

Studies on the effect of Graded doses of Nitrogen on the Yield Potentials of popular Ragi (*Eleusine Coracana Gaertn.*) strains of the Madras State *

by

B. KARUNAKARA SHETTY¹ and A. MARIAKULANDAI²

Synopsis: The response of the short duration strains of *Ragi* to the application of graded doses of nitrogen was studied in an experiment during the 1960 season. The results are discussed in this paper.

Introduction: In view of the need for fixing the optimum dose of nitrogen for the short duration varieties of Ragi released in the Madras State, for stepping up the production per unit area, it has been attempted to fill up the present gap in the knowledge about the nitrogen requirement of this important food crop. Krishna Rao and Nambiar (1952) have reported that millets respond very well to manuring. Bernad and Duthie (1953) reported that application of nitrogenous fertilizers greatly increased the yield of millets in East Africa. Popov (1952) reported the existence of differential varietal response to manuring in millets. Response of ragi to organic and inorganic manuring was studied in detail at Coimbatore and Palur during 1930-40 and appreciable increases have been reported due to the application of nitrogen as farm yard manure, compost, ammophos and ammonium sulphate (Anon 1944). Application of town compost to supply 25 lb of nitrogen per acre increased the yield of ragi by 278 lb per acre in Orissa (Acharya, 1948). Narasimhamurthi (1952) reported that highest yield was obtained at 50 lb nitrogen per acre in the form of groundnut cake.

Ragi responded very well to higher doses of nitrogenous fertilizers at four stations in Bombay State where increased yields from 21 to 400 per cent were obtained (Chavan and Shedge, 1955 and 1958).

Willimott and Anthony (1958) reported that 76 lb. of nitrogen per acre gave significant increase in grain yield of ragi on a dark sandy loam in Sudan while 38 lb nitrogen increased yields only slightly. An increase of 430 lb of grain per acre from plots receiving 30 lb nitrogen over that of 15 lb nitrogen was obtained in Hebbal (S. S. S., 1960).

Materials and Methods: The experiment was laid out at the Central Farm, Coimbatore during 1960 main season. Three short duration varieties viz., AKP. 2, E.C. 4728 and Co 7 were selected for study. The varieties mentioned above were tested with six equispaced doses of nitrogen (as ammonium sulphate) ranging from 0 to 100 lb per acre over a basal dressing of 20 lb P_2O_5 and K_2O and five tons of cattle manure. The yield data were subjected to statistical

* Formed part of dissertation submitted to University of Madras for the part-fulfilment of M.Sc. (Ag.) course by the first author under the guidance of the second author in June, 1961.

1. Assistant Lecturer in Agronomy, A. C & R. I., Coimbatore 3.
2. Professor of Agronomy, A. C & R. I., Coimbatore 3.

Received on 9-4-1963.

analysis according to the method followed by Panse and Sukhatme (1957) for split plot design. The fitting of the response curves as they are called was done by the methods of Orthogonal Polynomials as described in Gouldon (1959) and Fisher and Yates Tables (1948).

Results: The results of experiments were statistically analysed and significant differential response of varieties to manuring was observed.

1. *Yield of grain:*

(a) *Comparison of Varieties:*

Varieties	Mean yield of grain in lb.	S. E. of Mean	C. D. (P=0.05)
AKP. 2	1221.1		
E. C. 4728	1562.8	112.4	259.19
Co. 7	1946.2		

Conclusion: Co. 7, E. C. 4728, AKP. 2

The strain Co. 7 is superior in the yield of grain to the other two varieties. The culture E. C. 4728 is superior to the strain AKP. 2.

(b) *Comparison of levels of nitrogen:*

Levels of nitrogen	Mean acre yield of grain in lb.	S. E. of Mean	C. D. (P=0.05)
0	1212.7		
20 lb.	1428.6		
40 "	1542.7	88.7	173.85
60 "	1687.9		
80 "	1850.7		
100 "	1737.3		

Conclusion:

80 100 60 40 20 0

The results show that while there is response to the application of nitrogen, the increase in yield of grain beyond 60 lb. nitrogen is intangible.

(c) *Comparison of interaction effects:*

Levels of nitrogen	Varieties			S. E. of comparison of means of N levels in any one variety	C. D. (P=0.05)
	AKP. 2	E. C. 4728	Co. 7		
0	995.0	1171.4	1471.7		
20	1166.8	1532.4	1586.8		
40	1197.9	1625.7	1804.6	153.24	306.48
60	1166.8	1734.6	2162.5		
80	1485.0	1686.9	2380.2		
100	1314.6	1625.7	2271.4		

S. E. of comparison of any two variety means at one level of nitrogen

180.46

C. D. (P=0.05)

378.96

Conclusion:

(i) Varieties	Levels of nitrogen					
	80	100	40	60	20	0
AKP. 2						
E. C. 4728						
Co. 7						

(ii) Levels of nitrogen	Varieties		
	Co. 7,	E. C. 4728,	AKP. 2
0			
20			
40			
60			
80			
100			

Among the three varieties Co. 7 has recorded the greatest response to the applications of nitrogen. In the case of E. C. 4728 the response is significant but there is no marked increase in yield with increase in dose of nitrogen from 20 to 100 lb.

In AKP. 2 the yield recorded against 80 and 100 lb. nitrogen are alone significantly more than 'no nitrogen'. It is also seen that while Co. 7 is on a par with E. C. 4728 at the three lower levels of nitrogen, the former surpasses both E. C. 4728 and AKP. 2 at the higher levels. There is evidence that as between E. C. 4728 and AKP. 2 the former responds better to increase in the dose of nitrogen but this trend is not consistent.

Discussion: It is observed that Co. 7 has given significantly higher yields of grain over the other two varieties. These results confirm the findings of Sivagnanam (1960) and Samathuvam (1961) that A. K. P. 2 was inferior to E. C. 4728 and Co. 7.

Comparison of levels of nitrogen reveals that application of nitrogen beyond 80 lb. has not been found to be effective. Progressive increase in yield has been recorded upto 80 lb. nitrogen and thereafter a tendency to decline is noticed. The studies conducted by Narasimhamoorthy (1952) have indicated a progressive increase in yield of irrigated ragi only upto 50 lb of nitrogen. According to Willimot and Anthony (1958), Panickar (1960) increased grain yields at higher levels of nitrogen, both organic and inorganic forms, have been obtained.

In this study, interaction between varieties and levels of nitrogen is found to be highly significant which indicates a differential response of varieties to levels of nitrogen. The yield recorded from A. K. P. 2 is lower than the other two varieties at all levels of nitrogen. Though Co. 7 proved to be superior at all levels of nitrogen, the yield difference between Co. 7 and E. C. 4728 is not significant at lower three levels. Judging from the results of analysis, it is evident that

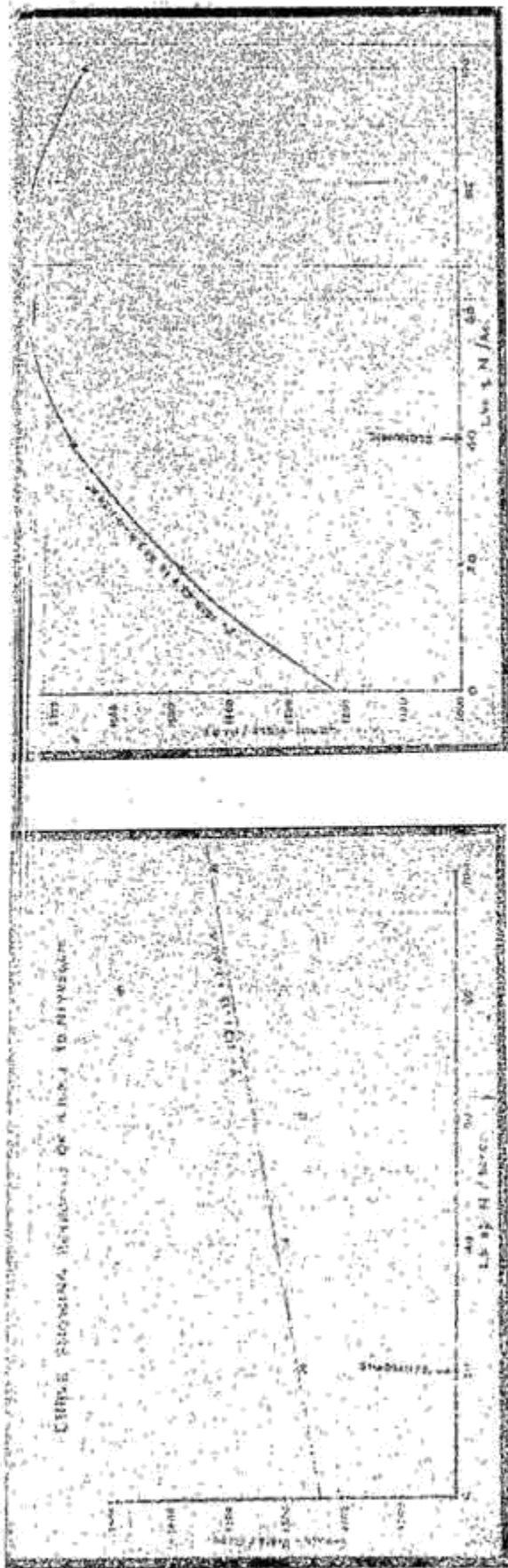


FIG. 1

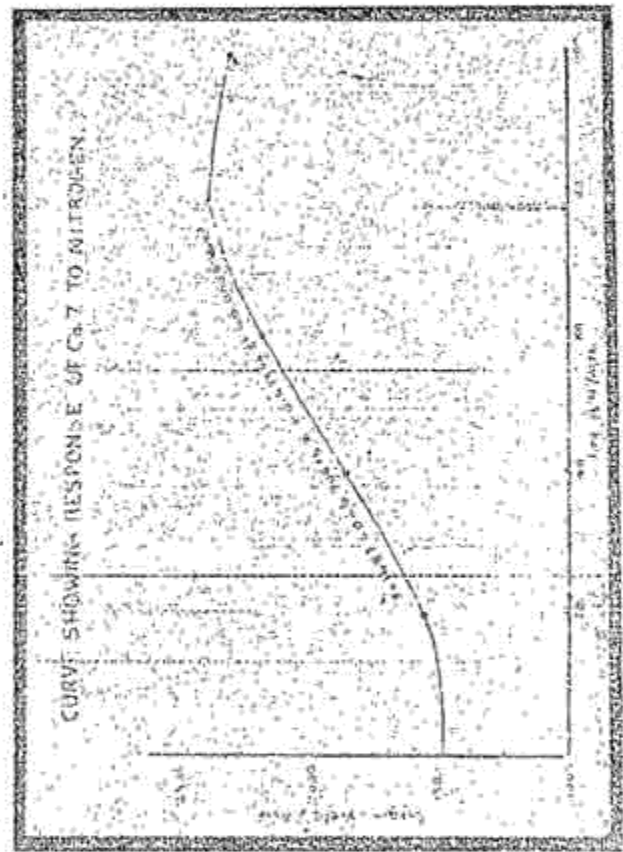


FIG. 2

FIG. 3

culture E. C. 4728 is capable of yielding as much as the popular Co. 7 at lower fertility levels while the latter is found to be suitable for higher fertility conditions to express its full inherent yielding capacity.

Response curves: The data and results obtained in this fertilizer experiment were utilised in finding out the nature or pattern of response of individual varieties to different doses of nitrogen so that (i) the probable yield for a given dose of nitrogen could be more or less predicted and (ii) the optimum economic dose may be determined.

In the regression analysis under variety A. K. P. 2 it is clear that the trend of response of this variety is linear and the response to a given dose of nitrogen is given by the relation $Y = 1131.15 + 1.80X$, where Y = predicted yield and X = dose of nitrogen. In terms of economic worth, it is seen that application of nitrogen is not profitable beyond 20 lb. per acre, as any increase beyond 20 lb. is insufficient to pay away the increased cost of fertilizer (Figure I.)

In regard to E. C. 4728, on the other hand, the linear pattern of response is non-significant but the quadratic trend alone is highly significant. The prediction equation obtained for this variety is $Y = 1215.62 + 15.339X - 1138x^2$.

The optimum dose for E. C. 4728 was found to be 39.9 lb. of nitrogen per acre. As the optimum dose required for maximum economic production is within the reach of the average farmer, this strain can be recommended for general cultivation (Figure II).

In regard to variety Co. 7, both linear and the cubic pattern of response are significant, but the quadratic is not. The prediction equation obtained is $Y = 1487.40 - 4.710x + 0.475x^2 - 0.0035x^3$. The optimum dose of nitrogen for this variety was found to be 77.17 lb. per acre. Thus, the present investigation has established the superiority of Co. 7 with regard to its responsiveness to higher levels of nitrogen : (Fig 3).

Summary: The present investigation reveals that the strain Co. 7 surpasses E. C. 4728 and A. K. P. 2 in respect of yield of grains.

As regards response to nitrogen, the strain Co. 7 is the most responsive to increased doses of nitrogen followed by E. C. 4728. Both strains have registered more or less equal response upto 40 lb. nitrogen per acre. In the case of strain A. K. P. 2, the responses are erratic.

The study of the pattern of responses to levels of nitrogen in the three strains, by fitting response curves, showed that the response of Co. 7 is linear and cubic, that of E. C. 4728 is quadratic only and of A.K.P. 2 is linear only.

The optimum dose of nitrogen was found to be 77.17 lb and 39.9 lb. of nitrogen per acre for Co. 7 and E. C. 4728 respectively. In the case of strain A. K. P. 2, any increase of nitrogen beyond 20 lb. per acre was found to be uneconomical.

The two important results of immediate practical utility that emerge from this investigation are :

- (i) That under conditions of low nitrogenous manuring upto 40 lb. per acre, E. C. 4728 yields on a par with the popular improved strain Co. 7.
- (ii) that, for getting higher yields per unit area, when more than 40 lb. nitrogen per acre are applied, Co. 7 should be preferred.

Acknowledgment: Authors are obliged to Sri K. A. Seshu, Lecturer in Statistics, Agricultural College, Coimbatore for his help in the statistical evaluation of the results.

REFERENCES

- | | | |
|---|------|--|
| Acharya, C. N. | 1948 | Further manurial trials with town compost. <i>Indian Fmg.</i> , 9:16-18. |
| Anon | 1944 | A review of the manurial experiments on the agricultural crops of the Madras Presidency for the decennial period 1930-40. <i>Madras agric. J.</i> , 32:83-91. |
| Bernard Keen and D. W. Duthie | 1953 | Crop responses to fertilizers and manures in East Africa. <i>E. Afr. agric. J.</i> , 19:19-57. |
| Chavan, V. M. and P. Y. Shendge | 1955 | Intensive method of cultivation of Nagli in Bombay State. <i>Poona agric. Coll. Mag.</i> , 46:180-82. |
| | 1958 | Fifty years of progress of Agronomic research. <i>Ibid.</i> , 48:144-48. |
| Fisher, R. A. and F. Yates | 1948 | <i>Statistical Tables for Biological, Agricultural and Medical Research</i> Oliver and Boyd, London-98, III pp. |
| Gouldon, C. H. | 1959 | <i>Methods of statistical analysis</i> Asia Publishing House. Bombay:457-ppl. |
| Immer, F. R., H. K. Hayes, L. R. Powers, | 1934 | Statistical determination of barley varietal adaptation. <i>Journ. Amer. Soc. Agron.</i> 26:403-19. |
| Krishna Rao and A. Kunhikoran Nambiar, A. | 1952 | Manuring of millets in Madras. <i>Madras agric. J.</i> 39:73-80. |
| Narasimhamurthy, B. L. | 1952 | Economic dose of groundnut cake (as manure) for enhancing yields of irrigated ragi. <i>Madras agric. J.</i> 34:183-84. |
| Panikkar, M. P. | 1960 | <i>Coordination of Agrl. Research in India. (Agronomy) Vol. 2, I. C. A. R., New Delhi.</i> 166 pp. |
| Paunse, V. G. and P. V. Sukhatme | 1957 | <i>Statistical methods for Agricultural workers.</i> I. C. A. R., New Delhi: 356 pp. |
| Popov, G. I. | 1952 | The causes of persistent productiveness of Millet varieties. <i>Selekeijai Semenovdotvo. Breeding and Seed growing</i> 3:31-40. <i>Plant Breed. Abstr.</i> 22:2728 (558) |
| (S. S. S.) | 1960 | N. P. K. trials on Ragi in Mysore. <i>Fertilizer News</i> , 5:31-32. |
| Samathuvam, K. | 1961 | Further studies on the performance of two early strains of Ragi. <i>Madras agric. J.</i> 48:60-63. |
| Sivagnanam, L. | 1960 | Early maturing cultures of Ragi, the finger millet. <i>Madras agric. J.</i> 47:437-39. |
| Willimott, S. G. and K. R. M. Anthony | 1958 | The response of <i>Eleusine</i> to different forms of nitrogen fertilizer. <i>Fmp. J. Exp. Agric.</i> , 26:373-78. |