SEm (±)		1392	1392	0.03
CD (P=0.05)		4289	4289	0.10

References

1. Hashim M, Dhar S, Vyas AK, Singh CB. Yield trends and changes in physicochemical properties of soil in maize-wheat cropping system under integrated nutrient management. *Journal of Environmental Biology*,2015;38:727-734.
2. Katyal V, Gangwar KS, Gangwar B. Long-term effect of integrated nutrient management on crop productivity of rice (*Oryza sativa*)-rice system. *Indian Journal of Agricultural Sciences*,2000;70(2):110-113.
3. Kumar A, Rajput NR, Lal M, Yadav BK, Pal AK, Brajendra, Singh AP. Effect of integrated nutrient management in wheat crop under rainfed condition *Progressive Research – An International Journal*,2016;11(1):220-224.
4. Mengel K, Kirkby EA. *Principles of Plant Nutrition*. Panina Publishing Corporation, New Delhi,1996:4:147-149.
5. Ram T, Mir MS. Effect of integrated nutrient management on yield and yield-attributing characters of wheat. *Indian J. Agronomy*,2006;51(3):189-192.
6. Roberts P, Jones DL, Edward-Jones G. Yield and vitamin C content of tomatoes grown in vermicompost wastes. *J. Sci. Food Agric*,2007;87:1957-1963.
7. Satyanarayana V, Prasad PVV, Murthy VRK, Boote KJ. Influence of integrated use of farm yard manure and ignoring fertilizers on yield and yield components on irrigated lowland rice. *Journal of Plant Nutrition*,2002;25(10):2081-2090.
8. Suthar S. Effect of vermicompost and inorganic fertilizer on wheat (*Triticum aestivum*). *Production, Nature, Env. and Poll. Technol*,2006;5:197-201.