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Effect of integrated nutrient management practices for production enhancement on yield and economics in irrigated transplanted Ragi

[*] M. G. Sreemathi, A. Karthikeyan and S. Babu

Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalai Nagar - 608002 (India)
[*]Corresponding author: Sreemathi M.G (M.Sc. Scholar), Department of Agronomy, Annamalai University, Annamalai Nagar - 608002 (India)
e.mail: sreemathi3028@gmail.com contact: 7695829965

Abstract

The field experiment was conducted in a farmer's field at salangapalayam village, Bhavani block of Erode district to study the effect of integrated nutrient management practices for yield maximization in irrigated transplanted ragi. The experimental plots were laid out in a randomized block design (RBD) with nine treatments and three replications. Among the various treatments implemented in this study, application of 100% RDF (60:30:30 kg of NPK ha^{-1}) + Soil application of Micronutrient mixture @12.5 kg ha^{-1} (T_3) significantly recorded higher number of earheads m^{-2} (114.02), length of earhead (8.75) (cm), number of fingers $earhead^{-1}$ (11.210), grain yield (3660 kg ha^{-1}), straw yield (5617.72 kg ha^{-1}) and economics (BCR : 2.37). Hence, treatment T_3 enhances the productivity of irrigated transplanted ragi through integrated nutrient management practices with which it earns profitability for ragi growing farming community.

Key words : Ragi, integrated nutrient management practices, yield, economics.

Ragi is commonly known as "Nutritious millet" on account of its superiority to many cereals (rice, corn and sorghum) in terms of proteins, minerals, iron, calcium and vitamins in abundance. Finger millet is considered as wholesome food for diabetic patients. It is an important staple food in parts of eastern and central Africa and India. Malnutrition and undernourishment are the major problems of Indian population due to which millets are becoming alternate source of human food globally as well as in India. The calcium content in this crop is higher than all other cereals while, the iodine content is said to be highest among all the food grains. Besides this, the importance of micronutrients such as zinc and iron in improving the quality of food or value addition also needs to be evaluated to overcome the imbalance of nutrients in the produce. With the changes in scenario of utilization of processed products and awareness among the consumers about the health benefits, finger millet has gained importance on account of its functional components, such as slowly digestible starch and resistant starch[3].

Micronutrient deficiency, including Zn, is increasing in most of the annual crops due to intensive cropping systems, use of modern high yielding cultivars, loss of organic matter in top soils by erosion, burning crop residues, liming acid soils, and use of inadequate rates in most cropping systems. Zinc deficiency in crop plants is reported worldwide. According to the studies about 50% of soils used for cereal production in the world contain low levels of plant-available Zn, which reduce yield and nutritional quality of grains. Micronutrient deficiencies have been reported to be one of the main causes for yield plateau or even yield decline in intensified cropping systems. The rainfed soils of North Western zone is red sandy loam and non-calcareous and major areas is deficient in zinc. Finger millet is one of the predominant rainfed crop grown in this zone in more than 75,000 ha. Suitable nutrient management in respect of integrated nutrient management practices has not yet been studied. Keeping all these view in addition to recommended dose of fertilizers, the experiment is proposed to find out the effect of effect of integrated nutrient management practices for production enhancement yield and economics in irrigated transplanted ragi[5].

Field experiment was carried out at farmer's field, Salangapalayam village, Bhavani block of Erode district to study the effect of integrated nutrient management practices for production enhancement on yield and economics in irrigated transplanted ragi from April to July 2021. The experimental field was geographically located at 11.42º N latitude and 77.57º E longitude at an altitude of 196 meters above mean sea level. The Soil of the experimental field was sandy clay loam soil. The soil was low (186.73) in available nitrogen, medium (10.497) in available phosphorus and medium (148.2) in available potassium. The experiment was laid out in Randomized Block Design (RBD) with three replications and nine treatments *viz*., T_1 - Control (without any fertilizers), T_2 - 100% RDF (60:30:30 kg NPK ha^{-1}), T_3 - 100% RDF + soil application of Micronutrient mixture (TN grade XI) @ 12.5 kg ha^{-1}, T_4 - 100% RDF + soil application of Humic acid @ 25 kg ha^{-1}, T_5 - 100% RDF + soil application of Seaweed extract @ 25 kg ha^{-1}, T_6 - 75% RDF (45.0:22.5:22.5 kg NPK ha^{-1}), T_7 - 75% RDF + soil application of Micronutrient mixture (TN grade XI) @ 12.5 kg ha^{-1}, T_8 - 75% RDF + soil application of Humic acid @ 25 kg ha^{-1}, T_9 - 75% RDF+ Soil application of Seaweed extract @ 25 kg ha^{-1}. The recommended fertilizer schedule of 60:30:30 kg of N as Urea, P_2O_5 as single super phosphate and K_2O as muriate of potash ha^{-1} were applied as per the treatment schedule. Fifty per cent of N and a full dose of P and K were applied as basal. The remaining 50% dose of N were applied into two equal splits on 30-35 and 40-45 days. The Finger millet variety ATL 1 was chosen for the study. Biometric observations were recorded at harvest and economics ere worked out based on the inputs cost, labour charges and market value of the produces. The data's were statistically analyzed as suggested by Yakadri & Reddy[6].

Yield attributes and yield :

Yield attributes and yield were significantly increased with integrated nutrient management practices (Table-1). Among different treatments, application of 100% RDF + soil application of Micronutrient mixture (TN grade XI) @ 12.5 kg ha^{-1} (T_3), recorded higher number of earheads m^{-2} (114.02), number of fingers earhead^{-1} (11.21), length of earhead (8.75cm), grain yield (3660 kg ha^{-1}) and straw yield (5617.72 kg ha^{-1}) in irrigated transplanted ragi. This was followed by the application of 100% RDF + soil application of Humic acid @ 25 kg ha^{-1} (T_4) with the number of earheads m^{-2} (109.50), number of fingers earhead^{-1} (10.78), length of earhead (8.23cm), grain yield (3103 kg ha^{-1}) and straw yield (5408.72 kg ha^{-1}) and it is on par with the application of 100% RDF + soil application of Seaweed extract @ 25 kg ha^{-1} (T_5). The least values for yield attributes and yield were recorded under the control (T_1).

The increase in number of earheads m^{-2}, number of fingers earhead^{-1} might be due to the reason that the MN mixture contains essential nutrients required for the promotion of meristematic and physiological activities. The beneficial effect on yield attributing characters could be due to an increased supply of all essential nutrients, which might have resulted in more synthesis of photosynthate. Due to the role of Zn in the biosynthesis of

Table-1. Effect of INM on yield attributes of irrigated transplanted ragi

Treatment	Yield attributes			Yield	
	No. of. Earheads (m^{-2})	No. of. Fingers earhead^{-1}	Lengthof earhead (cm)	Grainyield (kg ha^{-1})	Strawyield (kg ha^{-1})
T_1	83.48	7.73	5.01	986	2124.39
T_2	98.55	9.44	6.90	2765	4859.65
T_3	114.02	11.21	8.75	3660	5616.72
T_4	109.50	10.78	8.23	3103	5408.72
T_5	107.49	10.57	8.11	3021	5275.91
T_6	87.70	8.29	5.56	2406	4334.39
T_7	102.87	9.96	7.46	2895	5069.91
T_8	94.03	8.85	6.25	2625	4648.24
T_9	91.91	8.74	6.20	2546	4554.03
SEm±	1.35	0.15	0.15	38.62	59.84
CD (p=0 .05)	4.07	0.46	0.46	117.00	180.97

indole acetic acid (IAA) and especially its role in the initiation of primordial and reproductive parts and partition of photosynthates. This coincides with the results obtained by Giribabu *et al.*[1]. Grain yield was the ultimate end product of many yield contributing components and physiological and morphological processes that took place in plants during growth and development. The conjunctive use of organic and inorganic sources had a beneficial effect on the physiological process of plant metabolism and growth, thereby leading to higher grain yield. The easy availability of N due to mineralization of organics influenced the shoot and root growth favouring the absorption of other nutrients. The results conformed with the findings of Yakadri and Reddy[6]. Higher straw yield under conjoint organic and inorganic sources were due to higher plant height, LAI, DMP accumulation, more nutrient availability and uptake. These results were in agreement with the reports of Giribabu *et al.*[1] and Jagathjothi *et al.*[2]. Response of crop to Mn application may be due to deficiency of this nutrient in soil which was improved by this application. Matching results were also reported by Tabrizi *et al.*[4]. As straw yield is directly related to the growth and yield components, increase in their qualities made a significant increase in straw yield.

Economics :

Adoption of integrated nutrient management practices influenced the economics of irrigated transplanted ragi. Among the different treatments, application of 100% RDF + soil application of Micronutrient mixture (TN grade XI) @ 12.5 kg ha^{-1} (T_3), recorded the higher net return of Rs. 56164.00 ha^{-1} and BCR of 2.37. This was significantly followed by the application of 100% RDF + soil application of Humic acid @ 25 kg ha^{-1} (T_4) which recorded a net return of Rs. 41135.00 and BCR of 1.98 but it is on par with the application of 100% RDF + soil application of Seaweed extract @ 25 kg ha^{-1} (T_5). The least net return and BCR were recorded under the control (T_1). This could be due to higher grain and straw yield obtained with the integrated nutrient management practices adopted. The results were in harmony with the findings of Tabrizi *et al.*,[4]

Table-2. Effect of INM on economics of irrigated transplanted ragi

Treatments	Cost of cultivation	Gross income	Net income	BCR
T_1	33770.00	26774.00	-8784.00	0.75
T_2	38167.00	73985.00	33927.00	1.85
T_3	39042.00	97117.00	56164.00	2.37
T_4	39917.00	82984.00	41135.00	1.98
T_5	40667.00	80801.00	38185.00	1.90
T_6	37290.00	64484.00	25324.00	1.65
T_7	38040.00	77445.00	37517.00	1.94
T_8	37915.00	70273.00	30474.00	1.77
T_9	38540.00	68204.00	27765.00	1.69

From the present study, it can be concluded that application of 100% RDF + soil application of Micronutrient mixture (TN grade XI) @ 12.5 kg ha^{-1} (T_3) increased the yield and economics of irrigated transplanted ragi thereby achieves the maximum productivity and profitability in ragi production.

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