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Effect of Nutrient Management Practices on Productivity and Quality in Finger Millet under Zero Tillage Conditions in Rice Fallows

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ABSTRACT

Zero tillage and minimum till systems often result in greater stratification of physical, chemical and biological soil environment which differs greatly from that of conventional tillage. Hence keeping in view of the importance of zero tillage in conservation of soil health and with an aim to increase the production and productivity of finger millet under rice fallow conditions, this experiment was conducted to standardize the fertilizer management technology of finger millet under zero tillage. The experiment was conducted for three years from 2017-18 to 2019-20 during the *Rabi* season at Agricultural Research Station, Vizianagaram. Results showed that grain yield of finger millet was found to be significantly higher in the treatment received with 150% RDF (3571 kg ha^{-1}) along with spraying of 1% KNO_3 twice at flower initiation stage and 15 days after flowering and it was on par with 125% RDF + spraying of 1% KNO_3 (3309 kg ha^{-1}). Spraying of 1% KNO_3 twice at flower initiation stage and 15 days after flowering along with basal application of NPK helped in further increase in grain yield, compared to their respective treatments of NPK alone to the tune of 2.9% in 50% RDF, 5.8% at 75% RDF, 5.6% at 100% RDF, 5.7% at 125% RDF and 4.11% at 150% RDF respectively. The highest net returns and B:C ratio were recorded in 150% RDF+1% KNO3 foliar spray(2.53) which is very closely followed by 125% RDF+ 1% KNO3 foliar spray(2.42). Similarly soil available nitrogen, phosphorus and potassium were significantly high in 150% RDF+1% KNO3 foliar spray, and it was on par with 150% RDF and 125% RDF+1% KNO3 foliar spray. From this study, 125% RDF+1% KNO3 foliar spray was found to be the best nutrient management in finger millet grown under zero tillage conditions in rice fallow situation.

Keywords : *Nutrient management, Productivity, Quality, Finger millet and Zero Tillage*

Finger millet [*Eleusine coracana* (L.) Gaertn.] is a stable food crop for millions of people in the semi-arid region of the world, particularly in Africa and India and especially those who live by subsistence farming. The crop is adapted to a wide range of environments and can be grown in variety of soils with medium or low water holding capacity, but requires rainfall of at least 800 mm per annum.

Tillage operations are used to remove weeds and shape the soil into rows and furrows for planting of crops and irrigation which can ultimately lead to soil compaction, loss of organic matter, degradation of soil aggregates and death of soil microbes. So, all these after effects can be avoidedby zero tillage. With this way of farming, crop residues or other organic amenities are retained on the soil surface and sowing or fertilizing can be done with minimal soil disturbance. Rabi crops need to be sown immediately after rice harvesting by utilize residual moisture. Now a days the pulse productivity in rice fallows is gradually decreasing due to several reasons such as poor germination of seeds due to uneven moisture in the field, lack of improved varieties to withstand cold, Yellow Mosaic Virus and powdery mildew and water stress at flowering stage. Under such conditions most of the farmers are inclining towards growing of finger millet crop under zero tillage conditions when technical and market related information is provided.

Among all the small millets, the most striking feature which made finger millet an important dry land crop, is its resilience and ability to withstand adverse conditions when grown in soils having poor water holding capacity. Hence keeping in view of the importance of zero tillage in conservation of soil health and with an aim to increase the production and productivity of finger millet, this experiment was conducted to standardize the fertilizer management technology of finger millet under zero tillage.

MATERIAL AND METHODS

The field experiment was conducted consecutively for three *Rabi* seasons at Agricultural Research Station, Vizianagaram, Andhra Pradesh from, 2017 to 2019. The soil was sandy clay loam in texture, low in organic carbon, available nitrogen, high in available phosphorus and medium in available potassium. The experiment was laid down in Randomized complete block design with ten treatments replicated thrice. The treatments taken were: T_1: 50% RDF, T_2: 75% RDF, T_3: 100% RDF, T_4: 125% RDF, T_5: 150% RDF, T_6: T_1+ 1% Multi KNO_3 Foliar Spray, T_7: T2+ 1% Multi KNO_3 Foliar Spray, T_8: T3+ 1% Multi KNO_3 Foliar Spray, T_9: T4+ 1% Multi KNO_3 Foliar Spray, T_{10}: T5+ 1% Multi KNO_3 Foliar Spray. The Recommended dose of fertilizer (RDF) of finger millet in the North coastal zone of Andhra Pradesh is 60-40-30 kg NPK/ha. The initial soil samples before sowing of the crops and final soil samples after harvest of the crop were collected, for analysis of pH, EC, available N, P_2O_5, K_2O and available micronutrients viz., Zn, Fe, Cu and Mn as per the standard procedures (Lindsay and Norvell, 1978). The three years experimental pooled mean data was subjected to statistical analysis as per procedure described by Gomez and Gomez (1984). Differences among the means and treatments were compared by the least significant difference (LSD) at P d" 0.05.

RESULTS AND DISCUSSION

Different levels of NPK fertilizers, influence the growth and yield parameters in finger millet under zero tillage conditions in rice fallows (Table 1). The number of productive tillers/plant (2.7) and ear head length (6.79 cm) were found significantly high in the treatment with 150% RDF+1% KNO3 foliar spray. However, it was on par with 125% RDF+1% KNO3 and 150% RDF. These results are in agreement with the fact that higher application of fertilizers (150% RDF) had a positive consequence on growth pattern with betterment of physiological process such as cell division, cell elongation along with timely metabolic processes (Kushwah *et. al.,* 2014 and Sandhyarani *et al.,* 2017). Application of lower levels of NPK fertilizers *viz.,* 50% RDF and 75% RDF recorded lowest number of productive tillers/plant (1.7 and 1.8 respectively) earhead length (5.03 cm and 5.53 cm respectively) and no. of fingers/earhead (5.47 and 5.80 respectively) compared to rest of the treatments. Nutrient management in finger millet (variety, VR 847) in rice fallows under Zero tillage conditions showed that grain yield of finger millet was found to be significantly highest in the treatment received with 150 % RDF+ spraying of 1% KNO_3 twice at flower initiation stage and 15 days after flowering (3571kg/ha) over 100% RDF NPK fertilizers (2821 kg/ha) and was on par with 125% RDF + spraying of 1% KNO_3 twice at flower initiation stage and 15 days after flowering (3309 kg/ha). Spraying of 1% KNO_3 twice at flower initiation stage and 15 days after flowering had helped in increase in grain yield compared to their respective treatments of NPK fertilizers alone. The per cent yield increase due to spraying of 1% KNO_3 was found to be 2.9% in 50% RDF, 5.8% at 75% RDF, 5.6% at 100% RDF, 5.7% at 125% RDF and 4.11% at 150% RDF fertilizers and this may be due to more and rapid flower initiation and early vigor that resulted in more no. of productive tillers, bigger size ear heads and long finger length of finger millet. Higher Benefit: Cost ratio (2.53) (Table 1) was observed with 150%RDF + spraying of 1% KNO_3. These results are in conformity with Nigade and more (2013), Shivakumar *et al.*, (2011) and Sandhyarani *et al.* (2017).

The physicochemical properties of the soil (pH and E.C) (Table 2) showed no significant influence with the application of different nutrient management practices. The Organic Carbon percentage of the soil also has shown no significant influence due to various treatments. Post-harvest soil analysis showed that soil available nitrogen, phosphorus and potassium (Table 2) were significantly influenced by different nutrient management practices. The maximum soil available nitrogen, phosphorus and potassium after harvest of the crop was recorded with 150 % RDF + 1% KNO3 spray (161 kg ha^{-1}, 41 kg $ha^{-1}$and 238 kg/ha respectively). The macronutrients are involved in almost all biochemical pathways as a component part of energy carrier compounds. Thus, increased doses of nitrogen and phosphorus fertilizer application makes this nutrient available to crop plants and result in better growth and development. These results were in close agreement with Hemalatha and Chellamuthu (2013) and Rurinda *et al.* (2014). Whereas the soil available micronutrients showed no significant difference between the treatments.

Table 1: Effect of nutrient management practices on yield attributed, grain and straw yield of ragi in rice fallows under zero tillage conditions

	Plant height (cm)	No. of productive tillers/ plant	Boot leaf length (cm)	Ear head length (cm)	No. of fingers/Ear head	Grain yield (kg/ha)	Straw yield (kg/ha)	B:C
T_1: 50% RDF NPK	81.1	1.7	33.8	5.03	5.47	2470	5574	2.08
T_2: 75% RDF NPK	82.5	1.8	33.9	5.53	5.8	2572	6122	2.08
T_3: 100% RDF NPK	85.9	2.1	37.1	6.07	6.2	2821	6739	2.14
T_4: 125% RDF NPK	87.5	2.4	37.4	6.13	6.33	3135	7189	2.36
T_5: 150% RDF NPK	91.3	2.6	40.7	6.53	5.93	3430	7522	2.48
T_6: T1+ 1% KNO_3 spray	84	2.1	35.6	6.03	6.13	2542	5844	2.1
T_7: T2+ 1% KNO_3 spray	85.5	2.3	37.9	6	6.27	2720	6373	2.08
T_8: T3+ 1% KNO_3 spray	86.2	2.5	35.9	6.13	6.33	2979	6979	2.15
T_9: T4+ 1% KNO_3 spray	89.2	2.5	37	6.48	6.37	3309	7585	2.42
T_{10}: T5+ 1% KNO_3 spray	89.8	2.7	37.6	6.79	6.4	3571	7939	2.53
Mean	86.3	2.27	36.7	6.07	6.12	2955	6787	
SEm±	3.25	0.2	1.72	0.27	0.36	124.96	729.13	
C.D. (0.05)	NS	0.38	NS	0.58	NS	368.1	983.83	
C.V. (%)	6.52	15.4	8.14	7.71	10.28	8.48	9.18	

*** Significant at 0.05**

Table 2. Effect of nutrient management practices on soil available macronutrients and micronutrients of ragi in rice fallows under zero tillage conditions

Treatments	Soil pH	EC (dS m-1)	OC %	Avai. N (kg/ha)	Avai. P2O5 (kg/ha)	Avai. K_2O (kg/ha)	Zn (ppm)	Fe (ppm)	Mn (ppm)	Cu (ppm)
T_1	7.02	0.24	0.33	127	31	216	1.2	6.47	3.24	0.69
T_2	6.95	0.3	0.35	139	32	224	1.32	7.56	3.8	0.73
T_3	7	0.31	0.35	144	34	232	1.38	7.61	3.92	0.73
T_4	6.52	0.28	0.34	152	39	230	1.32	7.64	3.71	0.7
T_5	6.42	0.29	0.32	156	36	238	1.33	7.78	3.85	0.76
T_6	6.61	0.22	0.34	139	32	215	1.4	7.87	4.12	0.69
T_7	6.97	0.24	0.34	135	34	219	1.32	7.73	3.75	0.72
T_8	6.94	0.29	0.34	139	36	230	1.32	7.68	3.84	0.75
T_9	6.53	0.27	0.32	148	37	232	1.33	7.77	3.67	0.7
T_{10}	6.78	0.31	0.35	161	41	238	1.31	7.58	3.6	0.69
SEm±	0.18	0.02	0.01	5.85	1.8	5.09	0.07	0.36	0.26	0.04
CD (0.05)	NS	NS	NS	16.9	5.21	14.7	NS	NS	NS	NS
CV %	4.57	12.75	7.26	8.03	8.84	7.95	9.26	8.24	11.81	9.06
Initial soil samples	6.9	0.21	0.35	139	35	224	1.25	7.6	3.75	0.68

The results revealed that 150% RDF + 2 sprays of 1% KNO_3 showed higher yields and soil available nutrients when compared to 100% RDF and was also found on par with 125% RDF + 2 sprays of 1% KNO_3

LITERATURE CITED

Gomez K A and Gomez A A 1984. Statistical Procedures for Agricultural Research, 2nd edition. International Rice Research Institute, John Wiley and Sons, New York, USA.

Hemalatha S and Chellamuthu S 2013. Impacts of long-term fertilization on soil nutritional quality under finger millet- Maize cropping sequence. *Journal of Environmental Research Development*.**7**(4A): 1571–1576.

Kushwah S K, Dotaniya M L, Upadhyay A K, Rajendiran S, Coumar M V and Kundu S 2014. Assessing carbon and nitrogen partition in kharif crops for their carbon Sequestration potential. *National Academy Science Letters*. 37(3):213-217

Lindsay W L, Norvell W A 1978. Development of a DTPA test for zinc, iron, manganese and copper. Soil Science Society of American Journal. 42: 421–428.

Nigade R D and More S M 2013. Performance of finger millet varieties to different levels of fertilizer on yield and soil properties in sub-montane zone of Maharashtra. *International Journal Agricultural. Sciences*.9(1):256-259

Rurinda J, Mapfumo P, Van Wijk M T, Mtambanengwe F, Rufino M C, Chikowo R and Giller K E 2014. Comparative assessment of maize, finger millet and sorghum for household food security in the face of increasing climatic risk. *European Journal of Agronomy*.55 **(**4):29–41.

Sandhyarani Y, Triveni U, Patro T S S K and Anuradha N 2017. Effect of nutrient management on yield and quality of finger millet (*Eleusine coracana* (L.) Gaertn. *International Journal of Chemical Studies*. 5(6):1211-1216

Shivakumar B C, Girish A C, Gowda B, Kumar G C V, Mallikarjuna A P and Thimmegowda M N 2011. Influence of pongamia, mahua and neem cakes on finger millet productivity and soil fertility. *Journal of Applied Natural Sciences*. 3:274-276.

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