



## Barnyard Millet Quality Characters and NPK Uptake as Influenced by Integrated Organic Nutrients in Sandy Loam Soil

S.Srinivasan and D.Venkatakrishnan

Associate Professor, Dept. of Soil Science & Agricultural Chemistry, Faculty of Agriculture, Annamalai

University, Annamalainagar- 608 002. Mobile: 9791721396

E-mail : [sribal20@yahoo.com](mailto:sribal20@yahoo.com)

### ABSTRACT

A pot experiment was conducted to study the effect of coir pith compost, bone meal powder and panchagavya on barnyard millet (*Echinochloa frumentacea* (Roxb.) at the pot-culture yard, Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalainagar. The experiment was laid out in completely randomized block design (CRD) with nine treatments and three replications. The treatments are as follows: T<sub>1</sub>– Control, T<sub>2</sub>–100% RDF, T<sub>3</sub>– Coir pith compost @ 10 t ha<sup>-1</sup>, T<sub>4</sub>– Bone meal powder @ 1 t ha<sup>-1</sup>, T<sub>5</sub>– Panchagavya @ 3 % (Foliar spray), T<sub>6</sub>–T<sub>3</sub> + T<sub>4</sub>, T<sub>7</sub>– T<sub>4</sub> + T<sub>5</sub>, T<sub>8</sub>– T<sub>3</sub> + T<sub>5</sub> and T<sub>9</sub>– T<sub>3</sub> + T<sub>4</sub> + T<sub>5</sub>. The results of the pot experiment revealed that application of 100% RDF (T<sub>2</sub>) registered the highest quality characters viz., crude protein, crude fiber and ash contents were 5.50, 4.35 and 4.31 per cent, respectively. It also significantly influenced nitrogen, phosphorus and potassium uptake by barnyard millet grown in sandy loam soil. Application of 100% RDF (N:P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O @ 40:30:50 kg ha<sup>-1</sup>) (T<sub>2</sub>) was on par with the combined application coir pith compost @ 10 t ha<sup>-1</sup>, bone meal powder @ 1 t ha<sup>-1</sup> and panchagavya @ 3% foliar spray (T<sub>9</sub>).

**Keywords:** Barnyard millet, coirpithcompost, bonemeal, panchagavya, quality & NPK uptake.

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### INTRODUCTION

Millet is still the principal sources of energy, protein, vitamins and minerals for millions of the poorest people. India is one of the major producers of millets in the world. Among all the millets, barnyard millet (*Echinochloa frumentacea* (Roxb.) Link) is hardy and vigorous growing nature can be grown in drought and water logging conditions. In recent years, there is huge awareness among people about health, nutritive value of millets and there is a demand for barnyard millet due to its quality and better adaptability. Coir pith compost used as soil amendment under varied soil condition for improving physical, chemical and biological properties of soil. It is a good source of mulch for increasing the water holding capacity in sandy loam soil [1]. Application of bone meal had significant effect on crude protein and crude fiber content [3]. The presence of N,P,K, Ca, Fe, Zn, Cu and Mn besides reducing sugar (glucose) in panchagavya acts as ammonifiers and nitrifiers, which colonize in the leaves increased ammonia uptake and enhanced the total N supply [7].

### MATERIAL AND METHODS

The present investigation was carried out to find out the effect of different organic nutrient sources on quality and NPK uptake by barnyard millet (*Echinochloa frumentacea* (Roxb.) Link). A pot experiment was conducted at the Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University during February-May, 2019. The soil was collected from Farmers Field at Anaikkudam village, Udaiyarpalayam Taluk, Ariyalur District of Tamilnadu. The soil belongs to yellowish red to red colour, Alfisols in order and the taxonomic classification of *Typic Rhodustalfs*. The experiment was laid out in completely randomized block design (CRD) with nine treatments and three replications. The treatments are as follows: T<sub>1</sub>– Control, T<sub>2</sub>–100% RDF, T<sub>3</sub>– Coir pith compost @ 10 t ha<sup>-1</sup>, T<sub>4</sub>– Bone meal powder @ 1 t ha<sup>-1</sup>, T<sub>5</sub>– Panchagavya @ 3 % (Foliar spray), T<sub>6</sub>–T<sub>3</sub> + T<sub>4</sub>, T<sub>7</sub>– T<sub>4</sub> + T<sub>5</sub>, T<sub>8</sub>– T<sub>3</sub> + T<sub>5</sub> and T<sub>9</sub>– T<sub>3</sub> + T<sub>4</sub> + T<sub>5</sub>. The recommended dose of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O for barnyard millet is 40:30:50 kg ha<sup>-1</sup>. The calculated quantity of NPK fertilizers were applied for the particular treatment on dry weight basis. The organic nutrient sources viz., coir pith compost and bone meal were applied @ 10 and 1.0 t ha<sup>-1</sup>, respectively to the respective treatment. Panchagavya applied as per the treatment as seed treatment,

seedling treatment and foliar spray @ 3%. The pots were irrigated regularly as and when required to maintain moisture at field capacity. The crop was grown up to maturity. At maturity barnyard millet was harvested. The crude protein and crude fiber contents were estimated by adopting Micro Kjeldhal method ( $\text{H}_2\text{SO}_4:\text{HClO}_4$  at 5:2) as suggested by Humphries [4 and Chopra and Kanwar [2], respectively. The nutrients uptake *viz.*, N, P and K by barnyard millet also estimated by standard procedures.

## RESULTS AND DISCUSSION

### QUALITY CHARACTERISTICS

#### Crude protein

The data in table 1 clearly shows that there was a significant increase in crude protein content due to different treatments.

#### Crude protein (%)

It was found that there was a significant effect on crude protein content with application of different treatments. Among the treatments, the highest crude protein content of 8.34 was noticed in  $T_2$  – 100%RDF. It was on par with application of coir pith compost, bone meal powder and panchagavya ( $T_9$ ) recorded the crude protein content of 8.09. Application of coir pith compost ( $T_3$ ), bone meal powder ( $T_4$ ) and panchagavya ( $T_5$ ) registered crude protein content of 6.65, 5.98 and 6.59 %, respectively. However, the lowest crude protein content (5.50 %) was found to be with control ( $T_1$ ).

#### Crude fiber (%)

The crude fiber under various treatments ranged from 4.35 per cent ( $T_1$ ) and 5.92 per cent ( $T_9$ ). There was a significant increase in crude fiber to the application of different organic nutrient sources and inorganic fertilizers. The highest per cent of crude fiber was observed in 100% RDF ( $T_2$ ). This was on par with application of CPC+BMP+PG ( $T_9$ ) recorded the crude fiber of 5.86. Application of CPC+BMP ( $T_6$ ), BMP+PG ( $T_7$ ) and CPC+PG ( $T_8$ ) registered the crude fiber of 5.24, 5.19 and 5.56 per cent, respectively. The treatment  $T_6$  was on par with  $T_7$ .

#### Ash content (%)

Among the treatments, application of 100% RDF ( $T_2$ ) recorded the highest ash content of 4.31 per cent than control ( $T_1$ ) (1.29 %). The treatments  $T_3$ ,  $T_4$  and  $T_5$  registered the ash content of 2.30, 1.75 and 2.26 per cent, respectively. The treatment  $T_3$  was on par with  $T_5$ . The combined application of coir pith compost, bone meal powder and panchagavya ( $T_9$ ) recorded the ash content of 4.29 per cent. The treatment  $T_2$  was on par with  $T_9$ . However, the lowest ash content of 1.29 per cent was found to be control ( $T_1$ ).

Application of organic sources would have caused accumulation of nutrients in comparison to synthetic fertilization [8] which resulted better quality. This was also might be due to the availability of higher nitrogen content from inorganic sources. The nitrogen acts as an integral part of protein and hence higher crude protein is found in barnyard millet. This was also due to the more nitrogen uptake by plant and more nitrate reductase activity gave high crude protein content [5].

### NUTRIENTS UPTAKE

The organic nutrient sources and inorganic fertilizers significantly influenced nitrogen, phosphorus and potassium uptake by grain and straw of barnyard millet and the data are given in table 2.

#### Nitrogen uptake (g pot<sup>-1</sup>)

The various treatments significantly increased nitrogen uptake by grain and straw. The treatment  $T_2$  showed the highest nitrogen uptake by grain was 0.18 g pot<sup>-1</sup> which received 100% RDF and the combined application of coir pith compost, bone meal powder and panchagavya ( $T_9$ ) recorded the nitrogen uptake of 0.17 g pot<sup>-1</sup>.  $T_2$  was on par with  $T_9$ . However, the nitrogen uptake by grain was least (0.02 mg pot<sup>-1</sup>) observed under control ( $T_1$ ) which received no organic nutrient sources and fertilizers.

The highest nitrogen uptake by straw of 0.21 g pot<sup>-1</sup> was found to be with 100 % RDF (N:  $\text{P}_2\text{O}_5$ :  $\text{K}_2\text{O}$  @ 40:30:50 kg ha<sup>-1</sup>) ( $T_2$ ). It was followed by 0.19 g pot<sup>-1</sup> was observed under  $T_9$  which received coir pith compost, bone meal powder and panchagavya. Application of  $T_3$ ,  $T_4$  and  $T_5$  registered the nitrogen uptake by straw were 0.11, 0.09 and 0.11 g pot<sup>-1</sup>, respectively. However, the lowest nitrogen uptake by straw of 0.06 g pot<sup>-1</sup> was noticed in  $T_1$ .

This might be due to the application of coir pith compost had higher content of nitrogen to be mineralized and made available for the crop uptake.

#### Phosphorus uptake (g pot<sup>-1</sup>)

Similar to nitrogen uptake, phosphorus uptake by grain and straw of barnyard millet also showed significant differences among various treatments.

The phosphorus uptake grain was maximum (0.048 g pot<sup>-1</sup>) in  $T_2$  – 100% RDF. Application of coir pith compost, bone meal powder and panchagavya registered the phosphorus uptake by grain was 0.044 g

pot<sup>-1</sup>. The treatment T<sub>2</sub> was on par with T<sub>9</sub>. However, control (T<sub>1</sub>) recorded the minimum phosphorus uptake by grain was 0.005 g pot<sup>-1</sup>.

Among the different treatments, application of 100 % RDF (N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O @ 40:30:50 kg ha<sup>-1</sup>) (T<sub>2</sub>) recorded the highest phosphorus uptake by straw of 0.098 g pot<sup>-1</sup> than control (T<sub>1</sub>) (0.011 g pot<sup>-1</sup>). The treatments T<sub>7</sub>, T<sub>8</sub> and T<sub>9</sub> registered the phosphorus uptake by straw were 0.048, 0.073 and 0.089 g pot<sup>-1</sup>, respectively. The treatment T<sub>2</sub> was on par with T<sub>9</sub>.

The increased uptake of P may be due to the favorable influence in reducing the fixation of P and subsequently enhancing the dry matter production. The orthophosphate ion might have converted PO<sub>4</sub><sup>3-</sup> to HPO<sub>4</sub><sup>2-</sup> for short periods which resulted in increased concentration of P in the plants. These results are in accordance to the observation of Tilahun *et al.* [9].

#### Potassium uptake (g pot<sup>-1</sup>)

Application of coir pith compost, bone meal, panchagavya and inorganic fertilizers significantly increased the potassium uptake by grain and straw of barnyard millet.

The potassium uptake by grain due to different treatments ranged from 0.03 to 0.19 g pot<sup>-1</sup>. Among the treatments tried, application of coir pith compost, bone meal and panchagavya recorded the potassium uptake by grain was 0.17 g pot<sup>-1</sup>. This was on par with 100 % RDF (N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O @ 40:30:50 kg ha<sup>-1</sup>) (T<sub>2</sub>) recorded highest potassium uptake by grain was 0.19 g pot<sup>-1</sup>. However, lowest potassium uptake by grain (0.03 g pot<sup>-1</sup>) was noticed under T<sub>1</sub> which received no organic nutrient sources and inorganic fertilizers.

Application of 100% RDF (N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O @ 40:30:50 kg ha<sup>-1</sup>) (T<sub>2</sub>) recorded significantly highest potassium uptake by straw of 0.25 g pot<sup>-1</sup>. It was followed by the combined application of CPC+BMP+PG (T<sub>9</sub>) recorded the potassium uptake by straw of 0.24 g pot<sup>-1</sup>, respectively. These treatments were on par with each other. However, control (T<sub>1</sub>) registered the lowest potassium uptake by straw of 0.08 g pot<sup>-1</sup>. These results were in accordance with the findings of Monika [6] in pearl millet.

The increase in N, P and K uptake by grain and straw of barnyard millet were attributed to the higher grain and straw yield might be due to higher availability of nutrient in soil with addition of inorganic fertilizers. The results were in line with the findings of Udayakumar and Santhi [10] in pearl millet.

**Table 1.** Effect of coir pith compost, bone meal powder and panchagavya on crude protein, crude fiber and ash content of barnyard millet cv. CO 2

Treatment details	Quality Characteristics		
	Crude Protein (%)	Crude Fiber (%)	Ash Content (%)
T <sub>1</sub> - Control	5.50	4.35	1.29
T <sub>2</sub> - 100% RDF	8.34	5.92	4.31
T <sub>3</sub> - Coir pith compost @ 10 t ha <sup>-1</sup>	6.65	4.90	2.30
T <sub>4</sub> - Bone meal powder @ 1 t ha <sup>-1</sup>	5.98	4.59	1.75
T <sub>5</sub> - Panchagavya @ 3% (Foliar Spray)	6.59	4.86	2.26
T <sub>6</sub> - T <sub>3</sub> +T <sub>4</sub>	7.30	5.24	3.19
T <sub>7</sub> - T <sub>4</sub> + T <sub>5</sub>	7.27	5.19	2.85
T <sub>8</sub> - T <sub>3</sub> + T <sub>5</sub>	7.83	5.56	3.78
T <sub>9</sub> - T <sub>3</sub> +T <sub>4</sub> + T <sub>5</sub>	8.09	5.86	4.29
<b>S.Ed</b>	<b>0.16</b>	<b>0.12</b>	<b>0.07</b>
<b>CD (P = 0.05)</b>	<b>0.35</b>	<b>0.25</b>	<b>0.15</b>

**Table 2.** Effect of coir pith compost, bone meal powder and panchagavya on nitrogen, phosphorus and potassium uptake by barnyard millet cv.CO 2

Treatment details	Nutrients Uptake (g pot <sup>-1</sup> )					
	N Uptake		P Uptake		K Uptake	
	Grain	Straw	Grain	Straw	Grain	Straw
T <sub>1</sub> - Control	0.02	0.06	0.005	0.011	0.03	0.08
T <sub>2</sub> - 100% RDF	0.18	0.21	0.048	0.098	0.19	0.25
T <sub>3</sub> - Coir pith compost @ 10 t ha <sup>-1</sup>	0.07	0.11	0.010	0.029	0.09	0.11
T <sub>4</sub> - Bone meal powder @ 1 t ha <sup>-1</sup>	0.04	0.09	0.013	0.026	0.06	0.10
T <sub>5</sub> - Panchagavya @ 3% (Foliar Spray)	0.07	0.11	0.011	0.030	0.06	0.11
T <sub>6</sub> - T <sub>3</sub> +T <sub>4</sub>	0.10	0.13	0.019	0.045	0.11	0.16
T <sub>7</sub> - T <sub>4</sub> + T <sub>5</sub>	0.09	0.12	0.022	0.048	0.10	0.15
T <sub>8</sub> - T <sub>3</sub> + T <sub>5</sub>	0.14	0.16	0.036	0.073	0.14	0.20
T <sub>9</sub> - T <sub>3</sub> +T <sub>4</sub> + T <sub>5</sub>	0.17	0.19	0.044	0.089	0.17	0.24
<b>S.Ed</b>	<b>0.009</b>	<b>0.012</b>	<b>0.004</b>	<b>0.006</b>	<b>0.010</b>	<b>0.009</b>
<b>CD (P = 0.05)</b>	<b>0.019</b>	<b>0.024</b>	<b>0.008</b>	<b>0.012</b>	<b>0.021</b>	<b>0.018</b>

## CONCLUSION

The present study clearly indicates that highest quality characteristics and NPK uptake by barnyard millet were recorded with T<sub>2</sub>. This was on par with coir pith compost, bone meal powder and panchagavya (T<sub>9</sub>) and the lowest values were found to be with control (T<sub>1</sub>).

## REFERENCES

1. Chalwade, P.B., V.K. Kulkarni and M.B. Lakade, (2006). Effect of inorganic and organic fertilization on physical properties of Vertisol. *J. Soils Crops.*, 16(1): 148-152.
2. Chopra, S. L. and J. Kanwar. (1976). *Analytical Agricultural Chemistry*, Kalayani Publisher. Ludhiana, New Delhi.
3. Hossain, M.E., F.I. Zummy, M.M. Khatun and S. Islam. (2018). Nutrient content of meat and bone meal available in the market of Chittagong District of Bangladesh. *Bang. J. Anim. Sci.*, 47 (1): 28-34.
4. Humphries, E.C. (1956). Mineral components and ash analysis. *Modern method of plant analysis. Soil Sci.*, 100: 112-117.
5. Mohammed, A., Samir, G.A. and Fathy, S.E. (2014). Effect of integrated use of organic and mineral fertilizer on some quality parameters of maize (*zea mays L.*). *International J. Innovation & Scientific Res.*, 9(2):228-236.
6. Monika. (2017). Evaluation of nitrogen use efficiency in pearl millet cultivars under different nitrogen management. M.Sc. (Ag.) Thesis, Tamilnadu Agricultural University, Madurai.
7. Papen, H., A. Gabler, E. Zumbusch and H. Rennenberg. (2002). Chemolitho autotrophic nitrifiers in the phyllosphere of a spruce ecosystem receiving high nitrogen input. *Curr. Microbiol.*, 44; 56-60
8. Sanwal, S.K., Lakminarayana, K., Yadav, R.K., Rai, N., Yadav, D.S. and Mousumi, B. (2007). Effect of organic manures on soil fertility, growth, physiology, yield and quality of turmeric. *Indian J. Hort.*, 64(4): 444-449.
9. Tilahun, T. F., D. R. Nigussie., B. Wondimu and G. Setegn. (2013). Effect of farm yard manure and inorganic fertilizers on the growth, yield and moisture stress tolerance of rainfed lowland rice. *American Journal of Research Communication.*, 1(4): 274-301.
10. Udayakumar, S and R. Santhi. (2016). Effect of integrated plant nutrition system (IPNS) and initial soil fertility on yield and NPK uptake by pearl millet on inceptisol. *Int. J. Agric. Sci, ISSN, 0975-3710.*

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