International Journal of Ecology and Environmental Sciences
www.ecologyjournal.in
Online ISSN: 2664-7133; Print ISSN: 2664-7125; Impact Factor: RJIF 5.28
Received: 07-01-2021; Accepted: 22-01-2021; Published: 13-02-2021
Volume 3; Issue 1; 2021; Page No. 269-272

Response of bio-digested liquid manure and different nutrient levels on growth and yield barnyard millet under eastern dry zone of Karnataka

Shiva Kumara BS[1], Boraiah B[2], Lingaraju NN[3]
[1] Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru, Karnataka, India
[2] Associate Professor, College of Agriculture, UAS, GKVK, Bengaluru, Karnataka, India
[3] Senior Research Fellow, College of Agriculture, UAS, GKVK, Bengaluru, Karnataka, India

Abstract
A field experiment was conducted in a sandy loam soil at Zonal Agricultural Research Station, UAS, GKVK, Bengaluru to study the "Response of bio-digested liquid manure and different nutrient levels on growth and yield of barnyard millet under eastern dry zone of Karnataka" during *kharif*-2018. The test crop chosen was barnyard millet (DHBM 93-3) and the experiment was laid out in a randomized complete block design consisting of twelve treatments with three replications. The results of the experiment revealed that the application of $N:P_2O_5:K_2O$ at 30:20:20 kg ha^{-1} + FYM + BDLM on 35 DAS recorded significantly higher growth and yield attributes such as plant height, leaf area, total drymatter accumulation, number of tillers per plant, number of panicles per plant and 1000 grain weight (149 cm, 465 cm^2 $plant^{-1}$, 34.10 g $plant^{-1}$, 8.2, 14.9 and 3.71, respectively) compared to all other treatments and significantly higher grain yield, stover yield and harvest index (2373 kg ha^{-1}, 4297 kg ha^{-1} and 0.36, respectively) were recorded with application of $N:P_2O_5:K_2O$ at 30:20:20 kg ha^{-1} + FYM + BDLM on 35 DAS compared to rest of the treatments.

Keywords: barnyard millet, bio-digested liquid manure (BDLM), farmyard manure (FYM), nutrient

Introduction

Millets are one of the old nourishments known to people and conceivably the primary cereals utilized for household purposes. Millets are little seeded grasses that are strong and develop well in dry zones as rainfed crops, under minimal states of soil fertility and moisture conditions. Millets are important nutria cereals gaining importance because of their short growing season. When legitimately stored, entire millets will keep for at least two years. (Anon., 2000) [3]

Internationally, normal creation of coarse grains is assessed to be about 1130.25 m t. India contributed 3.6 per cent (40.19 m t) in worldwide generation of coarse grains and India stands fourth position after USA, China and Brazil. Over 70 per cent of the world coarse grains are created in USA, China, India, Russian Federation, Brazil, Nigeria, Mexico, Sudan, Ukraine, Ethiopia, Australia, Poland, Canada, Argentina, Tanzania, Spain and France. In India, the productivity of coarse grains is around 1433 kg ha^{-1} when compared to world normal productivity of 3512 kg ha^{-1}. The most elevated productivity of 8946 kg ha^{-1} was recorded in USA. In India, coarse grains are cultivated in an area of 27.67 million ha (22 per cent of all out nourishment grains) with a production of 39.95 million tons during 2012 and contributed about 17 per cent to national sustenance crate. Over 90 per cent coarse grains are delivered in Rajasthan, Maharashtra, Karnataka, Uttar Pradesh, Madhya Pradesh, Gujarat, Andhra Pradesh, Haryana, Bihar and Tamil Nadu states (Anon., 2014).

We can found different types of coarse grains across the globe such as great millet - sorghum, pearl millet - bajra, finger millet - ragi, foxtail millet - navane, little millet - same, proso millet - baragu, barnyard millet - oodalu and kodo millet - haaraka, although these millets are nutri- rich some of these are lacking good package of practice to grow them under field condition by farmers, where in barnyard millet having low glycemic index and fat content in its grains and recommended for the diabetic patients also falls in the same community with no proper nutrient management practice (Anon., 2010) [5].

Barnyard millet is grown for human consumption on the other hand it acts as a good source of fodder for animal feeding. It is commonly developed in zones where climatic and edaphic conditions are inadmissible for rice development (Yabuno, 1987) [23]. In India, The area under barnyard millet is about 1.95 lakh hectares and production of 1.67 million tonnes with the productivity of 8.57q ha^{-1} (RashmiYadav and Vijay Kumar Yadav, 2011). The crop is principally developed in two distinctive agro-ecologies, one in mid slopes of Himalayan locale of Uttarakhand in the North and another in Deccan level districts of Tamil Nadu in the south. Wild barnyard millet (*Echinochloacolona*) is usually found in rice fields as weed and devoured as nourishment amid dry spell a long time in numerous conditions of India (Padulosi*et al*. 2009) [15].

Subsequently, innovative intercession for the Barnyard millet is fundamental to help the creation on a productive scale. Fertilizer and manure application is a straight forward and viable technique for providing supplements to crops. To accomplish higher profitability, the harvest plants can be enhanced with supplements through fertilizers, compost and manures. It will made the crop to acquire remarkable changes in seed quality and yield. Thus, more consideration expected to support the efficiency, gainfulness and sustainability of Barnyard millet.

Combined application of BDLM, FYM and inorganic fertilizershad vast potential to improve the growth and yield of barnyard millet through slow and study release of nutrients along with improving biological activity of soil. The present paper revealed the "Response of bio-digested liquid manure and different nutrient levels on growth, yield and economics of barnyard millet under eastern dry zone of Karnataka".

Material and Methods

An experiment was conducted at Zonal Agricultural Research Station, University of Agricultural Sciences, Bengaluru during *kharif* 2018 to study the "Response of bio-digested liquid manure and different nutrient levels on growth, yield and economics of barnyard millet under eastern dry zone of Karnataka". The experiment was laid out in a randomized complete block design consisting of twelve treatments *i.e.,* Absolute control, $N:P_2O_5:K_2O$ at 20:20:0 kg ha^{-1}, $N:P_2O_5:K_2O$ at 20:20:0 kg ha^{-1} + FYM, $N:P_2O_5:K_2O$ at 20:20:10 kg ha^{-1} + FYM, $N:P_2O_5:K_2O$ at 20:20:20 kg ha^{-1} + FYM, $N:P_2O_5:K_2O$ at 20:20:20 kg ha^{-1} + FYM+ BDLM (at 35 DAS), $N:P_2O_5:K_2O$ at 30:20:10 kg ha^{-1} + FYM, $N:P_2O_5:K_2O$ at 30:20:20 kg ha^{-1} + FYM, $N:P_2O_5:K_2O$ at 30:20:20 kg ha^{-1} + FYM + BDLM (at 35 DAS), Only FYM, BDLM on N equivalent basis (at 25 and 35 DAS) and BDLM on N equivalent basis (at 25, 35 and 45 DAS) with three replications. The initial soil sample, bio-digested liquid manure (BDLM) and FYM were collected and analyzed for various parameters by adopting standard procedures. The soil was sandy loam in texture with a bulk density of 1.65 Mg m^{-3} and slightly acidic in soil reaction (pH of 5.85) and (EC of 0.16 dS m^{-1}). The soil possesses available nitrogen (354.76 kg ha^{-1}), phosphorus (28.79 kg ha^{-1}) and potassium (265.5 kg ha^{-1}) were recorded from the initial analysis of the soil before sowing the crop. Also contains appreciable amounts of sulphur and zinc of 30.65 and 0.59 ppm, respectively. BDLM and FYM were applied to the experimental plots as per the treatments. The analysis and interpretation of the data was carried out using Fisher's method of analysis technique.

Results and Discussion

Plant growth parameters

It was observed that plant height was significantly differed at 30, 60 DAS and at harvest. Application of N: P_2O_5: K_2O at 30:20:20 kg/ha + FYM + BDLM (at 35 DAS) recorded significantly higher plant height (56, 115 and 149 cm, respectively) over control (28, 69 and 89 cm, respectively) (Table 1). It was followed by application of N: P_2O_5: K_2O at 20:20:20 kg ha^{-1} + FYM+ BDLM at 35 DAS (50, 105 cm and 137 cm, respectively). The beneficial effect of FYM and BDLM along with fertilizer contributed in supplying additional plant nutrients to the crop. Increase in plant height might be due to the enhanced photosynthetic activity which resulted in improved photosynthates accumulation and translocation of sink due to better source and sink channel. Similar results were reported by Parasuraman*et al*. (2000), where application of enriched FYM (750 kg ha^{-1}) significantly resulted higher plant height of finger millet over control. Similar increment in growth characters was observed with increased level of BDLM and FYM for organic finger millet at several research stations *viz.,* Chintamani, Balajigapade, Navile and Naganahally (Reddy *et al*., 2011). With respect to leaf area, it is revealed from the obtained results that at 30, 60 DAS and at harvest, treatment receiving $N:P_2O_5:K_2O$ at 30:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS resulted significantly higher leaf area (295, 711 and 465 cm^2 $plant^{-1}$) followed by application of $N:P_2O_5:K_2O$ at 20:20:20 kg ha^{-1} + FYM+ BDLM at 35 DAS (262, 614 and 405 cm^2 $plant^{-1}$) compared to rest of the treatments and over the control (138, 333 and 260 $cm^2 plant^{-1}$) (Table 1). This might be due to nutrient content of FYM and BDLM and their faster mineralization of nitrogen. Also, in the same line Govindappa (2003) [8] noticed that the higher leaf area per plant was responsible for more photosynthetic activity which in turn resulted in higher total dry matter production.

Total dry matter production was influenced significantly due to different nutrient levels with BDLM application as shown in (Table 2). At 30 DAS, total dry matter production differed significantly with different nutrient levels with combined application of BDLM, FYM and inorganic fertilizers application compared to control. Application of $N:P_2O_5:K_2O$ at 30:20:20 kg ha^{-1} + FYM + BDLM at 30 DAS recorded significantly higher dry matter production (2.12 g $plant^{-1}$) and it was followed by treatment receiving $N:P_2O_5:K_2O$ at 30:20:20 kg ha^{-1} + FYM (2.01 g $plant^{-1}$) over rest of the other treatment combinations and control (1.33 g $plant^{-1}$). This might be due to the higher leaf area per plant, which was responsible for photosynthetic activity which in turn resulted in higher dry matter production. The results are in line with the findings of Naik*et al*. (2010) noticed that slow release of nutrients from the organic sources at later stages of crop growth might have increased the dry matter and yield.At 60 DAS and at harvest, significantly higher total dry matter production (16.82 and 34.10 g $plant^{-1}$, respectively) was noticed in treatment receiving $N:P_2O_5:K_2O$ at 30:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS and it was followed with nutrient application of $N:P_2O_5:K_2O$ at 20:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS (14.68 and 30.42 g $plant^{-1}$, respectively) compared to the rest of the treatment combinations (Table 2). Significantly lower dry matter production was observed in control with no fertilizer application (8.96 and 17.77 g $plant^{-1}$). The increased total dry matter production was associated with higher number of green leaves per plant, higher leaf area and leaf area index per plant which resulted in accumulation of photosynthates.

From the Table 2, it is evident that number of tillers per plant was increased at different stages of the crop growth. At 30 DAS, number of tillers per plant of barnyard millet was differed significantly with different nutrient management practice along with BDLM application compared to control without fertilizer application. Application of N: $P_2O_5:K_2O$ at 30:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS recorded significantly higher number of tillers (4.9) and followed by N: $P_2O_5:K_2O$ at 20:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS over rest of the treatments and control (2.6). At 60 DAS and at harvest, significantly higher number of tillers per plant (8.3 and 8.1, respectively) was recorded in treatment receiving N: $P_2O_5:K_2O$ at 30:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS and it was followed with nutrient supply of N: $P_2O_5:K_2O$ at 20:20:20 kg ha^{-1} + FYM+ BDLM at 35 DAS (7.3 and 7.6, respectively) compared to the rest of treatment combinations. Significantly lower number of tillers per plant was observed in control with no fertilizer application (4.0 and 3.9, respectively).

Yield parameters and yield of barnyard millet

Significantly higher number of panicles per plant was noticed in N: $P_2O_5:K_2O$ at 30:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS (14.8) and it was followed by N: $P_2O_5:K_2O$ at 20:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS (13.0). Significantly minimum number of panicles per plant was observed in control (5.1) (Table 3). This might be due to continuous supply of nutrients due to the release of nutrients from organics (FYM and BDLM) which resulted in better translocation of photosynthates. The results are in confirmity with the findings of Naik*et al*. (2010) and Neha *et al*. (2017) [14]. Reported that influence of organic manures along with inorganic fertilizer led to increase in number of panicles per plant. Significantly higher 1000 grain weight was recorded in treatment with supply of N: P_2O_5:K_2O at 30:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS (3.71 g). It was followed by N: P_2O_5:K_2O at 20:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS (3.52 g). Whereas, significantly minimum 1000 grain weight was observed in control (2.61 g) (Table 3).

Application of N: P_2O_5:K_2O at 30:20:20 kg ha^{-1} + FYM + BDLM at 35 DASrecorded significantly higher grain yield (2373 kg ha^{-1}) of barnyard millet (Table 3). It was followed by supply of N: P_2O_5:K_2O at 20:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS (2109 kg ha^{-1}) and found significantly over other treatments in the study. However, lower grain yield was observed in control (667 kg ha^{-1}).

The increase in grain and straw yields with enhanced nutrient application could be ascribed to increases the activity of cytokinin in plant which leads to the increased cell-division and elongation which leads to better plant growth, dry-matter production and higher photosynthesis. Thus, an increase in nutrient supply might have increased all the growth parameters, yield attributing characters which ultimately contributed to increase in yields. Increased grain yield due to varying levels of nutrients have also been reported (Neha*et al*., 2017) [14]. This may attributed to higher growth parameters in turn improvement in these characters was due to slow and steady rate of nutrient release into soil solution to match the absorption pattern of crop. Similarly, at Ranichauri, application of pine needle compost at 3.75 t ha^{-1} with gypsum and rock phosphate recorded significantly higher grain (2465 kg ha^{-1}) and straw yield (6380 kg ha^{-1}) of finger millet.

Similarly, at Chintamani, Reddy *et al*. (2010) reported that significantly higher grain yield (2788 kg ha^{-1}) of finger millet was obtained with the application of FYM 10 t ha^{-1} + BDLM equivalent to 60 kg N ha^{-1} than recommended practice (FYM 7.5 t h^{-1} + 50:40:25 kg NPK ha^{-1}) (1388 kg ha^{-1}). Naik*et al*. (2010) has also observed the similar results in foxtail millet.

Significantly higher stover yield was observed with the application of N: P_2O_5:K_2O at 30:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS (4297 kg ha^{-1}) and it was followed by N: P_2O_5:K_2O at 30:20:20 kg ha^{-1} + FYM (4125 kg ha^{-1}). Significantly, lower stover yield was recorded in control (1575 kg ha^{-1}). These results are in close conformity with the findings of Adikant*et al.* (2009) in kodo millet (Table 3).Significantly higher harvest index of barnyard millet was recorded in treatment receiving nutrient combination of N: P_2O_5:K_2O at 30:20:20 kg ha^{-1} + FYM + BDLM at 35 DAS (0.36) and lower harvest index was observed in N: P_2O_5:K_2O at 20:20:0 kg ha^{-1} (0.29) (Table 3).

Conclusion

Significantly higher plant height, number of tillers per plant, number of panicles per plant, test weight and seed yield were recorded with application of NPK at 30:20:20 kg ha^{-1}+FYM and BDLM on 35DAS. Integration of FYM and BDLM with inorganic fertilizers has resulted in higher growth and yield attributes, grain and stover yield was due to slow and steady rate of nutrient release into soil solution to match the absorption pattern of crop.

References

1. Adikant P, Rajput AS, Katlam BP. Organic kodo millet (*PaspalumscrobiculatumL.*) production through organic waste of forest produces. *Mysore J. Agric. Sci.* 2009; 43(3):574-576.
2. Annonymous. Status paper on coarse cereals.Directorate of Millets Development, Jaipur, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, 2014.
3. Anonymous. *Annual Progress Report*, All India Coordinated Research Project for Dryland Agriculture, Santhoshnagar, Hyderabad, 2000.
4. Anonymous. Annual.Report, All India Coordinated small Millet Improvement Project, ICAR, Univ. Agric. Sci., Bangalore, 2004.
5. Anonymous. *Annual Progress Repor*t, Indian institute of Millets Research India, Hyderabad, 2010.
6. Anonymous *Ann. Prog. Report*, All India co-ordinated Research Project for Dry land Agriculture, Univ. Agric. Sci., Bangalore, 2011, 113-120.
7. Babu RBT. and Reddy VC. Effect of nutrient sources on growth and yield of direct seeded rice (*Oryza sativa* L.).*Crop Res.* 2000; 19:189-193.
8. Govindappa M. Efficacy of different organic manures and inorganic fertilizer on growth and yield of rainfed finger millet [*Eleusinecoracana* (L.) Gaertn.] *M.Sc.* (*Agri.*) *Thesis*, Univ. Agric. Sci., Banagalore, 2003.
9. Hussain SI, Khakar KM, Amanullah J, and Farroq M. Effect of various mulches and soil amendments on germination, growth and fresh rhizomes yield of ginger.*Sarhad J.Agric.* 2001; 17(1):87-89.
10. Jackson ML. *Soil Chemical Analysis*. Prentice Hall of India (Pvt.) Ltd., New Delhi, 1967, 498.
11. Lindsay WL, Norwel WA. Development of DTPA soil test for Zn, Fe, Mn and Cu. *Soil Sci. Soc. American J.* 1978; 42:421-428.
12. MANJUNATHA, R., 2010, Effect of different combinations of organic nutrient sources on growth and yield of maize (*Zea mays* L.) under Cauvery command area. *M.Sc.* (*Agri.*) *Thesis*, Univ. Agric. Sci., Bangalore.
13. Naik TB, Murthy RK, and Pushpa K. Effect of integrated nutrient management on growth and yield parameters of foxtail millet (*Setariaitalica*) under rainfed condition of alfisol. Environment and ecology. 2010; 28(2):762-765.
14. Neha, Gautam Ghosh, Preeti Choudhary. Effect of varying nitrogen levels on yield of pearl millet [*Pennisetumglaucum* (L.)] and soil properties. *Chem. Sci. Rev. Lett.* 2017; 6(24):2350-2352.
15. Padulosi S, Bala Ravi S, Gowda J, Gowda KTK, Shantha Kumar G, Yenagi, N. and Dutta, M., Food security and climate change: role of plant genetic resources of minor millets. *Indian J. Plant. Genetics Res.* 2009; 22:1-16.
16. Parasuraman P, Duraiswamy D, Mani AK. Effect of organic, inorganic and bio-fertilizeer in soil fertility under double cropping system in rainfed red soils. *Indian J. Agron.* 2000; 45(2):242-247.

17. Piper CS. Soil and Plant Analysis, Academic Press, New York, 1966, 236.
18. Reddy VC, Jayaram Reddy M, Shivanandam VN, Yogananda SB, Govandaraju C, Jagadeesh BR et al. Developing package of practices for production of finger millet through compost and bio digester liquid manure. *Ann. Prog.Report*, Research Institute on Organic Farming.*Univ. Agric. Sci*., Bangalore. pp. 13-21, 23-26, 30-34 & 47-48.
19. Sheshadri Reddy S. Effect of different organic manures on available NPK status and organic carbon after harvest of groundnut (*Arachis hypogea*).*Crop Res.* 2005; 30(11):26-29.
20. Subbiah BV, Asija GL. a rapid procedure for the estimation of available nitrogen in soils. *Curr*. *Sci*. 1956; 25(8):259-260.
21. Suresh Naik, 2011, Effect of farmyard manure and bio digester liquid manure on growth and yield of rainfed maize (*Zea mays*). *M. Sc.* (*Agri.*) *Thesis*, Univ. Agric. Sci., Bangalore.
22. Walkely AJ, Black TA. Estimation of soil organic carbon by the chromic and titration method. *Soil Sci.* 1934; 37:29-38.
23. Yabuno T. Japanese barnyard millet (*Echinochloautilis*) in Japan.*Econ. Bot*. 1987; 41:484-493.