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# Effect of integrated nutrient management on growth and yield of proso millet (*Panicum miliaceum* L.)

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**Abstract**
A field experiment was conducted to study the integrated nutrient management in proso millet (*Panicum miliaceum* L.) on lateritic soil having low to moderate soil fertility status during *kharif*, 2017. Results in the data revealed that, among the various fertilizer levels, 125 per cent RDF recorded significantly higher values of all the growth parameters and yield attributers viz. plant height hill$^{-1}$, number of functional leaves hill$^{-1}$, number of functional tillers hill$^{-1}$ and dry matter accumulation hill$^{-1}$ over all other lower fertilizer levels under study. Similarly, significantly higher values of yield attributing characters viz., number of panicles hill$^{-1}$, length of panicle (cm), weight of panicle (g), number of rachis panicle$^{-1}$ and test weight (g) were recorded at 125 per cent RDF, which resulted into significantly higher grain and straw yield of proso millet over remaining fertilizer levels under study. Among the organic nutrient sources, application of biofertilizer plus green manure treatment recorded significantly higher growth attributes (mean plant height hill$^{-1}$, number of functional leaves hill$^{-1}$, number of functional tillers hill$^{-1}$ and dry matter accumulation hill$^{-1}$) and yield attributes of proso millet over remaining organic sources under study. Grain and straw yield of proso millet crop was also significantly superior in biofertilizer plus green manure treatment.

**Keywords:** Integrated nutrient management, proso millet, growth and yield

## Introduction
Proso millet (*Panicum miliaceum* L.) is considered as self-pollinated annual crop which belongs to family Poaceae. It is known as common millet and Vari in Marathi. Proso millet is well adapted to many soil and climatic conditions. Proso millet is mainly cultivated for human consumption in Eastern and Central Asia and to a lesser extent in Eastern Europe (Russia, Danube region) and from Western Asia to Pakistan and India (Bihar, Andhra Pradesh, Maharashtra, Karnataka etc.). In India, it is cultivated over an area of 0.07 million ha with total production of 0.43 million tonnes, (Anonymous, 2013) [1] with a two-third share of the total recorded millet trade. In Maharashtra, the area under millets is 9309 thousand ha and production is 9809 thousand tonnes with productivity of 1054 kg ha$^{-1}$ during 2005-06, with the largest area under millets is in the Konkan comprising Raigad, Thane, Sindhudurg, Ratnagiri and Palghar district and on hill slopes of Sahyadri mountains in Kolhapur, Nasik, Satara, Sangli and Pune districts.

Integrated Nutrient Supply System (INSS) approach involves the combined use of chemical fertilizers, organic manures and micronutrient fertilizers which ensures higher crop productions and also helps to restore and sustain the soil fertility (Kadrekar, 1993) [7]. Fertilizer and manures play important role in increasing the production and improving quality of cereals. The fertilizers are costly inputs. Organic manures including FYM, compost, biofertilizer, green manures and vermicompost contain all the nutrients required for healthy growth of crop. Further, they improve soil structure and aeration of soil. They help in increasing the nutrient availability from soil and applied sources (Halkatti *et al*., 1997) [6].

'Vari No-10' is a variety of Proso millet released by Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli which is quite suitable for commercial cultivation under Konkan agro-climatic conditions. The response of farmers for cultivation of this variety is increasing. However, no systematic research work has been conducted so far to study the effect of micronutrients on this crop. Hence, the present investigation was undertaken.

## Material and Methods

The field experiment was conducted at Agronomy farm, College of Agriculture, Dapoli. Dist. Ratnagiri during *kharif* season 2017. The experiment was laid out in split plot design with three main plot and four sub-plot treatments. The soil of the experimental plot at the initial stage i.e. before the commencement of the experiment, was acidic in reaction (5.41) and showed low electrical conductivity (0.08 $dSm^{-1}$). While, it was found to be high in organic carbon (11.57g $kg^{-1}$), medium in available N (211.45kg $ha^{-1}$), low in available $P_2O_5$ (9.81kg $ha^{-1}$) and moderately high in $K_2O$ (200.6kg $ha^{-1}$). The main plot treatments comprised of three fertilizer levels viz., 75, 100and 125 per cent of RDF. The sub plot treatments consisted of our different organic manures sources viz., control, biofertilizer (azatobacter), green manure (glyricidia), biofertilizer plus green manure. Thus, there were twelve treatment combinations, replicated thrice. Variety of proso millet vari no-10 were selected for the present investigation. Nursery of proso millet sown on (12/06/2016) and seedlings was used for transplanting at age of 30 days. Nursery was raised on BBF of size 3 m x 1m.The field was prepared for transplanting by ploughing. Transplanting of seedling was done across the slope. During transplanting two seedlings $hill^{-1}$ were transplanted at 20 cm ×15 cm spacing. Seedlings were planted by using recommended "thomba" method of transplanting. Recommended dose of FYM @ 5 t $ha^{-1}$ was applied and incorporated before last preparatory tillage operation. The proso millet crop was fertilized and manured as per the treatments. The RDF for proso millet was 80:40:00 kg NPK $ha^{-1}$. Nitrogen was applied in the form of urea and phosphorus was applied through single super phosphate. Growth parameters viz. plant height, number of functional leaves $hill^{-1}$, number of functional tillers $hill^{-1}$ and dry matter accumulation $hill^{-1}$ were studied periodically at 30, 60, 90 DAT and at harvest. Yield attributes viz number of panicle, length of panicle, weight of panicle, number of rachis, test weight of proso millet studied at harvest.

## Results and discussions

### Fertilizer levels

### Growth parameter

Growth parameters influenced by different fertilizer levels under study are presented in Table no.1. The data regarding growth parameter as influenced by fertilizer levels under study revealed that the plant height $hill^{-1}$, number of functional leaves $hill^{-1}$, number of tillers $hill^{-1}$and dry matter accumulation $hill^{-1}$of proso millet were significantly affected by fertilizer levels throughout the crop growth period. The significantly higher plant height, number of functional leaves $hill^{-1}$, number of functional tillers $hill^{-1}$ and dry matter accumulation $hill^{-1}$wererecorded with application of 125% RDF and lower in 75% RDF. This could be attributed to the fact that higher dose of nitrogen, being constituent of enzyme and protein, enhanced cell expansion and various metabolic processes. It might be due to faster availability of nutrient through chemical fertilizers helped to gain more plant height, number of tillers, number of levees and dry matter accumulation reported that Meena *et al*. (2003) [8], Pradhan *et al*. (2015) [10], Mudalagiriyappa *et al*. (2015) [9].

### Yield attributing characters

The yield attributing characters *viz.* total number of panicles $hill^{-1}$, length of panicle (cm), weight panicle $hill^{-1}$ (g)and 1000 grain weight (g) as influenced by different treatments are presented in Table.2. The yield attributing characters were significantly higher in treatment with application 125% RDF as compared to application of fertilizers at 100% RDF and 75% RDF. Lower yield attributing characters recorded in application of 75% RDF. Generally, higher nutrients influenced number of tillers $hill^{-1}$ and it ultimately reflected into increased panicle number in proso millet crop. These result confirms the finding of Shanmugam and Veeraputhran (2001) [11] and Bana *et al*. (2012) [2]. Davari *et al.* (2012) [5] reported that it might be due to more availability nutrients, which turn in the highest yield attributing characters.

### Yield

Application of 125% RDF recorded significantly higher grain and straw yield over 100% RDF and 75% RDF (Table 3.). The grain and straw yield in application of 125% RDF were (13.84 and 28.17q $ha^{-1}$), followed by application of 100% RDF (12.22 and 24.18q $ha^{-1}$) and 75% RDF (9.51 and 19.81q $ha^{-1}$) during the investigation. The higher grain and straw yield were outcome of higher values of yield attributing characters. The application of 125% RDF recorded appreciably higher number of panicle, length of panicle and weight of panicle over the application of 100% RDF and 75% RDF, respectively during *kharif* season. Since the grain and straw yield is the result of all these yield contributory characters, the yield in the present experiment was increased with increase in fertilizer levels. It was optimum at maturity stage due to diversion of food material from source to sink. Meena *et al*. (2003) [8]. These findings are on similar lines with the findings of Mudalagiriyappa *et al*. (2015) [9], Chouhan *et al.* (2015) [4].

### Effect of organic manures

### Growth parameters

Significantly more plant height $hill^{-1}$, number of functional leaves $hill^{-1}$, number of tillers $hill^{-1}$ and dry matter accumulation $hill^{-1}$ were recorded in application of biofertilizer + green manures, over application of green manures, biofertilizer and control (Table 1). Combined application of green manure and biofertilizer might be resulted into enhancement of $N_2$ fixation by biofertiliser along with increase in nutrient availability through green manure. Basavarajappa *et al*. (2002) [3] and Bana *et al*. (2012**)** [2] concluded that overall improvement in the crop growth under the influence of microbial fertilization seems to be on account of their impact on nutritional environment and involvement in various physiological process in the plant system which are considered to be pre-requisite for crop growth.

### Yield attributing character

Among the organic sources under study application of biofertilizer + green manures resulted into significantly higher yield attributing characters *viz*. total number of panicles $hill^{-1}$, length of panicle (cm), weight panicle $hill^{-1}$ (g) and 1000 grain weight. Generally, higher availability nutrients influenced number of tillers $hill^{-1}$ and ultimately reflected into increased yield attributing characters. This might be due to proper crop growth rate and maximum crop net assimilation rate followed by attainment of physiological growth, particularly panicle initiation, flowering and asynchronous tillering Shanmugam and Veeraputhran (2001) [11], Bana *et al*. (2012**)** [2] and Davari *et al.* (2012) [5].

### Yield

Application of biofertilizer + green manure produced significantly higher grain yield (13.47 q $ha^{-1}$) while, the

lowest grain yield was recorded with control treatment (10.21 q ha$^{-1}$) (Table 3). Since the grain yield is the result of all the yield contributory characters, the yield in the present experiment was increased due to increase in yield attributes with use of different organic sources. These findings are in conformity with those reported by Shanmugam and Veeraputhran (2001) [11] and Bana *et al*. (2012) [2]. The data show in Table.3 in respect of straw yield at harvest indicated that the straw yield of proso millet was significantly influenced due to organic sources used in the study. Application of biofertilizer + green manures produced significantly higher straw yield (27.04 q ha-1) of proso millet. The lower straw yield recorded in treatment control (19.83 q ha$^{-1}$). This might be due to the fact that different organic sources influenced the physiological activity, which increased the dry matter accumulation and it was optimum at maturity stage due to diversion of food material from source to sink. These results confirm the findings of Shanmugam and Veeraputhran (2001) [11] and Bana *et al*. (2012) [2].

## Conclusion

Thus, it can be concluded that, proso millet crop (var. Vari no.10) should be applied with 125 per cent RDF (100:50:0 NPK) along with biofertilizer (Azatobacter @ 2.5 kg ha-1) and green manure (Glyricidia @ 5 t ha-1) to obtain better crop growth, higher yields attributes characters and yield.

**Table 1:** Mean plant height (cm), number of functional leaves hill$^{-1}$, number of tillers hill$^{-1}$ and dry matter accumulation hill$^{-1}$ (g) at harvest

| Treatment | Plant height (cm) | No. of functional leaves hill$^{-1}$ | No. of functional tillers hill$^{-1}$ | Dry matter hill$^{-1}$ (g) |
|---|---|---|---|---|
| | At harvest | At harvest | At harvest | At harvest |
| **A) Fertilizer levels** | | | | |
| $F_1$ : 75% RDF | 154.84 | 5.95 | 3.77 | 34.02 |
| $F_2$ : 100% RDF | 157.22 | 7.25 | 4.22 | 36.06 |
| $F_3$ : 125% RDF | 159.99 | 8.09 | 4.75 | 39.71 |
| S. Em. ± | 0.44 | 0.09 | 0.07 | 0.39 |
| C.D. at 5% | 1.74 | 0.23 | 0.27 | 1.53 |
| F. test | Sig. | Sig. | Sig. | Sig. |
| **B) Organic sources** | | | | |
| $A_1$ : Control | 155.67 | 6.18 | 3.87 | 34.32 |
| $A_2$ : Biofertilizer | 156.92 | 6.68 | 4.21 | 35.81 |
| $A_3$ : Green manures (Glyricidiya ) | 157.79 | 7.00 | 4.35 | 37.49 |
| $A_4$ : Biofertilizer+ Green manures | 159.02 | 7.26 | 4.56 | 38.77 |
| S. Em. ± | 0.31 | 0.12 | 0.09 | 0.35 |
| C. D. at 5% | 0.91 | 0.34 | 0.26 | 1.04 |
| F. test | Sig. | Sig. | Sig. | Sig. |
| **C) Interaction effect** | | | | |
| F. test | N.S. | N.S. | N.S. | N.S. |
| S. Em. ± | 0.53 | 0.20 | 0.15 | 0.61 |
| C. D. at 5% | 1.58 | 0.59 | 0.45 | 1.80 |
| General mean | 157.35 | 7.05 | 4.23 | 38.59 |

**Table 2:** Yield attributes viz., number of panicles hill$^{-1}$, length of panicle (cm), weight of panicle (g), number of rachis panicle$^{-1}$ and Test weight (g) of proso millet as influenced by different treatments

| Treatment | No. of panicles hill$^{-1}$ | Length of panicle (cm) | Weight of panicle (g) | No. of rachis panicle$^{-1}$ | Test weight (g) |
|---|---|---|---|---|---|
| **A) Fertilizer levels** | | | | | |
| $F_1$ : 75% RDF | 3.73 | 34.52 | 7.74 | 16.98 | 1.43 |
| $F_2$ : 100% RDF | 4.21 | 36.15 | 8.72 | 18.03 | 1.61 |
| $F_3$ : 125% RDF | 4.69 | 38.69 | 9.56 | 19.00 | 1.74 |
| S. Em. ± | 0.13 | 0.16 | 0.14 | 0.11 | 0.01 |
| C. D. at 5% | 0.51 | 0.63 | 0.56 | 0.42 | 0.04 |
| F. test | Sig. | Sig. | Sig. | Sig. | Sig. |
| **B) Organic sources** | | | | | |
| $A_1$ : Control | 3.79 | 34.28 | 8.09 | 16.87 | 1.41 |
| $A_2$ : Biofertilizer | 4.11 | 36.53 | 8.54 | 17.79 | 1.58 |
| $A_3$ : Green manures (Glyricidia) | 4.32 | 37.20 | 8.91 | 18.36 | 1.67 |
| $A_4$ : Biofertilizer+ Green manures | 4.53 | 37.91 | 9.14 | 18.97 | 1.72 |
| S. Em. ± | 0.10 | 0.23 | 0.13 | 0.15 | 0.02 |
| C. D. at 5% | 0.29 | 0.70 | 0.33 | 0.44 | 0.06 |
| F. test | Sig. | Sig. | Sig. | Sig. | Sig. |
| **C) Interaction effect** | | | | | |
| F. test | N.S | N.S | N.S | N.S | N.S |
| S. Em. ± | 0.17 | 0.41 | 0.24 | 0.26 | 0.03 |
| C. D. at 5% | 0.51 | 1.21 | 0.68 | 0.76 | 0.10 |
| General mean | 4.19 | 36.45 | 8.67 | 18.00 | 1.59 |

**Table 3:** Grain yield and straw yield of proso millet as influenced by different treatments.

| Treatment | Grain yield (q ha$^{-1}$) | Straw yield (q ha$^{-1}$) |
|---|---|---|
| **A) Fertilizer levels** | | |
| $F_1$ : 75% RDF | 9.51 | 19.81 |
| $F_2$ : 100% RDF | 12.22 | 24.18 |
| $F_3$ : 125% RDF | 13.84 | 28.17 |
| S. Em. ± | 0.43 | 0.50 |
| C. D. at 5% | 1.70 | 1.94 |
| F. test | Sig. | Sig. |
| **B) Organic sources** | | |
| $A_1$ : Control | 10.21 | 19.83 |
| $A_2$ : Biofertilizer | 11.39 | 24.10 |
| $A_3$ : Green manures (Glyricidia) | 12.36 | 25.25 |
| $A_4$ : Biofertilizer+ Green manures | 13.47 | 27.04 |
| S. Em. ± | 0.23 | 0.48 |
| C. D. at 5% | 0.69 | 1.44 |
| F. test | Sig. | Sig. |
| **C) Interaction effect** | | |
| F. test | N.S. | N.S. |
| S. Em. ± | 0.40 | 0.84 |
| C. D. at 5% | 1.19 | 2.49 |
| General mean | 11.85 | 24.05 |

## References


1. Anonymous. Research Review Committee Report (2013) under All India Coordinated Research Project on Agro Meteorology, held at Dr. B.S.K.K.V. Dapoli Dist. Ratnagiri (M.S.), 2013.
2. Bana RS, Gautam RC, Rana KS. Effect of different organic sources on productivity and quality of pearl millet (*Pennisetum glaucum*) and their residual effect on wheat (*Triticum aetivum*). Annals of Agricultural Research. 2012; 33(3):136-130.
3. Basavarajappa R, Prabhakar AS, Halikatti SI. Effect of tillage, organic, nitrogen and their interactions on yield attributes and yield of foxtail millet (*Setaria italica*) under shallow Alfisols during rainy season. Indian Journal of Agronomy. 2002; 47(3):390-397.
4. Chouhan M, Gudadhe NN, Kumar D, Kumawat AK, Kumar R. Transplanting dates and nitrogen levels influences on growth, yield attributes, and yield of summer pearl millet. The Bioscan, 2015; 10(3):1295-1298.
5. Davari MR, Sharma SN, Mirzakhani M. Effect of different combinations of organic manures, rice residues and biofertilisers in organic farming of wheat (*Triticum aetivum*). Journal of Organic Systems. 2012; 7(2).
6. Halkatti SV, Doddamani MB, Nagnur SV. Importance of organic manure in agriculture. Farmer and Parliament. 1997; 33(2):17-18.
7. Kadrekar SB. Nurturing finite land resources to nurture teeming millions. Journal of Indian Society of Soil Science. 1993; 41(4):611-612.
8. Meena S, Singh S, Shivay YS. Response of hybrid rice (*Oryza sativa*) to nitrogen and potassium application in sandy clay-loam soils. Indian Journal of Agricultural Sciences. 2003; 73(1):8-11.
9. Mudalagiriyappa B., Raghavendra, Goud Ramachandrappa BK, Nanjappa HV. Influence of customized fertilizers on growth and yield of finger millet (*Eleusine coracana* L. Gaertn.) in alfisols of Southern India. Indian Journal of Dry land Agriculture Research. & Development. 2015; 30(1):50-54.
10. Pradhan A, Sao A, Patel DP, Nag SK, Mukherjee SC. Effect of establishment methods and nitrogen levels on finger millet (*Eleusine coracana* Linn. Gaertn.). Annals of. Agricultural Research. 2015; 36(1):107-113.
11. Shanmugam PM, Veeraputhran R. Effect of organic manure, biofertilizers, inorganic nitrogen and zinc on growth and yield of rabi rice (*Oryza sativa* L.). Madras Agricultural Journal. 2001; 87(1/3):a90-93.