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Nitrogen Management in Transplanted *ragi*

S Poorna Teja, K V Ramana Murthy, A S Rao and Ch Mukunda Rao
Department of Agronomy, Agricultural College, Naira, Andhra Pradesh

ABSTRACT

A field experiment conducted during *rabi*, 2013-14 on sandy loam soils of Agricultural college farm, Bapatla on Nitrogen management in transplanted ragi. The experiment was laid out in Randomized Block Design with nine treatments replicated thrice. The results showed that the highest plant height, number of tillers, drymatter production, straw yield and N-uptake were observed with 125% RDN+ ST with Azospirillum @ 5kg ha^{-1} + 0.2% Zn spray at flowering stage and yield attributes and yield were observed with 75% RDN+ 25% N through Vermicompost. However, the highest benefit cost ratio (2.5) was 100% RDN and hence was found to be optimum and economical for the production of white seeded transplanted ragi.

Key words :*Azospirillum*, FYM, Nitrogen management, Ragi,Vermicompost, Zn-spray.

Finger millet(*Eleusine coracana* L. *Gaertn*) is an important small millet crop grown in India and has the pride place of having highest productivity among millets. Ragi plays a vital role of providing quality nutrition to human race. The protein of ragi is considered to be "biologically complete". Finger millet is normally grown on poor, marginal soils and imbalanced nutrient managements. Among various nutrients nitrogen is an inevitable nutrient for any crop. Combined application of nitrogen through organic manures and chemical fertilizers generally produces higher crop yield than sole application. Among various organic manures FYM, vermicompost, bio-fertilizers not only increase the yield but also improve the quality of taste of the produce. A complementary use of organic manures and chemical fertilizers may probably increase the efficiency of both these inputs and produce quality grain with much environmental safety. Besides this, soil application of biofertilizers was found to increase the crop yield through N-fixation thereby reducing the crop demand for the nitrogen, In view of the above, development of management methods for nitrogen for quantitative and qualitative production is required.

MATERIAL AND METHODS

A field trial was conducted during *rabi,* 2013-14. The experiment was laid out in a randomized block design with nine treatments viz., Control (T_1), 75% RDN + 25% N through FYM (T_2), 50% RDN + 50% N through FYM (T_3), 75% RDN + 25% N through Vermicompost(T_4),50% RDN + 50% N through Vermicompost (T_5),100% RDN (T_6),75% RDN + ST with *Azospirillum* @ 5Kg/ha+0.2% Zn spray at flowering (T_7),100% RDN + ST with *Azospirillum* @ 5Kg/ha +0.2% Zn spray at flowering (T_8) and 125% RDN+ ST with *Azospirillum* @ 5Kg/ha +0.2% Zn spray at flowering (T_9). The cultivar is Hima (VRW-936). The experimental soil was sandy loam in texture, slightly alkaline in reaction, low in organic carbon and available nitrogen, low in available phosphorus, low in available potassium. The test variety 'Hima (VRW-936) was sown at a spacing of 30cm × 10cm. Half of the recommended dose of nitrogen was applied through urea, as basal in all the treatments except T_3 and T_5 where farm yard manure and vermicompost are applied to meet 50% nitrogen requirement. All phosphorus, potassium was applied as basal and the remaining nitrogen was applied at 30 days after transplanting.

RESULTS AND DISCUSSION

Growth parameters

Maximum plant height (130.3cm) was recorded with the application of 125% RDN+ ST with *Azospirillum* @ 5kg ha^{-1}+ 0.2% Zn spray at flowering stage (T_9) which was on a par with 75% RDN + 25% N through Vermicompost (T_4) and

significantly superior over the other treatments, similar trend was associated in dry matter production at harvest with a total dry matter production of (12101 kg ha ^{1}) in 125% RDN+ ST with *Azospirillum* @ 5kg ha^{-1}+ 0.2% Zn spray at flowering stage (T_9). But regarding number of tillers (m^{-2}) T_9 recorded highest (180) than all other treatments.

Significantly higher plant height and number of tillers (m^{-2}) in treatment T_9 over other treatments might be due to higher dose of nitrogen supplied in this treatment than the RDN. Nitrogen was associated with increase in protoplasm, cell division and cell enlargement resulting in taller plants (Tisdale et *al*., 1985), and also increased chlorophyll content at all growth stages and might have increased the photosynthesis results in increased plant height and number of tillers (m^{-2}). A similar result with plant height in response to higher dose of nitrogen was reported with Saini *et al*., 1996. Increased plant height, number of tillers (m^{-2}) and dry matter accumulation in vermicompost treated plots might be due to its higher content of N when compared to FYM. Similar results were obtained by Amanullah *et al.* (2006).

Yield attributes

The yield attributes viz., no.of ear heads^{-1}, no. of grains finger^{-1} recorded were the higher with 75% RDN +25% N through Vermicompost (T_4), which was on a par with 125% RDN+ ST with *Azospirillum* @ 5kg ha^{-1}+ 0.2% Zn spray at flowering stage (T_9), 100% RDN+ ST with *Azospirillum* @ 5kg ha^{-1}+ 0.2% Zn spray at flowering stage (T_8) and 100% RDN (T_6) proved significantly superior over all other treatment combinations.

Number of ear heads m^{-2} and no. of grains finger^{-1} revealed that highest number of ear heads m^{-2} noticed with combined application of 75% recommended dose of nitrogen through inorganic sources and 25% nitrogen through vermicompost (T_4). This might be due to sufficient amount inorganic N coupled with prolonged availability of nitrogen during the crop growth period from vermicompost might have enhanced number of ear heads m^{-2} and better conversion efficiency. Similar results were obtained by Raman and Kuppuswamy (2002) with vermicompost regarding number of earheads m^{-2}.

Yield

Highest grain yield and higher straw yield were recorded with 75% RDN + 25% N through Vermicompost (T_4) and 125% RDN + ST with *Azospirillum* @ 5 kg ha^{-1}+ 0.2% Zn spray at flowering stage (T_9) which was on a par with 100% RDN+ ST with *Azospirillum* @ 5kg ha^{-1}+ 0.2% Zn spray at flowering stage (T_8) and 100% RDN (T_6) proved significantly superior over all other treatment combinations regarding grain yield.

The above data indicated that grain yield was highest, when combined application of 75% recommended dose of nitrogen through inorganic sources and 25% nitrogen through Vermicompost (T_4) due to optimum dose of inorganic N and prolonged availability of nutrients during the crop growth period from vermicompost might have enhanced the growth and yield attributes and finally augmented the grain yield as evidenced through highest nunber of ear heads m^{-2} and number of filled grains with this treatment. The data also indicated that the supply of nitrogen to transplanted white seeded ragi could be substituted upto 25% level with vermicompost as it was on par with 100% RDN. Similar observation were recorded by Umesh *et al*. (2006), Raman and Kuppuswamy (2002), Kishorebabu (2010) and Saini *et al*. (1996). Analysis of the data further revealed that substitution of nitrogen with either FYM or Vermicompost up to 50% level had drastically reduced the grain yield. 75% RDN integrated with ST with *Azospirillum* @ 5 kg ha^{-1}combined with 0.2% Zn spray at flowering stage (T_7) was not able to influence the grain yield to the extent of either T_4 and T_9, which clearly proved that use of biofertilizer *Azospirillum* and foliar application of Zinc was not able to match the 25% nitrogen requirement of the crop. Similar results were observed with Arulmozhiselvan *et al*., 2013 with Zn- spray. The yield of transplanted ragi crop reduced by 69% in control treatment as compared to 75% recommended dose of nitrogen through inorganic sources and 25% N through Vermicompost (T_4).

Economics

The Highest gross return was recorded with 75% RDN+ 25 % N through Vermicompost (T_4), but however net returns and benefit cost ratio were lower for T_4. The benefit cost ratio was highest with 100% RDN (T_6). The gross returns and net

Table 1. Growth parameters of finger millet as influenced by nitrogen management methods.

Treatments	Plant height (cm)	Dry matter production (kg ha^{-1})	No. of tillers (m^{-2})
T_1 : Control	68.01	6016	78
T_2 : 75% RDN+25% N through FYM	114.17	10132	132
T_3 : 50% RDN+50%N through FYM	100.63	9071	115
T_4 : 75% RDN+25% N through Vermicompost	125.22	11463	148
T_5 : 50% RDN+50% N through Vermicompost	103.07	9150	116
T_6 : 100% Recommended dose of nitrogen (RDN)	118.83	10694	142
T_7 : 75%RDN+ ST with Azospirillum @ 5kg ha^{-1} + 0.2% Zn spray at flowering stage	109.73	9958	129
T_8: 100%RDN+ ST with Azospirillum@ 5kg ha^{-1} + 0.2% Zn spray at flowering stage	118.93	10773	143
T_9 : 125% RDN+ ST with Azospirillum@ 5kg ha^{-1} + 0.2% Zn spray at flowering stage	130.03	12101	180
SEm±	3.4	319.3	4.72
CD @ 0.05	10.17	957	14
CV (%)	5.35	5.6	6.23

Table 2. Yield attributes, yield and economics of finger millet as influenced nitrogen management methods in transplanted ragi.

Treatments	No. of earheads m^{-2}	No. of grains finger^{-1}	Yield		Net returns	B:C ratio
			Grain (kg ha^{-1})	Straw (kg ha^{-1})		
T_1 : Control	54	102	899	4943	4272	0.3
T_2 : 75% RDN+25% N through FYM	92	148	2380	7643	27732	2.0
T_3 : 50% RDN+50%N through FYM	80	130	2011	6792	20065	1.3
T_4 : 75% RDN+25% N through Vermicompost	113	192	2899	8695	31385	1.6
T_5 : 50% RDN+50% N through Vermicompost	81	132	2098	6778	8305	0.3
T_6 : 100% Recommended dose of nitrogen (RDN)	108	177	2713	7897	33756	2.5
T_7 : 75%RDN+ ST with Azospirillum @ 5kg ha^{-1} + 0.2% Zn spray at flowering stage	88	139	2161	7547	23529	1.6
T_8: 100%RDN+ ST with Azospirillum@ 5kg ha^{-1} + 0.2% Zn spray at flowering stage	109	179	2751	7973	32945	2.2
T_9 : 125% RDN+ ST with Azospirillum@ 5kg ha^{-1} + 0.2% Zn spray at flowering stage	110	185	2826	9268	34322	2.2
SEm±	3.3	8.2	80.6	280.5	1299.8	0.08
CD @ 0.05	10	25	242	840	3896	0.2
CV (%)	6.1	9.2	6.1	6.5	9.4	9.3

returns with 125% RDN + ST with *Azospirillum* @ 5 kg ha^{-1}+ 0.2% Zn spray at flowering stage(T_9) was comparable with 100% RDN + ST with *Azospirillum* @ 5 kg ha^{-1} + 0.2% Zn spray at flowering stage(T_8) and 100% RDN (T_6). Highest benefit cost ratio with T_6 might be due to higher net returns and lower cost of cultivation.

Conclusion

From this study, it can be concluded that application of 100% RDN (50kg N ha^{-1}) in inorganic form was found to be optimum and economical for the production of white seeded transplanted ragi during *rabi* season and nitrogen requirement of transplanted ragi can be substituted up to 25% level with vermicompost without penalty on yield.

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