Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.8810

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2021) *9*(5), 89-93

Indian Journal of Pure & Applied Biosciences

Peer-Reviewed, Refereed, Open Access Journal

Research Article

Effect of Integrated Nutrient Management in Barley (*Hordeum vulgare* L.)

Huleshwar Gir[1]* and A. S Tiwari[2]

[1]M. Sc. (Ag) Student, Department of Agronomy, AKS University, Sherganj Satna (M.P.)

[2]Teaching Associate, Department of Agronomy, AKS University, Sherganj Satna (M.P.)

*Corresponding Author E-mail: huleswargiri@gmail.com

Received: 12.09.2021 | Revised: 17.10.2021 | Accepted: 24.10.2021

ABSTRACT

A field experiment was conducted at Instructional Farm Department of Agronomy, Faculty of Agriculture, AKS University, Sherganj, Satna (M.P.) to study the effect of integrated nutrient management on yield of barley during winter seasons of 2020- 21. Twelve treatments were evaluated in randomized block design with three replications. Results revealed that the 75 % RDF + 5 t/ha vermicompost significantly improved the plant height (83.61 cm) and number of tillers/plant at 90 DAS (9.53), spike length (21.22 cm), grains/ spike (36.33) and test weight (42.10 g) of barley. Application of 75 % RDF + 5 t/ha vermicompost produced grain (64.97 q/ ha) and straw (70.93 q/ ha) of barley. The integrated use of chemical fertilizers and vermicompost improved the protein content in grain and maximum value (10.69 %) was recorded with 75 % RDF + 5 t/ha vermicompost. The results indicated that combined use of 75 % RDF + 5 t/ha vermicompost was the most appropriate nutrient management for higher growth, yield and quality parameters of barley.

Keywords: *Tillers, Grain, Straw, Test weight, Protein content.*

INTRODUCTION

Barley (*Hordeum vulgare* L) is an important rabi cereal crop in India. It has low cost of production and input requirement, so it is preferred by resource poor farmers in the country. The major portion of grain produced is consumed as flour to prepare Chapaties or to make "Sattu" by roasting and grinding grains. It is also used to prepare malt for manufacturing bear and whisky and other products such as industrial alcohol and vinegar. The crop needs less water and is more tolerant to salinity and alkalinity condition than other winter cereals.

In Madhya Pradesh barley is grown both on rainfed situation and as an irrigated crop on light textured marginal soils, low in organic matter, phosphorus and potassium resulting into stunted plant growth and uneconomical harvest.

Cite this article: Gir, H., & Tiwari, A. S. (2021). Effect of Integrated Nutrient Management in Barley (*Hordeum vulgare* L.), *Ind. J. Pure App. Biosci. 9*(5), 89-93. doi: http://dx.doi.org/10.18782/2582-2845.8810

It is because of poor productivity leading to less profit that area under barley is progressively shrinking year by year. The increased use of chemical fertilizers in agriculture has certainly enhanced the food production but brought with it a lot of problems related to micronutrient deficiency and environmental pollution. This alarming situation itself has emphasized the importance of organic manures in agriculture. A sudden reversion to organic farming cannot satisfy both the hungry soil and the ever-growing population. Organic manures have become scarce seems to be infeasible under intensive agriculture. It is advocated the use of organics plus limited input of chemical fertilizers and pesticides as the first stage of transition from conventional to organic farming. Integrated use of chemical fertilizers with organic manures could be quite promising in maintaining higher productivity and providing greater stability in crop production.

The basic concept underlying the integrated nutrient management system (INM), nevertheless, remains the maintenance and possible improvement of soil fertility for sustained crop productivity on long term-basis and also to reduce inorganic (fertilizer) input cost. Thus, integrated nutrient supply/management (INM) aims at maintenance or adjustment of soil fertility and of plant nutrient supply to an optimum level for sustaining the desired crop productivity through optimization of benefit from all possible sources of plant nutrients in an integrated manner.

Vermicompost which is the major sources of plant nutrients in traditional agriculture, received less emphasis with the advent of high analysis chemical fertilizers. Without detracting from the fact that chemical fertilizer will continue to be main instrument for quicking the pace for agriculture production the recent researches indicated that a judicious combination of organic manures and fertilizers can better maintain the long term soil fertility and sustain high levels of productivity. Therefore, use of both organic manure and chemical fertilizers in appropriate proportion assumes special significance as complementary and supplementary to each other in crop production. Hence, present investigation was carried out to study the growth, yield and qualitative behavior of barley to define optimum dose under integrated use of organic manure and fertilizers.

MATERIALS AND METHODS

The experiment was carried out at Instructional Farm, Faculty of Agriculture, AKS University, Satna (M.P.) during rabi season 2020- 21. The experiment was conducted in randomize complete block design with three replications. The treatments were; T1= Control, T2= 100 % RDF, T3= 50 % RDF + 2.5 t Vermicompost, T4= 75 % RDF + 2.5 t Vermicompost, T5= 25% RDF + 2.5 t FYM, T6= 50 % RDF + 2.5 t FYM, T7= 75 % RDF + 2.5 t FYM, T8= 25 % RDF + 5 t Vermicompost, T9= 50 % RDF + 5 t Vermicompost, T10= 75 % RDF + 5 t Vermicompost, T11= 25 % RDF + 5 t FYM and T12= 50 % RDF + 5 t FYM. The barley (JB- 58) was sown on November 12th, 2020 using 100 kg seeds per ha. The gross and net plot size was 5.0 m x 3.5 m and 4.0 m x 3.0 m, respectively. The N, P_2O_5 and K_2O were applied through urea, single super phosphate and muriate of potash, respectively. Half dose of N as per treatment and full dose of P_2O_5 and K_2O were applied at the time of sowing. Remaining half dose of N was top dressed in two equal splits at 30 and 60 DAS i.e., at tillering and late jointing stage. Quantity of FYM & vermicompost (as per treatment) was mixed in respective plots as per treatments. The other crop management practices were followed as per standard recommendation. The crop was harvested at the physiological maturity. All the other

agronomic practices were applied uniformly to all the treatments.

RESULTS AND DISCUSSION

Data regarding plant height and number of tillers per plant are reported in Table- 1. Statistical analysis of the data revealed that maximum plant height (83.61 cm) and number of tillers/plant at 90 DAS (9.53) at maximum crop growth stage of 90 DAS were observed under the integrated use of chemical fertilizers and vermicompost with 75 % RDF + 5 t/ha vermicompost while, lowest values were observed under the control.

Data regarding length of spike, number of grains per spike, test weight, grain & stover yield of barley and protein content are reported in Table- 1 and maximum values were observed when crop fertilized with chemical fertilizers and organic manure. Statistical analysis of the data revealed that highest spike length (21.22 cm), grains/ spike (36.33), test weight (42.10 g), grain yield (64.97 q/ ha) and straw yield (70.93 q/ ha) per hectare and protein content (10.69 %) recorded under the integrated use of chemical fertilizers and vermicompost with 75 % RDF + 5 t/ha vermicompost.

The increase in growth attributes with the application of 75 % RDF + 5 t/ha Vermicompost might be due to improved photosynthetically active leaf area for longer period during vegetative and reproductive phases, led to more absorption and utilization of radiant energy which ultimately resulted in higher dry matter accumulation and significant increase in plant growth. It is an established fact that organic manure improves the physical, chemical and biological properties of soil and supplies almost all the essential plant nutrients for growth and development of plants along with growth hormones and beneficial microbes which might have developed more favorable environment of nutrients in soil for longer period resulted in increased plant height, new shoots and increased dry matter accumulation. It is fact that organic matter acts as a chelate for nutrients and soluble chelates probably increase their availability and uptake to plants and mobility in soils. Thus, increased availability of macro and micro nutrients might also be the reason of improved growth characters of the crop. The results of the present investigation are in conformity with those of Mali et al. (2016) and Neelam et al. (2018).

The growth attributes also significantly increased with the increasing levels of fertilizers during the year of experiment. The increase in growth attributes might be due to increase in availability of major nutrients of nitrogen and phosphorus due to direct addition in the form of fertilizer. Nitrogen is one of the major essential plant nutrients required for growth and the increased availability of nitrogen due to direct addition of nitrogen in the form of inorganic fertilizer on otherwise poor soil might have increased number of cells and cell size leading to better growth of crop. Nitrogen also accelerates photosynthetic rate and thereby increases the supply of carbohydrates to plant, which might have in turned into increased dry matter production in plant of barley. Thus, application of recommended dose of fertilizers at optimum level increased the plant growth. The observed improvement in overall vegetative growth of the barley crop with the application of fertilizer, nitrogen and phosphorus are in conformity with the findings of Meena et al. (2016), Mali et al. (2017), Berkesia et al. (2018) and Kumar et al. (2021).

Increase in the yield attributes and yield has been reported to be associated with the release of macro and micronutrients during the course of microbial decomposition (Ram & Singh, 1999). Organic matter is also a source of energy for soil micro-flora, which brings about the transformation of organic form of nutrients present in soil, into available form for any crop.

The increase in yield attributes with the application of vermicompost in increasing rate might be due to higher availability of balanced plant nutrients throughout the crop period specially at critical stages of plant favourable C:N ratio (Marimuthu et al., 2002), better utilization of nitrogen for reproductive growth rather than for vegetative growth, functional role of nitrogen in the plant body i.e. in multiplication, cell elongation and tissue differentiation.

The application with integrated nutrient management treatment of 75 % RDF + 5 t/ha Vermicompost treatment recorded significantly maximum number of tillers and length of spike, number of grains per spike, test weight, grain and straw yield. The increase in the yield attributes with the application of 75 % RDF + 5 t/ha Vermicompost ascribed to improved physical, chemical and biological properties of soil, direct addition of plant nutrients (macro and micro) and growth regulators and also due to increased microbial population of soil, which accelerated the process of humification, removal of obnoxious smell and detoxification of soil pollutants.

The integration of inorganic fertilizers with organic manures had also been observed to be quite promising not only in maintaining higher productivity but also in imparting greater stability to crop production. For better nourishment of the crops for longer period Vermicompost has been advocated as good organic manure for use in integrated management practice in field crops. These findings are in accordance with Dahiya et al. (2019), Sekaran et al. (2019), Lal et al. (2020), Parashar et al. (2020a) and Yadav et al. (2020).

The perusal of data of protein content in grain with the application of fertilizers revealed that the protein content in grain of barley significantly increased with increasing level of RDF. Significant increase in protein content with fertilizer levels might be due to increased nitrogen content in grain which might have resulted due to increased availability of nitrogen to plants and increased activity of nitrate reductase enzyme. These results are in conformity with the findings of Ram et al. (2014) and Yadav et al. (2020).

Table 1: Effect of integrated nutrient management on growth, yield and quality of barley

Treatment	Plant height (cm)	Number of tillers/ plant	Spike length (cm)	Number of grains per spike	Test weight (cm)	Grain yield (q/ha)	Stover yield (q/ha)	Protein content (%)
T_1	40.29	3.47	8.33	19.07	35.43	21.42	52.79	8.13
T_2	78.14	7.73	19.11	33.27	40.91	60.44	68.77	9.70
T_3	76.94	7.47	18.91	32.60	40.70	59.17	67.89	9.56
T_4	79.71	8.00	19.27	33.40	41.33	62.50	69.57	10.01
T_5	70.61	6.27	17.92	29.27	39.50	53.31	63.90	8.38
T_6	73.68	6.80	18.27	30.47	40.01	55.83	65.71	8.74
T_7	75.96	7.27	18.72	32.33	40.26	58.78	67.37	9.20
T_8	81.10	8.20	19.50	35.00	41.67	63.83	70.13	10.12
T_9	82.65	8.60	19.66	35.40	42.03	64.64	70.81	10.14
T_{10}	83.61	9.53	21.22	36.33	42.10	64.97	70.93	10.69
T_{11}	72.12	6.53	18.09	29.93	39.96	55.25	64.96	8.61
T_{12}	74.84	7.07	18.53	31.27	40.22	57.39	66.54	8.97
S. Em±	0.79	0.18	0.14	0.39	0.23	1.77	0.65	0.14
C.D.(P=0.05)	2.28	0.52	0.41	1.15	0.67	5.15	1.89	0.41

Acknowledgment

authors are thank to dr.T. Singh Prof and head Agronomy for very kindly providing all the experimental facilities and suggestions for successful conduct of the experiment.

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