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PHOSPHATE AND POTASH FERTILISATION OF RICE IN THE CLAY LOAM SOILS OF KUTTANAD

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Low iand rice soils generally fail to respond to phosphate and potash fertilisation. Studies conducted in the lateritic sandy loam soils of the Rice Research Station, Pattambi over a period of 35 years revealed no appreciable response to applied phosphorus, (Nair and Pisharody, 1970). Kalam *et at,* (1966) also observed little response to phosphate application in the sandy clay loam soils of Karamana. This phenomenon was attributed to the increased availability of native phosphorus under reduced conditions, (Ponnamperuma, 1955; Mitsui, 1960). While Mukerjee (1955) and Goswamy *et al.* (1971) found significant response to potash, Dubey and Das (1961) and Rao *et al,* (1974) observed lack of response to this nutrient in cultivators' fields. Experiments conducted in cultivators fields in Kerala also revealed Inconsistent response to potash fertilisation, {Annony 1972, 1973). It is of interest, therefore, to study whether rice could be grown without continuous application of phosphate and potash in the acid clayey loam soils of Kuttanad.

Materials and Methods

The experiment was conducted at the Rice Research Station, Moncompu for four consecutive seasons, commencing from the 'Puncha' season (October to January) of 1974—'75. The soil of the experimental plot was a clay loam containing 1.35% of organic carbon, 20.75 Kg. of available P/ha and 88.5 Kg. of available K/ha The pH of the soil was 5.2. There were 10 treatments which are listed in Table 1. The experiment was laid out in randomised block design, replicated 3 times. The test variety was Triveni, a dwarf indica rice of 105 days duration. All the treatments received a uniform dose of 70 Kg N/ha in three split applications, at planting, at tillering and at panicle initiation stage. The doses of P and K were 35 Kg. each per ha. These nutrients were applied in the form of finely powdered rock phosphate and muriate of potash respectively. The experiment was conducted in the same set of plots without independent randomisation and hence the yields obtained from the plots are due to the cumulative effects of the treatments in the plots over the previous seasons.

For the integration of the data collected over the seasons, combined analysis has been done, after getting the ANOVA for each season separately. The criteria adopted for selecting a treatment as superior to the standard treatment of NPK during every season were (i) the treatment should show mean yield superior to or at least on par with the standard treatment. (2) the regression of yield of the treatment on the yield of the standard treatment should be significant, assuming that the yields under the standard treatment can be taken as the index of environmental effect. (3) the reciprocal of the square of the regression coefficient (b) is taken as the measure of stability of the treatment. Thus for $b = 1$ the index is 1, when b is less than 1 the index is greater than 1 and when b is greater than 1 the index is less than 1. The treatment satisfying the first and second conditions having the highest index of stability will be preferred. This is in partial modification of the criterion proposed by Rawlo and Das (1978), who preferred the reciprocal of the absolute value of b, as the index.

Table 1 Grain yield (Kg./ha) corresponding to the treatments

	Treatments				Grain yield				
	1974—75 Puncha	1975—76 Puncha	1976 Addl. crop	1976—77 Puncha	1974—75 Puncha	1975—76 Puncha	1976 Addl. crop	1976—77 Puncha	Mean
T_1	NPK	NPK	NPK	NPK	4585	3464	3548	4600	4050
T_2	NPK	NPK	NPK	N-K	4619	3476	2501	4366	3740
T_3	N-K	NPK	N-K	NPK	4415	34L3	3i80	4101	3777
T,	NPK	N-K	N-K	NPK	42*8	3259	3320	4493	3835
T_5	N-K	NPK	N-K	N-K	4:00	3310	2630	3935	3515
T_6	NPK	NP-	NPK	NP-	4497	3498	3106	4)99	3825
T,	NP-	NPK	NP-	NPK	4471	3632	3528	4240	3968
T_8	NPK	NP-	NP-	NPK	4486	3387	2990	3678	3635
T,	NP-	NPK	NP-	NP-	4486	3419	2938	4019	3716
T_{10}	N- -	N- -	N- -	N- -	4153	3235	2389	3700	3369
CO (0.95)					...	...	...	...	308

Results and Discussion

The analysis of data for the four seasons taken separately did not show significance, while the combined analysis showed significance. Treatments T_7, T_4, T_6 and T, were found to be on par with T_1, the standard treatment. (Table 1.) The regression of yields of treatments on the yields under treatment T_1, showed significant regression coefficients for T, and T_7 only. The indices of stability of the treatments showed maximum stability for treatment T_7. The values of the coefficients of regression and indices of stability are given in Table 2. Hence the treatment T_7, which is skipping the application of K during alternate seasons, is found to be superior to the standard treatment. Under this treatment there is no significant reduction in yield, while there is saving by way of expenditure on fertiliser.

Table 2 Coefficients of regression and indices of stability

Treatment	Coefficient of regression	Index of stability
T_1	1.0000	1.0000
T_2	1.3442	0.5534
T_3	0.8720	1.3152
T_4	1.0047*	0.9906
T_5	0.9812	1.0386
T_6	0.9441	1.1219
T_7	0.7063*	2.0046
T_8	0.8006	1,5602
T_9	0.9654	1.0730
T_{10}	0.9899	1.0206

* Significant at 0.05 level.

Regular application of nitrogen alone, without P and K recorded the lowest yield. Skipping of P also resulted in reduced yields and the yields show the least stability as can be seen from the data corresponding to T_8. The crop under T_{10}, namely application of N without P and K exhibited characteristic symptoms of phosphate deficiency during the vegetative phase. No such symptoms were observed on the crop under the other treatments.

Continuous application of nitrogen, in the absence of phosphorus and potash is certainly deleterious to the crop as well as the soil. Skipping of phosphorus is also having adverse effects. Skipping of K during two consecutive seasons also has depressing effect on yield.

Summary

A field experiment was conducted at the Rice Research Station, Moncompu to assess whether rice crop can be raised without continuous application of phosphorus and potash in the clay loam soils of Kuttanad. The variety used was Triveni. Results revealed that skipping of potash during the alternate seasons is not affecting the yield, and hence can be adopted for economising the expenditure. Skipping of phosphorus is having depressing effect on yieid. Application of nitrogen alone without phosphorus and potash has shown significant reduction in yield, and the crop exhibited typical symptoms of phosphate deficiency.

സംഗ്രഹം

കട്ടനാട്ടിലെ ചെളിമണ്ണിൽ ഭാവഹത്തിന്റേയും ക്ഷാരത്തിന്റേയും തുടർച്ചയായുള്ള പ്രയോഗം കൂടാതെ നെൽകൃഷിനടത്താമോ എന്നു് മങ്കൊമ്പ നെല്ലുഗവേഷണ കേന്ദ്രത്തിraS പരീക്ഷിക്കകയുണ്ടായി. തുടർച്ചയായ നാലു സീസണകളിൽ നടത്തിയ ഈ പഠനത്തിൽനിന്നും താഴെകൊട്ടത്തിരിക്കന്ന ഫലങ്ങളം ലഭിക്കകയുണ്ടായി. ഒന്നിടവിട്ടുള്ളതായ സീസണകളിൽ ക്ഷാരവളപ്രയോഗം ഒഴിവാക്കന്നതു് വിളവിനെ ബാധിക്കന്നില്ല. എന്നാൽ ഭാവകവളപ്രയോഗം ഒഴിവാക്കന്നതു് വിളവിനെ സാരമായി ബാധിക്കന്നു. ഭാവഹവും, ക്ഷാരവും ഒഴിച്ചു് നൈട്രജൻ മാത്രം നൽകന്നതു് നെല്ലുല്പാദനത്തെ പ്രതികൂലമായി ബാധിക്കന്നു.

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