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# Growth and Yield of Pearlmillet [*Pennisetum glaucum* (L.)] as Influenced by Integrated Nutrient Management Practices

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**ABSTRACT**

A field experiment conducted during *kharif*, 2017 on sandy soil of Agricultural College Farm, Bapatla. Experiment was laid out inrandomized block design with eight treatmentsand replicated thrice. The results indicated that the highest plant height at harvest (194.7 cm), drymatter production (566.0, 3068.0 and 6475.0 kg ha$^{-1}$ at 30,60 DAS and harvest stages), number of earheads m$^{-2}$ (32.2), grain yield (1556.1 kg ha$^{-1}$), stover yield (3534 kg ha$^{-1}$) and highest benefit cost ratio (1.66) was recorded with 50 % RDN + 1.5 t ha$^{-1}$ PM + *Azotobacter*followed by 50 % RDN + 10 t ha$^{-1}$FYM + *Azotobacter*and significantly superior to the rest of the treatments.

**Key words :***Pearlmillet, Integrated Nutrient Management, FYM, Poultry manure,*

Pearlmillet [*Pennisetum glaucum* (L.)] is one of the important millet crops of arid and semiarid climatic conditions of the world. It has been estimated that pearlmillet embodies a tremendous productivity potential, particularly in areas having extreme environmental stress conditions on account of drought. Pearlmillet can be grown on variety of soils like poor and sandy soils. Its drought escaping character have made it popular crop of drought prone areas. Pearlmillet provides staple food for the poor people in relatively short period in dry tracts of the country. It is nutritionally superior to many cereals as it is a good source of protein (11%) having higher digestibility (12.1%), fats (5%), carbohydrates (69.4%) and minerals (2.3%). Grains are also used as feed for cattle and poultry etc.

Green fodder is used either as such or it is preserved as hay or silage which has proved extremely useful in dry regions especially during lean periods.

India is the largest producer of pearlmillet having 8.16 m ha area with annual production of 9.56 m tonnes and with productivity of 1172 kg ha$^{-1}$. In Andhra Pradesh, it is grown in an area of 0.09 m ha, with the production of 1.2 m tonnes and productivity of 711 kg ha$^{-1}$.

Integration of chemical fertilizer with organic manures has been found quite promising not only in sustaining the soil health and productivity but also in stabilizing the crop production in comparison to the use of each component separately.

Farmyard manure can be supplemented with NPK fertilizers. Although, it is costlier than chemical fertilizers on nutrient basis its beneficial effects on soil can compensate for the added cost. Poultry manure is another important source of nutrients which plays direct role in plant growth. Besides major nutrients, poultry manure also contains traces of micronutrients which are generally not supplied by the chemical fertilizers but essential for plant growth.

## MATERIALAND METHODS

A field trial was carried out on sandy soil of Agricultural College Farm, Bapatla during*kharif,*2017. The soil was neutral and low in organic carbon (0.19%), low in available nitrogen (125 kg ha$^{-1}$) and medium in available phosphorus (13.5 kg ha$^{-1}$) and low in potassium (113kg ha$^{-1}$). The experiment was laid out in randomized block design with eight treatments and replicated thrice. The treatments consisted of $T_1$:100% RDN,$T_2$ : 75% RDN + 5 t ha$^{-1}$ FYM, $T_3$ : 75 % FYM + 0.625 t ha$^{-1}$ PM, $T_4$ : 50 % RDN + 10 t ha$^{-1}$ FYM, $T_5$ : 50 % RDN + 1.5 t ha$^{-1}$ PM, $T_6$ : $T_1$ + *Azotobacter*, $T_7$ : $T_4$ + *Azotobacter*, $T_8$ : $T_5$ + *Azotobacter*.The pearlmillet hybrid (Mahalaxmi) was sown on 24$^{th}$ July 2017. A total of 664.5mm rainfall was received during the crop growth period in 25 rainy days.Thinning and gap filling was done at 15 DAS.The nitrogen was applied as per the treatments.Half dose of nitrogen andentire dose of phosphorus and potassium were applied as basal in the form ofurea, SSP andMOP and nitrogen was applied as 2$^{nd}$ split at (30 DAS). The data on plant height, drymatter production, yield attributes, yield and net return were recorded as per statistical procedures.The observation on growth parameters *viz.,* plant height, drymatter production, days to floweringand yield parameters *viz.,*number of earheads m$^{-2}$, earhead length,test weight, grain yield and straw yield were analysed by adopting Panse and Sukhatme (1978) standard procedures.

## RESULTS AND DISCUSSION

### Growth parameters

The results (Table 1) revealed that the plant height was significantly affected by integrated nutrient management practices.Significantly taller plants (79.9, 177 and 194.7 cm at 30, 60 DAS and at harvest,respectively) was recorded with $T_8$ treatment (50% RDN+ 1.5 t ha$^{-1}$PM +*Azotobacter*) followed by $T_7$ treatment (50 % RDN + 10 t ha$^{-1}$FYM + *Azotobacter*) 72.2,159.7,174.1 cm at 30, 60 DAS and at harvest stages. The $T_8$ treatment was found to be significantly superior to rest of the treatments. Similar trend was noticed in respect of plant height recorded at 60 DAS and at harvest stage as that was observed with 30 DAS.The reason for better growth and development with this treatment might be the increased availability of nutrients to plant initially through inorganic fertilizers and then by organic manures like FYM and poultry manure matching to the need of crop throughout the growing season.The results of present investigation are in conformity with those of Yadav and Beniwal (2003) and Parihar *et al*., (2012).

Significant drymatter production (Table 1) was recorded by$T_8$at allthe stages of crop growth. Application of $T_8$(50 % RDN+ 1.5 t ha$^{-1}$PM +*Azotobacter*) treatment recorded higher drymatter production (566, 3068 and 6475 kg ha$^{-1}$at 30, 60 DAS and at harvest stages, respectively) over the rest of the treatments but it was statistically at par with the $T_7$treatment *i.e.*50 % RDN + 10 t ha$^{-1}$FYM + *Azotobacter* (511, 2526 and 6071 kg ha$^{-1}$ respectively).Higher drymatter production recorded by $T_8$treatment (50% RDN + 1.25 t ha$^{-1}$ PM + *Azotobacter*) might be due to the biofertilizer (*Azotobacter*) component in the treatment in combination with organic and inorganic sources that might had synergistic and additive effect on drymatter production. However, they increased the fertilizer use efficiency of the crop as well as soil fertility by promoting soil microbial activity and narrowing down C : N ratio which in turn might have resulted in availability of the nutrients for longer period throughout the crop growth period.These results are in agreement with those findings of Patil *et al*., (2013), Kumar *et al.,* (2014) and Reddy *et al*., (2016).

Increase in the levels of organic manures and nitrogen in combination with biofertilizer (*Azotobacter*) significantly reduced the days to 50 per cent flowering in pearlmillet. The treatment ($T_8$) 50% RDN + 1.25 t ha$^{-1}$PM + *Azotobacter* recorded highest days to 50 per cent flowering (55 days) among all the treatments. Lowest number of days to 50 per cent flowering (47 days) was recorded with the treatments ($T_4$) 50% RDN + 10 t ha$^{-1}$ FYM followed by ($T_3$) 75 % RDN + 0.625 t ha$^{-1}$ PM and ($T_6$) 100% RDN + *Azotobacter*(48 days). There is a difference of 8 days between the highest and lowest number of days to 50 per cent flowering within the treatments. With increase in the levels of organic manures and chemical fertilizers, along with biofertilizer, time taken to 50 per cent flowering showed declining trend.

### Yield attributes

Highest number of earheads m$^{-2}$(32) were recorded with $T_8$ (50% RDN + 1.25 t ha$^{-1}$PM + *Azotobacter*and lowest in $T_2$(75% RDN + 5 t ha$^{-1}$ FYM). The treatment $T_8$was found to be significantly superior to rest of the treatments. The increase in number of earheads m$^{-2}$may be ascribed to better nutrition due to application of fertilizers, manures along with biofertilizer which might have aided in higher root growth and development that might have enhanced the uptake and translocation of nutrients. The results of present investigation are in conformity with those of Parihar *et al*., 2012.

Among the treatments, application of 50% RDN + 1.25 t ha$^{-1}$ PM + *Azotobacter*recorded maximum earhead length (21.7) and it was statistically on par with 50% RDN + 10 t ha$^{-1}$ FYM + *Azotobacter* (20.6), 50% RDN + 1.25 t ha$^{-1}$ PM (20.5), 75% RDN + 0.625 t ha$^{-1}$ PM (20.3), 75% RDN + 5 t ha$^{-1}$ FYM (20.1) and 100% RDN (20.3) but significantly superior over 100% RDN + *Azotobacter* (19.2) and 50% RDN + 10 t ha$^{-1}$ FYM (19.45). This might be due to better nutrition and also can be ascribed to application of chemical fertilizers along with organic manures and biofertilizer together which might have facilitated better root growth and development and enhanced nutrient availability, uptake and translocation and thus increased the earhead length. The results of present investigation are in conformity with the findings of Narolia and Poonia (2011).

Application of fertilizers, organic manures along with biofertilizer did not show any significant difference for test weight in pearlimillet because, test weight is governed by genetic character. The results (Table 4.2) reveals that different integrated nutrient management practices numerically improved the harvest index of pearlmillet but didn't attain to the level of statistical significance.

### Grain yield and straw yield

Maximum grain yield (1556 kg ha$^{-1}$) and straw yield(3534 kg ha$^{-1}$) were recorded (Table 2)with the combined application of inorganic, organic and biofertilizer (*Azotobacter*) (50% RDN + 1.5 t ha$^{-1}$PM + *Azotobacter*) but it remained at par with 50 % RDN + 10 t ha$^{-1}$ FYM + *Azotobacter*.This could mainly be associated with the increased growth of the crop in

**Table 1. Effect of integrated nutrient management practices on plant height (cm), drymatter production (kg ha$^{-1}$) at different stages and days to 50% flowering of pearlmillet**

| Treatment | Plant height (cm) | | | Drymatter production | | | Days to 50% flowering |
|---|---|---|---|---|---|---|---|
| | 30 DAS | 60DAS | Harvest | 30DAS | 60DAS | Harvest | |
| $T_1$: 100% RDN | 66.3 | 158.8 | 169.7 | 317 | 1860 | 5203 | 49 |
| $T_2$: 75% RDN + 5 t ha$^{-1}$ FYM | 70.6 | 153.8 | 170.5 | 312 | 1838 | 5139 | 49 |
| $T_3$: 75% RDN + 0.625 t ha$^{-1}$ PM | 70.5 | 155.1 | 167.2 | 307 | 1776 | 5039 | 48 |
| $T_4$: 50% RDN + 10 t ha$^{-1}$ FYM | 70.3 | 152.6 | 167.9 | 318 | 1961 | 5669 | 47 |
| $T_5$: 50% RDN + 1.25 t ha$^{-1}$ PM | 71.6 | 159.5 | 172 | 320 | 2206 | 5720 | 53 |
| $T_6$: 100% RDN + *Azotobacter* | 71.5 | 156 | 168.8 | 304 | 1545 | 5015 | 48 |
| $T_7$: 50% RDN + 10 t ha$^{-1}$ FYM+ *Azotobacter* | 72.2 | 159.7 | 174.1 | 511 | 2526 | 6071 | 53 |
| $T_8$: 50% RDN + 1.25 t ha$^{-1}$ PM + *Azotobacter* | 79.9 | 177 | 194.7 | 566 | 3068 | 6475 | 55 |
| S.Em ± | 2.27 | 4.56 | 5.27 | 22 | 179.6 | 255.5 | 1.63 |
| CD (P=0.05) | 6.91 | 14.17 | 16 | 66 | 538 | 766 | 4.96 |
| CV (%) | 5.5 | 5.1 | 5.3 | 10.7 | 15.5 | 8.4 | 5.6 |

**Table 2. Effect of integrated nutrient management practiceson yield attributes and yield of pearlmillet**

| Treatment | Earheads (No.m$^{-2}$ ) | Earhead length (cm) | Test weight g/1000 grains | Grain yield (kg ha$^{-1}$) | Straw yield (kg ha$^{-1}$) | Harvest index (%) |
|---|---|---|---|---|---|---|
| $T_1$: 100% RDN | 22 | 20.3 | 7.5 | 1179 | 2884 | 29 |
| $T_2$: 75% RDN + 5 t ha$^{-1}$ FYM | 21 | 20.1 | 7 | 1291 | 2942 | 32 |
| $T_3$: 75% RDN + 0.625 t ha$^{-1}$ PM | 25 | 20.3 | 7.8 | 1282 | 2711 | 32 |
| $T_4$: 50% RDN + 10 t ha$^{-1}$ FYM | 25 | 19.4 | 8.2 | 1353 | 2888 | 31 |
| $T_5$: 50% RDN + 1.25 t ha$^{-1}$ PM | 27 | 20.5 | 7.2 | 1386 | 3006 | 31 |
| $T_6$: 100% RDN + *Azotobacter* | 27 | 19.2 | 7.9 | 1277 | 2531 | 30 |
| $T_7$: 50% RDN + 10 t ha$^{-1}$ FYM+ *Azotobacter* | 27 | 20.6 | 8.2 | 1489 | 3124 | 32 |
| $T_8$: 50% RDN + 1.25 t ha$^{-1}$ PM + *Azotobacter* | 32 | 21.7 | 8.5 | 1556 | 3534 | 33 |
| S.Em ± | 1.3 | 0.66 | 0.53 | 54.5 | 131.8 | 1.09 |
| CD (P=0.05) | 3.95 | 2.01 | NS | 165.3 | 400 | NS |
| CV (%) | 8.6 | 5.6 | 9.6 | 6.9 | 7.7 | 6.1 |

terms of plant height and drymatter accumulation recorded under these treatments due to greater availability of most of the macro and micro nutrients in balanced proportion that led to higher uptake of the nutrients. The increased growth provided greater site for photosynthesis and diversion of photosynthates towards sink (ear and grain). The higher grain and stover yield with these treatments is also due to higher plant population which aids in more uptake of nutrients from soil which results in more drymatter accumulation.

The beneficial effect on grain and stover yield might also be due to the increased supply of all the essential nutrients by FYM and poultry manure that might have resulted in higher manufacture of food and its subsequent partitioning towards sink. The increase in grain yield of pearlmillet with these treatments was also largely due to high harvest index that showed high partitioning of the plant assimilates towards the sink.Similar results have also been reported earlier by scientists *viz*., Kumar *et al*., (2014), and Parihar *et al*., (2012).

## CONCLUSION

Based on the above results and discussion, it can be concluded that application of 50% RDN + 1.5 t $ha^{-1}$ PM + *Azotobacter*gave higher growth, yield parameters, grain and straw yield in pearlmillet.

## LITERATURE CITED

**Kumar, Rakesh, Archana, Dinesh and Sushil 2014.** Integrated nutrient management in pearlmillet (*Pennisetum glaucum*L.) - wheat (*Triticum aestivum*) cropping sequence in semiarid condition of India. *International Journal of agricultural Sciences*10 (1): 96-101.

**Narolia R S and Poonia B L 2011** Growth dynamics, yield and economics of pearlmillet (*Pennisatum glaucum*L.) as influenced by vermicompost and fertilizers. *Annals of Arid Zone* 50(2): 145-149.

**Panse V G and Sukhatme P V 1978** Statistical methods for agricultural workers. Indian Council of Agricultural Research, New Delhi, pp. 145-152.

**Parihar C M, Rana K S, Jat M L, Jat S L, Parihar M D, Kantwa S R, Singh D K and Sharma S 2012** Carbon footprint and economic sustainability of pearlmillet-mustard system under different tillage and nutrient management practices in moisture stress conditions. *African Journal of Microbiology Research* 6 (23), pp. 5052-5061.

**Patil A S, Patel H K, and Chauhan N P 2013** Yield, quality and monetary returns of summer pearlmillet (*pennisetum glaucum*L.) as influenced by integrated nitrogen management and sowing methods. *Crop Research* 47 (1, 2 & 3): 24-28.

**Reddy S, Naga Madhuri K V, Keerthi Venkaiah and Prathima T 2016** Effect of nitrogen and potassium on yield and quality of pearlmillet (*Pennisetum glaucum* L.). *International Journal of Agriculture Innovations and Research* 4(4): 2319-1473.

**Yadav N D and Beniwal R K 2003** Response of pearlmillet to N and FYM under rainfed condition. *Arid Zone Research Association of India* 5: 276-279.

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