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EFFICACY OF DIFFERENT ORGANIC NUTRIENT MANAGEMENT PRACTICES ON GROWTH AND YIELD OF FINGERMILLET

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ABSTRACT

A field experiment was conducted during *kharif*, 2016 to study the effect of various nutrient management practices on growth and yield of fingermillet. The experiment was laid down in a randomised block design, replicated thrice with eight treatments of different combinations of organic sources *viz*., farm yard manure, biofertilizers (*Azospirillum*+ PSB), beejamrutha, jeevamrutha and panchagavya. The results revealed that the growth parameters, yield attributes, grain and straw yields were found at their best with the application of 100 per cent recommended dose of nutrients through fertilizers *i.e.* 60-30-30 kg N, P_2O_5 and K_2O ha^{-1}. Among the various organic sources tried, application of 100 per cent N through FYM + seedling treatment with beejamruta + soil application of jeevamrutha @ 500 l ha^{-1} just after transplanting and at every 10 days interval up to 15 days before harvest (T_7) was found to be the best organic nutrient management practice.

KEYWORDS: Fingermillet, jeevamrutha, panchagavya, farm yard manure, beejamrutha.

INTRODUCTION

Fingermillet [*Eleusine coracana* (L.) Gaertn.] is the third most important millet crop in India, next to sorghum and pearl millet, grown over an area of 1.13 million hectares with an annual production of 1.98 million tonnes and a productivity of 1661 kg ha^{-1}. In Andhra Pradesh, it is cultivated in an area of 44,000 hectares with a production of 36,000 tonnes having productivity of 1045 kg ha^{-1} (Ministry of Agriculture and Cooperation, 2016).Fingermillet being rich in calcium, iron, protein with a balanced amino acid profile and lower glycemic index offers plausible health benefits and thus referred as a miracle grain. Recently it is re-emerging as a vital dietary food crop owing to increased public awareness about its nutritional value and climate resilience crop with wider adaptability to adverse weather conditions. The current global scenario is firmly emphasizing the need to adopt eco-friendly agricultural practices in view of the growing demand for safe, healthy and nutritious food.The paucity of adequate qualitative cheaper organic manures availability is limiting the adoption of inclusive organic nutrient management. Due to the dearth of scientific data on the validation of various liquid organic formulations, it has become a major thrust area of research. Thus, in order to sustain the crop productivity and for better on-farm resource utilization, combined use of organic manures along with liquid organic formulations deserves priority as a viable alternative. Hence, an experiment was carried out for estimating the effect of combined application of various organic sources on the performance of fingermillet.

MATERIALS AND METHODS

The field experiment was conducted during *kharif*, 2016 at S.V. Agricultural college dryland farm, Tirupati campus of ANGRAU, on sandy clay loam soil with pH 7.1 having low organic carbon content (0.49%), low available nitrogen (154 kg ha^{-1}), low available P_2O_5 (10 kg ha^{-1}) and medium available K_2O (166 kg ha^{-1}). The experiment was laid out in randomized block design with eight treatments and replicated thrice. The treatments were T_1: control, T_2: 100 per cent RDF (60-30-30 kg N, P_2O_5 and K_2O ha^{-1}), T_3: 100 per cent N through farm yard manure (FYM), T_4: 100 per cent N through FYM + seedling treatment with biofertilizers (*Azospirillum* + PSB), T_5: seedling treatment with beejamruta + soil application of jeevamrutha @ 500 l ha^{-1} just after transplanting and at every 10 days interval up to 15 days before harvest, T_6: seedling treatment with beejamruta + foliar application of panchagavya @ 3 per cent foliar spray just after transplanting and at every 10 days interval up to 15 days before harvest, T_7: T_3+ T_5, T_8: T_3+ T_6.The test

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variety of fingermillet was 'Vakula'. Fingermillet seedlings of 21 days old were transplanted @ one seedling per hill with a spacing of 22.5cm x 10cm. Seedling treatment was done by root dipping for 30 minutes in prepared beejamruta solution or biofertilizer slurry (prepared by mixing the microbial inoculants of *Azospirillum*, PSB, FYM and water at 1:1:5:10 ratio) as per the treatment schedule.The entire dose of P_2O_5, K_2O and half of the N was applied as basal where as the remaining quantity of nitrogen was applied as top dressing at 30 days after transplanting. Application of panchagavya was done by diluting 3 litres of filtrate from the stock solution in 100 litres of water and sprayed with high pore size nozzle on fingermillet crop at ten days interval starting from the day of transplanting to till 15 days before harvest. The prepared solution of jeevamruta was diluted in water (1:10) and applied to soil uniformly covering the total field area on the day of transplanting and at every ten days interval until 15 days before harvest. Similarly jeevamruta was prepared for each application at ten days interval.

RESULTS AND DISCUSSION

The growth parameters *viz*., plant height and dry matter production at harvest, yield attributes *viz*., number of productive tillers m^{-2}, ear weight, grain and straw yield of fingermillet were found to be significantly influenced by various sources of nutrients (Table 1).

The highest plant height and dry matter production of fingermillet was noticed with 100 per cent recommended dose of nutrients through fertilizers (T_2), which was significantly superior to the different organic sources tested. This might be attributed to the quick release and availability of nutrients and especially nitrogen, which is an important constituent of protoplasm playing a positive role in cell division and elongation resulting in vigorous crop growth with effective interception of light and higher rate of photosynthesis. Dry matter accumulation is the prerequisite for higher yields, which is an indication of the biosynthetic processes associated with the crop growth and development.The next higher values of plant height and leaf area index were noticed with the application of 100 per cent N through FYM +seedling treatment with beejamruta + soil application of jeevamrutha @ 500 l ha^{-1} just after transplanting and at every 10 days interval up to 15 days before harvest(T_7).The soil application of jeevamruta might have accelerated the soil microbial activities, which might have helped in the continuous mineralization of applied FYM leading to better availability of nutrients, particularly nitrogen as well as growth promoting hormones *viz*., IAA and GA_3in jeevamruta which might have favored rapid cell division and multiplication leading enhanced biological efficiency in terms of plant height and dry matter accumulation. Further, seedling treatment with beejamruta with cow dung as an integral component which is rich in several genera of bacteria and fungi that might have enhanced the availability of soil native nutrients. The lowest values recorded with control might be due to non-availability of sufficient quantity of nutrients to produce even a moderate stature of fingermillet crop.Similar results were perceived by Kesarwani (2007), Lakshmipathi (2012) and Kasbe *et al*. (2015).

The stature of yield attributes is a complex process governed by complementary interaction between source and sink. Thus the favorable effect of adequate quantity of readily available nutrients with 100 per cent recommended dose of nutrients through fertilizers (T_2) is evident with higher dry matter accumulation and effective translocation of photosynthates to the sink, which resulted in improved stature of yield attributes *i.e*. number of productive tillers m^{-2} and ear weight. Among the organic sources of nutrients tried, application of 100 per cent N through FYM + seedling treatment with beejamruta + soil application of jeevamrutha @ 500 l ha^{-1} just after transplanting and at every ten days interval up to 15 days before harvest(T_7) exerted a synergistic effect of FYM, jeevamruta and beejamruta on the yield attributes of fingermillet. Jeevamruta, a cow dung based formulation is a rich source of naturally occurring beneficial microorganisms, which put forth a direct influence on production of plant growth promoting hormones *viz*., auxins, gibberlins and cytokinins in addition to the supply of biologically fixed nitrogen, solubilization of the insoluble phosphates and better release of potassium into available pool (Girija *et al*., 2013). Hence, the regular soil application of jeevamrutha might have enhanced the conversion of organically bound nutrients in the soil as well as FYM to inorganic forms, thereby making them concurrently available synchronizing with peak period of crop requirement *i.e.* panicle initiation, flowering and grain filling stages. This is in accordance with the results reported by Kesarwani (2007), Lakshmipathi (2012), Rathnayake *et al*. (2013), Nigade *et al*. (2014) and Kasbe *et al*. (2015). The deflated stature of yield attributes

Table 1. Growth parameters, yield attributes and yield of fingermillet as influenced by different organic nutrient management practices

Treatments	Plant height (cm)	Dry matter production (kg ha^{-1})	Number of productive tillers m^{-2}	Ear weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1 : Control	57.7	3751	41.0	2.00	722	2768
T_2 : 100% RDF (60-30-30 kg N, P_2O_5 and K_2O ha^{-1})	104.6	6865	67.3	4.30	2102	4702
T_3 : 100% N through farm yard manure (FYM)	70.4	4863	52.0	2.62	1135	3266
T_4 : 100% N through FYM + seedling treatment with biofertilizers (*Azospirillum* + PSB)	82.1	5769	57.0	3.20	1347	3704
T_5 : Seedling treatment with beejamruta + soil application of jeevamrutha @ 500 l ha^{-1} just after transplanting and at every 10 days interval up to 15 days before harvest	69.6	4707	51.3	2.56	1076	3215
T_6 : Seedling treatment with beejamruta + foliar application of panchagavya @ 3% foliar spray just after transplanting and at every 10 days interval up to 15 days before harvest	58.9	4004	42.3	2.09	734	2784
T_7 : 100% N through FYM + T_5	93.0	6384	61.0	3.76	1648	4148
T_8 : 100% N through FYM + T_6	81.6	5692	56.0	3.13	1333	3693
SEm±	3.39	157.2	0.95	0.150	61.6	138.9
CD (P=0.05)	10.3	477	2.8	0.45	186	421

noticed with control might be ascribed to the fact that the inherent soil fertility status (154-10-166 kg N, P_2O_5 and K_2O ha^{-1}) was insufficient to meet the crop requirement for supporting normal growth and development.

The highest grain and straw yields of fingermillet were recorded with 100 per cent recommended dose of nutrients through fertilizers (T_2). This might be due to the cumulative effect of elevated growth stature as well as yield attributes under the condition of adequate nutrient supply, favoring the production of photosynthates coupled with better partitioning to the sink. Application of recommended dose of fertilizers recorded 27.5 per cent higher grain yield over the next best treatment of 100 per cent N through FYM +seedling treatment with beejamruta + soil application of jeevamrutha @ 500 l ha^{-1} just after transplanting and at every ten days interval up to 15 days before harvest(T_7). Supplementation of FYM with beejamruta and jeevamruta (T_7) registered 45.1 per cent higher yield over 100 per cent N through FYM alone (T_3) where as 53.1 per cent higher grain yield over only beejamruta and jeevamruta (T_5). Further it was noticed that application of either beejamruta and jeevamruta (1076 kg ha^{-1}) or FYM alone (1135 kg ha^{-1}) has resulted in comparative yield. Provision of required carbon substrate through FYM and microorganisms through fermented liquid organic sources might have maintained a steady rhizosphere enzymatic and biological activity for the favorable biochemical reactions, thereby creating congenial environment for mineralization and continuous supply of essential macro and micro nutrients. Further, application of FYM along with jeevamruta might have enhanced the activity of dehydrogenase, phosphatase and urease in the soil as reported by Bhoomiraj and Christopher (2007), Gore (2010) and Lakshmipathi (2012). Hence, the positive effect of combined application of FYM, beejamruta and jeevamruta was reflected with higher grain and straw yields. These results are in accordance with the findings of Kesarwani (2007), Lakshmipathi (2012), Rathnayake *et al*. (2013), Nigade *et al*. (2014), Kasbe *et al*. (2015) and Sahare (2015).

CONCLUSIONS

In conclusion, the present investigation revealed that higher grain yield of fingermillet could be realized with 100 per cent recommended dose of nutrients through fertilizers *i.e*. 60-30-30 kg N, P_2O_5 and K_2O ha^{-1}. Among the various organic sources of nutrients tried, 100 per cent N through FYM + seedling treatment with beejamruta + soil application of jeevamrutha @ 500 l ha^{-1} just after transplanting and at every ten days interval up to 15 days before harvest (T_7) was proved to be the most promising, feasible and economically viable organic nutrient management practice for higher yield, economics of fingermillet along with maintenance of soil biological activity and fertility for the sustenance of soil ecology.

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