

A Study of Functional Relationship for Rice (Padma) Response to Nitrogen

BY

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ABSTRACT

With the objective of finding the optimum level of fertiliser for the rice variety Padma, an experiment was laid out with six levels of nitrogen. The quadratic form of response curve was found to be the best fit. It was found that additional yield due to fertiliser application was seemed to be maximum at the level of 160 kg of nitrogen per ha and the additional income at this level was Rs. 1,694. 50 per ha.

INTRODUCTION

The short erect and nitrogen responsive varieties like T. N. 1, I. R. 8, I. R. 5, I. R. 20, Padma, Jaya, Karuna, Cauvery, Kanchi and Ponni were introduced to replace the local paddy varieties. The present study was conducted to (i) fix the optimum dose of nitrogen for Padma rice variety, and (ii) to find out the response curve which fits best for the data collected to this variety.

MATERIALS AND METHODS

An experiment was conducted during 1970-'71 at the Agricultural College Farm, Madurai on the rice varieties viz Padma, Cauvery and TKM6 with nitrogen applied at six equispaced rates (0, 40, 80, 120, 160, and 200 kg per ha.). The experiment was laid out in a $(3)^2 \times 6$ split-plot design replicated thrice. The varieties and

spacing levels were assigned to the main plots and the levels of nitrogen to the sub-plots. The gross and net sizes of each plot was 4.00 x 2.40 m. The cultivation practices generally followed on the College Farm were adopted. The nursery was raised on 29-9-1969 and the seedlings were transplanted on 24-10-1969. No organic manure including green manures was applied to the experimental plot. 80 Kg of P_2O_5 as superphosphate and 80 Kg of K_2O as Muriate of Potash was applied per ha. as a pre-plant basal dressing uniformly to all the plants in one dose. Nitrogen as urea was applied to supply the required quantities of nitrogen. Half the dose of nitrogen was applied basally as pre-plant application and the remaining as top dressing on the 35th day after transplanting.

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RESULTS AND DISCUSSION

The results of the experiment are given in Table 1.

It is seen that 160 kg of nitrogen per ha has given the superior yield than the other levels. From the table it can be seen that the productive tillers per hill increases with every increase in the level of nitrogen upto 160 kg and decreased at 200 kg level. The present results are in agreement with the findings of Padhi and Misra (1968). They observed that dwarf indica varieties produce more productive tillers with increased levels of nitrogen. The 1000-grain weight was influenced by nitrogen application. Maximum response was obtained at 160 kg of nitrogen per ha and there was reduction in grain weight at 200 kg dose. Mahapatra *et al.* (1966) had observed redu-

ction in the grain weight beyond a certain limit of nitrogen supply. The grain yield was significantly influenced by the different levels of nitrogen. The maximum yield was recorded at the level of 160 kg nitrogen per ha. Though the grain yield increases with every increase in the level of nitrogen upto 160 kg, the increase was in the diminishing scale. Similar trend could be seen for productive tillers and 1000-grain weight also.

Response Functions

The functional relationship between grain yield and level of nitrogen was studied by fitting linear, quadratic square-root functions. Since the experiment considered in the present analysis included only equi-spaced nitrogen level, it facilitated the estimation of linear and quadratic functions

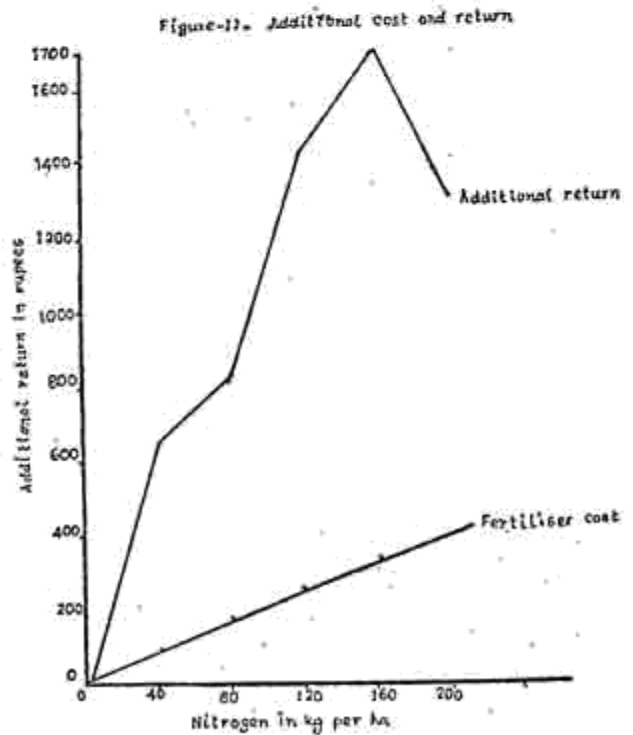
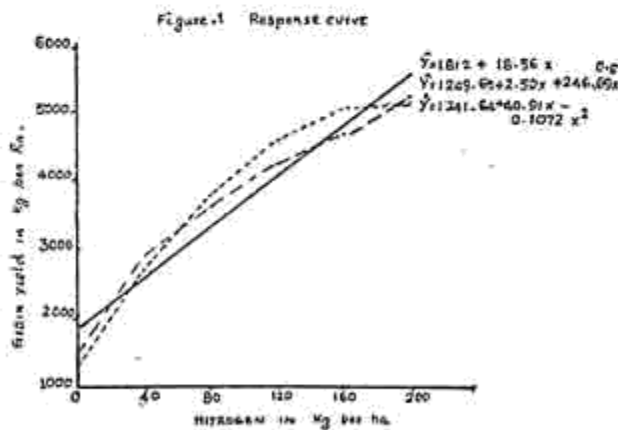


TABLE 1. Level of Nitrogen and its influence on yield and yield components.

Level of Nitrogen per ha [kg]	Productive tillers per hill	1000-grain weight [g]	Grain yield per ha [kg]	Additional yield [kg]	Increased yield over control [kg]	Value of output (Rs)	Value of input [Rs]	Additional income due to fertilizer
0	4.8	19.923	1317
40	6.8	22.013	2775	1458	1458	729.00	80	649.00
80	7.4	23.800	3263	488	1946	973.00	160	813.00
120	8.5	25.667	4654	1391	3337	1668.60	240	1428.20
160	9.7	27.100	5346	692	4029	2014.50	320	1694.50
200	9.3	26.467	4721	-625	3404	1702.00	400	1302.00
S. E.	0.078	0.131	111.3					
C. D	0.22	0.384	317.7					

Note : Cost of grain Rs. 0.50/Kg. Cost of Nitrogen Rs. 2.00/Kg.

TABLE 2. Response equations

Response equations	Coefficient of multiple determination
Grain yield	
i) Linear : $\hat{Y} = 1812 + 18.66 X$	0.8428
ii) Quadratic : $\hat{Y} = 1241.64 + 40.91 X - 0.1072 X^2$	0.9805
iii) Quadratic Square root : $\hat{Y} = 1249.65 + 2.50 X + 246.69 X^{0.5}$	0.9191
Productive tillers	
$Y = 5.5 + 0.04663 X - 0.000099 X^2$	0.9701
1000-grain weight	
$Y = 19.71 + 0.06919 X - 0.000017 X^2$	0.9140

by the method of orthogonal polynomials. For estimating the parameters of the quadratic square-root function, the method of least squares was adopted. Since the coefficient of multiple determination was high for quadratic function, it is taken as the best fit for the present response study. Similar quadratic equations were also fitted to find the relationship of level of nitrogen on productive tillers and 1000-grain weight. The estimated equations are presented in Table-2.

The estimated curves of the three functions fitted to the data on grain yield are given in Fig. 1.

Estimation of profitable level

The main objective of fitting response functions is to determine the economic optimum which will maximise the profit of the farmer under a given factor product ratio. The additional cost and additional return and profit due to application of nitrogen was calculated (Table 1.) The additional income due to fertiliser application increases upto the level of

160 kg per ha and then declines. The additional income is maximum i. e. Rs. 1694.50 per ha when 160 kg of nitrogen is applied. The fertiliser cost line and the additional income line are indicated in Fig. 2. The optimum level of fertiliser application worked out from the quadratic equation fitted to the grain yield is 172 kg of nitrogen per ha. The return will be maximum at this dose for Padma.

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