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Yield Maximization in Ragi Under Rainfed Condition

C.J.SRIDHARA, NARAYAN S. MAVARKAR AND S.KRISHNA NAIK

Department of Agronomy
College of Agriculture, Shimoga - 577 204

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Abstract : A field experiment was conducted on yield maximisation in ragi during the kharif seasons of 1996, 1997 and 1998 on Red sandy loam soil at Agricultural college farm of Shimoga district. The experiment was laidout in randomised complete block design with three replications and eight different treatment combinations comprising of record NPK and record. NPK along with other single plant nutrients like Zn, Ca, azatobacter as well as mixture of all plant nutrients along with recommended NPK. Soil of the experimental site was slightly acidic and available nitrogen was low, available P_2O_5 and K_2O were medium. Application of recommended. NPK along with azatobacter, zinc sulphate and gypsum recorded significantly more number of leaves per plant (60), higher number of tillers per plant (8.27) and higher mean yield (61.09 q/ha) when compared with application of recommended NPK alone. Maximum benefit-cost ratio was obtained in the treatment consisting of recommended. NPK along with azatobacter, zinc sulphate and gypsum (2.48:1) when compared to application of recommended NPK only. Application of recommended NPK along with zinc sulphate and gypsum was on par with the application of NPK along with zinc + azatobacter and application of recommended NPK along with gypsum + azatobacter. This indicates that ragi responds to zinc and gypsum along with the bio-fertilizer.

Introduction

Ragi (*Eleusine coracana* L.) also known as finger millet, is one of the important minor millets grown in India. It ranks second in importance among the millets grown in India. It is being grown on an area of 2.50 m.ha with a production of 2.9 m.t.. Karnataka stands first in the country with an area of 0.99 m.ha and a production of 1.09 m.tonnes. It is one of the important food crops of southern transitional zone. The average productivity of one state is considerably very low when compare with other states. This may be due to improper fertilization. It is found that most of the farmers are not applying secondary and micro nutrients for this crop. Ragi requires considerable amount of zinc as well as calcium for its growth and grain development. Deficiency of secondary and micronutrients leads to reduction in number of effective tillers and improper grainfilling (Shetty *et al.,* 1993). In the same way it has been known that use of Biofertilizer not only supplement the nutrients but, also made unavailable plant nutrients into available form to the crop plants and also increased the grain yield (Pradhan, 1992). Keeping all there in view the experiment was carried out to find out the effect of biofertilizer (Azatobacter) along with zinc and gypsum on ragi under rainfed condition.

Material and Methods

A field experiment was carried out on yield maximisation in ragi under rainfed condition during kharif seasons of 1996,1997 and 1998 at College of Agriculture, Navile farm on red sandy loam soil. The soil was slightly acidic (PH 6.0). The available Nitrogen in the soil was low (59.00 kg/ha). The available P_2O_5 and K_2O were medium (328 kg/ha and 335 kg/ha respectively). There were 8 treatments viz. T_1-recommended NPK, T_2-Recommended NPK + azatobacter, T_3-Recommended NPK + $ZnSO_4$ (10kg/ha), T_4-Recommended NPK + gypsum (500kg/ha), T_5-recommended NPK+azatobacter + $ZnSO_4$, T_6-recommended NPK + azatobacter+ gypsum, T_7-recommended NPK+ $ZnSO_4$ + gypsum, T_8-recommended NPK+ azatobacter+$ZnSO_4$ + gypsum. Recommended dose of 50:37.5:25 kg NPK/ha was applied to all the treatments. The experiment was laid out in randomised block design with three replications. GPU-28 variety

was used for experimentation. Twenty-two days old seedlings were transplanted to mainfield by adopting 22.5 cm x 10 cm spacing. All the recommended management practices were followed regularly.

The observations on growth (plant height, number of leaves and number of tillers/plant) and yield components viz. Number of earheads/ plant, number of fingers/plant and test weight were recorded on randomely selected five plants from the net plot. The experimental data was analysed by Fisher's method of analysis of variance particular to the as per the procedure given by Sunder raj *et al.* (1972).

Results and Discussion

Application of recommended dose of fertilizer (50:37.5:25 kg NPK/ha) with $ZnSO_4$ (10 kg/ha), gypsum (500 kg/ha) and azatobacter biofertilizer (1kg/ha root dipping) recorded significantly higher number of tillers per plant (8.27) when compared to the application of recommended fertilizer alone (3.53) and combination of fertilizer with any other single nutrients viz.T_2 (4.60), T_3 (4.27) T_4 (5.10), T_5 (4.97) and T_6 (5.97). Maximum plant height (109.2 cm) was recorded with application of recommended dose of fertilizer along with $ZnSO_4$, gypsum and azatobacter fertilizer which was significantly superior to recommended NPK alone (84.2&m). Maximum number of leaves per plant (60.30) was recorded with this treatment combination which is significantly superior over recommended NPK alone (52.30) and recommended NPK+ gypsum (51.80). It was interesting to note that the trend clearly indicates the positive response of combined applications. Similar finding was also observed by Patel *et al.*(1993). This may be due to combination of micronutrients along with biofertilizer might have activated the availability of more plant nutrients and also helps in releasing unavailable plant nutrients into available form to the crop plants effectively.

Maximum number of earheads per plant (7.83) was recorded with T_8 and was significantly superior to T_1(3.23/plant) and was on par with T_7 (7.76/plant). Minimum number of earheads per plant was recorded with T_1(3.23/plant). There was no significant different with regard to test weight, however maximum test weight (22.32 g/plant) was recorded with T_8 and minimum test weight was recorded with T_1 (21.27 g/plant). Maximum number of fingers per plant (43.03)was recorded in the treatment consisting of recommended NPK, azatobacter, $ZnSO_4$ and gypsum and was significantly superior over the

Table 1. Effect of biofertiliser, gypsum and zinc sulphate and their combination on growth and yield components of ragi

Treatments	Plant height (cm)	No.of leaves plant	No.of tillers plant	No.of earheads/ plant	No.of fingers/ plant	Test weight (g)
T_1 - Rec.NPK	84.20	52.30	3.53	3.23	25.06	21.27
T_2-Rec.NPK+Azatobacter	101.10	56.30	4.60	4.33	27.90	21.22
T_3-Rec.NPK+$ZnSO_4$(10kg/ha)	106.90	54.60	4.27	4.00	29.00	21.70
T_4-Rec.NPK+Gypsum(500dg/ha)	78.76	51.80	5.10	4.90	35.40	21.40
T_5-Rec.NPK+Azatobacter+$ZnSO_4$	103.10	54.80	4.97	4.70	37.36	20.98
T_6-Rec.NPK+Azatobacter+Gypsum	105.10	56.00	5.97	5.76	39.20	21.03
T_7-Rec.NPK+$ZnSO_4$+Gypsum	103.90	58.00	8.10	7.76	41.96	21.41
T_8-Rec.NPK+Azatobater+ Gypsum+$ZnSO_4$	109.20	60.30	8.27	7.83	43.03	22.32
S.Em$\pm$	1.93	2.48	0.15	0.15	1.18	0.42
C.D.at 5%	5.87	7.51	0.46	0.46	3.59	1.27

rest of the treatments except the treatment consisting recommended NPK, $ZnSO_4$ and gypsum. Lowest number of fingers per plant was recorded in application of recommended NPK alone. (Shetty *et al,* 1993). Mean grain yield was maximum (61.09 q/ha) when combination of recommended NPK, $ZnSO_4$, gypsum and azatobacter was there and least was observed in application of NPK alone (T_1). In all the three years, significantly highest grain yield was recorded in the treatment comprising recommended NPK, $ZnSO_4$, gypsum and azatobacter (T_8) when compared with recommended NPK alone (T_1) and it was on par with combination of recommended NPK, $ZnSO_4$ and gypsum (T_7). The application of calcium, zinc and biofertilizer along with recomended NPK inturn increases the number of tillers, number of earheads/plant and number of filled grains per finger. (Alwar Arunachalum *et al.,*1995). Maximum benefit-cost ratio was observed in T_8(2.48) which was mainly due to higher grain yield and the less cost incurred on bio-fertilizers. Hence, T_8 was more profitable than rest of the treatments.

Table 2. Influence of azatobacter, zinc sulphate and gypsum and their combinations on yield of ragi

Treatments	Yeild(q/ha)	Mean yield	Benefit cost		
	1996	1997	1998	(q/ha)	ratio
T_1-Rec.NPK	49.20	48.00	48.93	48.71	2.16
T_2-Rec.NPK+Azatobacter	50.00	51.66	51.09	50.92	2.23
T_3-Rec. NPK+$ZnSO_4$ (10dg/ha)	53.60	53.03	52.06	52.90	2.29
T_4-Rec.NPK+Gypsum(500dg/ha)	57.00	51.21	51.90	53.37	2.24
T_5-Rec.NPK+Azatobacter+$ZnSO_4$	62.20	52.80	52.40	55.80	2.39
T_6-Rec.NPK+Azatobacter+Gypsum	62.00	54.18	54.52	56.90	2.37
T_7- Rec.NPK+Azatobacter+Gypsum	60.70	59.44	56.91	59.02	2.42
T_8- Rec.NPK+Azatobacter+Gypsum+$ZnSO_4$	63.80	60.58	58.88	61.09	2.48
S.Em±	0.90	0.96	0.92		
C.D.at 5%	2.96	2.92	2.71	-	-

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