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Effect of Integrated Nutrient Management on Yield and Yield Attributes of Pearl Millet [*Pennisetum glaucum* (L.) R. Br. Emend stuntz]

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A B S T R A C T

A, field experiment was conducted at agriculture research farm, school of agriculture, Suresh Gyan Vihar University, Jagatpura, Jaipur, Rajasthan during *kharif* season of the year 2018 to ascertain the 'effect of integrated nutrient management on yield and yield attributes of pearl millet [*Pennisetum glaucum* (L.) R. Br. emendstuntz]. There were eight treatments of different integrated nutrient management practices in randomized block design replicated thrice. The result revealed that the grain and fodder yield of pear millets were significantly exaggerated due to different treatment combinations. The maximum effective tillers/m row length (25.36),ear head length(28.50 cm), test weight(7.53 g)), grain yield (1905 kg ha^{-1}), stover yield(5442 kg ha^{-1}), biological yield(7347kg ha^{-1}) and harvest index(25.92 %), were obtained when pearl millet fertilized with 40% RDF along with 25% FYM+25% vermicompost+10% biomix of Treatment (T_7) where is the lowest value was recorded in T_0 (Control).

Introduction

Pearl millet is an important millet crop and grown for both food and fodder purpose. Cultivation of pearl millet is emphasized due to its profuse tillering habit, multicut nature, drought tolerance, resistance to insect pest and disease, absence of poisonous prussic acid, good performance even in poor soil, good per day productivity leafiness, quick growing and palatable to animal. The average nutrient composition of the edible portion of the seed is 67 % carbohydrates, 12.4 % moisture, 11.6 % protein, 3.5 % fat, 1.5 to 3.0 % fiber and 2.7 % minerals (Sharma and Burark, 2015). It is the predominant rainfed crop and contributed only 6 percent to the total food grain production of the country. The reason for such a low contribution can be attributed to the lack of improved cultural practices; cultivation of poor and marginal lands on low fertility and poor or delayed germination due to soil crusting. Hence with our research efforts constraints responsible for poor yield should be eliminated. Nitrogen fertilizer had played a key role in increasing the food grain production in India and continued to do so in the future (Prasad, 2011) But several studies show that nitrogen application can increase the millet production efficiency, an adequate

supply of nitrogen is associated with vigorous vegetative growth (Ayub *et al*., 2009 and Manan *et al*., 2006). Phosphorus is known to stimulate extensive root system thereby enabling the plant to uptake moisture and mineral nutrients optimally. Vermicompost reduces C: N ratio and also helps in increasing the humus content of soil and provides plants with a wide range of readily available nutrients such as Nitrate, Phosphorus, Potassium, Calcium, Magnesium (Talashikar *et al*., 1999). Farmyard manure has play a role in increasing fertility of the soil and improving water holding capacity of the soil (Keerthanan *et al*., 2018). Farmyard manure increased nitrogen use efficiency of the crop and the status of organic carbon, available N, P_2O_5 and trace elements in the soil and countering deleterious fixing bacteria has been reported to fix about 20 kg N / ha / year in non-legume crop fields and also secretes some growth promoting substances (Subbarao, 1982). Phosphate solubilizing micro-organism, particularly the soil bacteria belonging to the genera *Pseudomonas* and *Bacillus* and fungi belonging to the genera *Penicillum* and *Aspergillus* possess the capability to transform insoluble phosphate into soluble forms (Alexander, 1977). Many crop scientists have indicated that *Vesicular arbuscular mycorrhiza* (VAM) fungi are capable of alleviating the adverse effect of drought on plant growth and improves tolerance capacity of plants against drought stress (Jayne and Quigley, 2014).As no single farm input is capable of supplying a balanced amount of nutrients, the integrated use of all input sources is a must to supply balanced nutrients to plants (Hedge and Babu, 2004).

Materials and Methods

The field experimental site was situated at 26.9° North latitude and 75.7° East longitude at an altitude of 1417 meter above mean sea level. The distance between Jagatpura, India and tropic of cancer is 388 km. The average annual rainfall of the region is about 500 to 700 mm which is mostly received between July to August and 80 to 100 mm in September. The average humidity of the tract is about 65 per cent. The experiment was laid out in Randomized Block Design (RBD) with 3 replications. The treatments comprised 8 combinations viz., Recommended dose of fertilizer (60:30:0 NPK kg ha^{-1}), 75 % Farm yard manure + 25 % Biomix, 75 % RDF + 25 % Biomix, 70 % Vermicompost + 30 % Biomix, 75 % RDF + 25 % FYM, 50 % RDF + 50 % Vermicompost, 40% RDF+ 25 % FYM + 25 % Vermicompost + 10 % Biomix and control. All agronomical practices were followed during investigation period and meteorological week wise weather parameters were also observed. Pearl millet cultivar "RHB-177" used as experimental materials and sowing at 45×15 spacing in field. FYM, Vermicompost and Biomix (*Azotobacter*, Phosphate solubilizing bacteria and *Vesicular arbuscular mycorrhiza*) were applied 10@ tonnes ha^{-1}, 5 @ tonnes $ha^{-1}$and 4 kg ha^{-1}respectively as per treatments prior to sowing. Urea was applied half dose at the time of sowing and remaining half dose at flowering stage as per treatment. Phosphorus was applied before sowing as per treatment. Five tagged plants from each plot were selected randomly for recording different observations. The statistical analysis of data was done using analysis of variance (ANOVA) technique at 0.05 probability level.

Results and Discussion

Yield attributes

The result revealed that the number of effective tillers per metre row length, Ear head length and test weight of pearl millet were significantly affected due to different integrated nutrient management treatments are furnished presented in (Table 1). Application

of 40% RDF along with 25% FYM+ 25% Vermicompost+10% Biomix Treatment (T_7) produced significantly higher the effective tillers per metre row length (25.36), ear head length (28.50 cm) as compared to rest of all the treatments. The minimum value of effective tillers per meter row length (18.00)and ear head length (18.76 cm)were obtained under the treatment T_0i.e(control).It is evident that the test weight was not significantly influenced by different treatments of integrated nutrient management. However, the uppermost (7.53 g) test weight was also observed under the treatment(T_7)i.e. 40% RDF along with 25% FYM+25% Vermicompost+10% Biomix) followed by (7.43 g) under T_6 (50% RDF+50% Vermicompost) whereas, the lowest value (6.46 g) of test weight was noted under control (T_0).

The increase in yield attributes may be because INM application of fertilizer makes more availability of nutrients which in turn provides higher availability of nutrients to the plant, the increased growth provided greater sight for photosynthesis and diversion of photosynthesis towards sink (ear and grain). The application of biofertilizers led to a higher availability of N and P_2O_5 as well as promoted the root growth, which promoted yield attributes characters.

Table.1 Effect of integrated nutrient management on yield attributes of pearl mill

Treatments	Effective tillers/m row length	Ear head length (cm)	Test weight (g)
T_0Control	18.00	18.76	6.46
T_1 Recommended dose of fertilizer (60:30:0 NPK kg ha^{-1})	21.40	20.86	7.20
T_2 75 % Farmyard manure + 25 % Bio mix	19.70	20.80	6.66
T_3 75 % RDF + 25 % Biomix	20.20	22.96	7.26
T_4 70 % Vermicompost + 30 % Bio mix	22.60	22.26	7.24
T_5 75 % RDF + 25 % FYM	23.53	24.60	7.36
T_6 50 % RDF + 50 % Vermicompost	24.53	27.46	7.43
T_7 40 % RDF + 25 % FYM + 25 % Vermicompost + 10 % Biomix	25.36	28.50	7.53
SE(m) ±	1.10	0.99	0.87
C.D at 5%	3.37	3.03	NS

Table.2 Effect of integrated nutrient management on yield of pearl millet

Treatments	Grain yield (kg ha^{-1})	Stover yield (kg ha-1)	Biological yield (kg ha^{-1})	Harvest index (%)
T_0 Control	650	1834	2484	26.16
T_1Recommended dose of fertilizer (60:30:0 NPK kg ha^{-1})	1160	3245	4405	26.33
$T_2$75 % Farm yard manure + 25 % Bio mix	1012	3020	4032	25.09
$T_3$75 % RDF + 25 % Bio mix	1283	3503	4786	26.80
$T_4$70 % Vermicompost + 30 % Bio mix	1230	3145	4375	28.11
$T_5$75 % RDF + 25 % FYM	1402	3837	5239	26.76
$T_6$50 % RDF + 50 % Vermicompost	1768	5123	6891	25.65
$T_7$40 % RDF + 25 % FYM + 25 % Vermicompost + 10 % Bio mix	1905	5442	7347	25.92
SE(m) ±	61.50	197.70	280.59	1.17
C.D at 5%	188	605	859	NS

The beneficial effect may also be due to an increase in the supply of all the essential nutrients by vermicompost and FYM that might have resulted in manufacturing of food and its subsequent partition towards the sink. The findings of present investigations are supported by Khan *et al.* (2000) and Kumar and Gautam (2004) in pearl millet, Kumawat and Jat (2005) in barley, Hashim *et al.* (2015) in maize and Divya *et al.* (2017) in pearl millet.

Yield

A perusal of data presented in (Table 2) showed that different combinations of fertilizers and manures caused a remarkable effect on grain, stover and biological yield of pearl millet over control. The maximum grain and stover yield (1905 and 5442 kg ha^{-1}) was obtained in treatment T_7 (40% RDF+25% FYM+25% Vermicompost+10% Biomix) followed by (1768 and 5123 kg ha^{-1}) under T_6 (50% RDF+ 50% Vermicompost) which is at par. The minimum (650 and 1834 kg ha^{-1}) was recorded under T_8 (control). A critical review of data of biological yield revealed that the treatment T_7 (40% RDF+25% FYM+25% Vermicompost+10% Biomix) significantly increased the biological yield of pearl millet followed by (6891 kg ha^{-1})under T_6 (50% RDF+ 50% Vermicompost) and both treatments are at par. However, the lowest biological yield (2484 kg ha^{-1}) was recorded under T_8 (control).The result presented in (Table 2) revealed that the different doses of fertilizers/manures numerically improved the harvest index of pearl millet but could not bring any changes.

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