would effect the factory stimuli and alter the insect behaviour in the crop. Here, the phytochemicals produced by cumbu would have altered the oviposition of gravid moths of *A. modicella* and led to minimum damage by the leaf miner in the intercropped system.

The mortality due to the bethylid parasite, *Goniozus* sp. was observed to be comparatively high (6.4%) in groundnut + cumbu combination, which was on par with other intercropping systems except groundnut + Cowpea combination (2.4%). The pure groundnut crop yielded 1154 kg/ha of pods. The yield in the groundnut + cumbu system was 684 kg/ha. Though the yield of the base crop in groundnut + Cumbu system was low, because of substantial increase in yield of the companian crop, cumbu, this system recorded the highest net return of Rs2423 comparetive base crop (Rs. 2308). Thus, groundnut + Cumbu intercropping system recorded 4.7 per cent increased monitary benefit, followed by groundnut + Redgram system (1.6%) and others were not profittable.

REFERENCES

KAVIMANI,R., V.GEETHA LAKSHMI and T.S.RAVEENDRAN, 1989. Redgram and ideal intercrop in groundnut, Oilseeds News Letter, III(3), Directorate of Extension, New Delhi.

RISCH,S.J. 1979. Effect of plant density on the population dynamics of several beetle pests in monoculture and polycultures of corn, beans and squesh in casta Rica. Unp ub. Ph.D. Thesis, Univ. of Michigan, 215p.

KENNEDY,F.J.S. and T.S.RAVEENDRAN, 1989. Intercroppings minimise pests incidence, Oilseeds News Letter, III(4), Directorate of Extension, New Delhi.

TAHVANAIANEN,J.A. and R.J.ROOT, 1972. The influence of vegetational diversity on the population ecology of a specialised herbivore, Phyllocteta crucifera. Oecolgia (Berlin), 10: 321-346.

Madras Agric. J., 13-16 January, 1993

https://doi.org/10.29321/MAJ.10.A01619

A REVIEW OF THE EXISTING BLANKET RECOMMENDATION TO RICE IN CAUVERY BASIN OF TAMIL NADU

V.MURUGAPPAN[1], R.NAGARANAJ[2], K.NATARAJAN[3], SP.PALANIAPPAN[4] and T.S.MANICKAM[5]

An attempt was made to find out whether or not the available rice response information indicates the possibility of increasing the productivity with a higher level of fertilizer application. The results clearly indicated the need for an upward revision of N dose from the present level of 100 kg to 150 kg N ha^{-1} for realizing yields corresponding to maximum profit in rice in Cauvery basin of Tamil Nadu. In the absence of such clear cut indications with respect to P and K, the presently recommended levels of 20 kg P and 40 kg K ha^{-1} seem to be sufficient until more detailed investigations are carried out relating rice response with application, fixation and availability of P and K.

To an Indian farmer agriculture is no more a way of life but a progressive and dynamic business. Hence, it becomes imperative that efforts are made to generate technologies aimed to increase crop production by exploiting the high level of managerial ability of our farmers.

Rice is the major food crop grown in Tamil Nadu in 27.5 lakh hectares with an annual production of 65 lakh tonnes of paddy. The average yield is well below 2.5 tonnes ha^{-1}. In a review of the research work on nitrogen management for rice, Palaniappan and Balasumbramanian (1983) have reported that the average rice yields in Cauvery basin of Tamil Nadu are 1426, 1018 and 1112 kg

1, 2, 3 and 5 Professors of Soil Science, TNAU, Coimbatore
4 Director (SCMS), TNAU, Coimbatore

ha^{-1}, respectively in *Kuruvai, Thaladi* and *Samba* seasons. Hence it is needless to emphasize that drastic measures are to be taken for increasing the per hectare yield, especially in Cauvery delta, the rice bowl of Tamil Nadu. One way is to increase the quantity of fertilizer inputs used. This effort will be particularlyy relevant in the context of our farmers' adaption to high level management.

An attempt was therefore made with available crop response information from the field experiments conducted in the Cauvery basin of Tamil Nadu to find out whether or not these data indicate the possibility of increasing the productivity of rice with a high level of fertilizer application.

MATERIALS AND METHODS

The needed efficiency parameters (soil and plant) and rice response data required for the present investigation were collected from the field experiments, conducted in the two major soil series of Thanjavur district, viz., Kalathur (fine clayey calcareous iso-hyperthermic typic Chromustert) and Adanur (fine clayey non- calcareous iso-hyperthermic association of Chromustert and Pellustert) of the old delta of Cauvery basin.

The C_1 and C values obtained through Mitscherlich-Bray response function (Bray, 1944) in experiments conducted in Kalathur and Adanur soil series with high yielding varieties of rice were gathered (Dhanapalan Mosi *et al.*, 1979) and the mean of those C_1 and C values over experimental sites; seasons and years falling within the limit of one standard deviation were used for forming the master response function, one each for nitrogen, phosphours and potassium.

The nutriet requirements and soil and fertilizer nutrient efficiencies were obtained from the published results of the experiments conducted in Kalathur soil series with high yielding varieties of rice under the auspices of Response Project (Rani Perumal *et al.*, 1982) for forming the master targetted yield equations (Ramamoorthy and Velayutham, 1971). In these equations the average values of nutrient requirements and soil and fertilizer nutrient efficiencies over seasons and years were used.

Rice response data obtained from eight field experiments of the type proposed by Colwell (Table 1) with high yielding varieties of rice conducted by the Tamil Nadu State Department of Agriculture in Kalathur and Adanur soil series were used for establishing the relationship between yield and fertilizer doses under multiple regression approach. Average yield data over locations, seasons and years were used for establishing this relationship in a quadratic polynomial form (Snedecor and Cochron, 1968).

Average soil fertility indices for nitrogen, phosphorus and potassium related to 30 out of 100 villages of Papanasam taluk of Thanjavur district (Murugappan *et al.*, 1988) were used to compute the fertilizers requirement in the master Mitscherlich Bray and targetted yield equations. These indices are the mean of the mean values of alkaline, $KMno_4$-N (Subbish and Asija, 1956), Bray'S-P (Bray and Kurtz, 1945) and neutral normal NH_4OAc-K (Hanway and Heidal, 1952) of all the 30 villages falling within the limit of one standard deviation.

RESULTS AND DISCUSSION

The average soil fertility indices obtained from the 30 villages of Papanasam taluk of Thanjavur district were 227, 87 and 341 kg ha^{-1} respectively, of nitrogen, phosphorus and potassium.

The nutrient-wise master Mitscherlich-Bray response functions for the Cauvery basin of Tamil Nadu are :

$$Y = A\,(1-e^{-0.001876\ SN\ -\ 0.003242\ FN})$$

$$Y = A\,(1-e^{-0.022360\ SP\ -\ 0.015790\ FP})$$

$$Y = A\,(1-e^{-0.004705\ SK\ -\ 0.006020\ FK})$$

Where, A is the theoretical maximum yield, Y is the yield expected, SN, Sp and SK are, respectively, alkalinine $KMnO_4$-N, Bray's-P and neutral N NH40OAc-K in kg ha^{-1} and FN, FP and FK are, respectively, fertilizer N, P and K in kg $ha^{-1.}$

The master targetted yield equations are:

FN = 6.64 T - 0.79 SN
FP = 3.02 T - 0.46 SP
FK = 5.24 T - 0.85 SK

where, T is grain yield target of rice, FN, FP and FK are respectively, fertilizer N, P_2O_5 and K_2O in kg ha^{-1} and other expressions have the same meaning assigned earlier.

The quadratic polynomial expression of the relationship between rice yield and fertilizer N, P and K doses is:

$$Y = 29.0981 + 0.1297^{**} N + 0.3507^{**} P + 0.0581 K - 0.0004 N^2 - 0.0043 P^2 - 0.0005 K^2 + 0.0005 NP + 0.0002 NK - 0.0011 PK \; R^2 = 0.8347^{**}$$

From this function, the fertilizer doses corresponding to maximum profit were obtained for the existing price levels of rice grain and fertilizer inputs as per the procedure outlined by Murugappan *et al.* (1988). The economic yield level of rice was derived for these dosesand it was 50.22 q ha^{-1}.

For this economic yield level the fertilizer N, P and K requirements were derived from the master targetted yield equations by considering it (50 q ha^{-1}) as the yield target and for the average soil fettility indoics of Pananasam taluk.

From this function, the fertilizer doses corresponding to maximum profit were obtained for the existing price levels of rice grain and fertilizer inputs as per the proceudre outlined by Murugappan *et al.'l (1988). The economic yield level of rice was*

Table 1. Fertilizer treatments for field experiments of the type proposed by Colwell

S.No.	Treatments	S.No.	Treatments
1.	$N_0 P_0 K_0$	21.	$N_{150} P_0 K_{120}$
2.	$N_0 P_0 K_{80}$	22.	$N_{150} P_{20} K_0$
3.	$N_0 P_{20} K_{40}$	23.	$N_{150} P_{20} K_{40}$
4.	$N_0 P_{20} K_{120}$	24.	$N_{150} P_{20} K_{80}$
5.	$N_0 P_{40} K_{40}$	25.	$N_{150} P_{40} K_0$
6.	$N_0 P_{40} K_{80}$	26.	$N150 P_{40} K_{40}$
7.	$N_0 P_{40} K_{120}$	27.	$N150 P_{40} K_{80}$
8.	$N_0 P_{60} K_0$	28.	$N150 P_{40} K_{120}$
9.	$N_0 P_{60} K_{80}$	29.	$N150 P_{60} K_{40}$
10.	$N_{75} P_0 K_{40}$	30.	$N150 P_{60} K_{80}$
11.	$N_{75} P_0 K_{120}$	31.	$N150 P_{60} K_{120}$
12.	$N_{75} P_{20} K_0$	32.	$N225 P_0 K_0$
13.	$N_{75} P_{20} K_{40}$	33.	$N225 P_0 K_{80}$
14.	$N_{75} P_{20} K_{80}$	34.	$N225 P_{20} K_{40}$
15.	$N_{75} P_{40} K_0$	35.	$N225 P_{20} K_{120}$
16.	$N_{75} P_{40} K_{80}$	36.	$N225 P_{40} K_{40}$
17.	$N_{75} P_{60} K_{40}$	37.	$N225 P_{40} K_{80}$
18.	$N_{150} P_0 K_{40}$	38.	$N225 P_{40} K_{120}$
19.	$N_{150} P_0 K_{40}$	39.	$N225 P_{60} K_0$
20.	$N_{150} P_0 K_{80}$	40.	$N225 P_{60} K_{80}$

For this economic yield level the fetilizer N, P and K requirements were derived from the master targetted yield equations by considering it (50 q ha^{-1}) as the yield target and for the average soil fertility indices of papanasam taluk.

From the master Mitscherlich-Bray equations, fertilizer doses corresponding to 87.5, 98 and 98 per cent sufficiency levels, respectively for N, P and K were computed for the average soil fertility indices of Papanasam taluk. These doses were 147 kg N, zero (negative value) kg P and 16 kg K ha^{-1} (Table 2). For the combined sufficiency level of these doses the absolute yield was 50.20 q ha^{-1} (the reported theoretical maximum yields were 89.13, 74.13 and 65.70 q ha^{-1}, respectively for N, P and K).

The existing blanket recommendation of 100 kg N, 20 kg P and 40 kg K ha^{-1} is not based on any sound fertilizing policy with proper through the various approaches adopted in the present study (Table 2) are theoretically more valid than the doses presently followed as general blanket recommendation. In respect of N dose, for realizing yield upto the level where profit accruel is maximum, there was agreement between the three approaches followed. An indication for the upward revision of the presently recommended level of 100 kg N ha^{-1} to 150 kg N ha^{-1} was well pronounced.

The multiple regrssion approach indicated that 35 kg P and 30 kg K along with 150 kg N ha^{-1} were the doses for realising maximum profit. The phosphorus rate computed through the targetted yield approach was 50 kg P ha^{-1} for a yield target of 50 q ha^{-1}. The soil available phospherus status was high (average soil fertility index was 87 kg Bray's-P ha^{-1}) and hence, the indication of such a high P requirement could be considered as a correct dose. Murugappan (1985) has reported that, in the case of P, the soil nutrient efficiency is often very high and sometimes more than 100 per cent on account of failure of the soil test method to extract from the soil proportional amount of phosohorus corresponding to an uptake by crop. Since, such high soil phosphorus efficiencies were used for framing the master targetted yield equations in the present investigations, this has evidently resulted in the viciated high phosphorus doses.

The Mitscherlich-Bray approach indicated that 16 kg of K ha^{-1} was sufficient for obtaining maximum profit which was more or less 50 per cent of the K dose obtained by multiple regression approach. The indication of the results, that P applicatiion by Mitscherlich-Bray approach and K application by targetted yield approach are not needed, has no relevance in the contest of generalizing a blanket recommendation for the rice for a region. At least a maintenance dose of these nutrients must be incorporated in such generalizations.

Thus, it can be concluded that the present investigation clearly established the fact that an upwatd revision of N dose from the presently recommended level of 100 kg to 150 kg N ha^{-1} is needed for realizing yields corrésponding to maximum profit in rice in Cauvery basin of Tamil Nadu. In the absence of such a clear cut indications with respect to P and K, the presently recommended levels of 20 kg P and 40 kg K ha^{-1} seem to be sufficient until more detailed investigations are carried out relating rice response data with application, fixation and availability of P and K.

REFERENCES

BRAY,R.H. 1944. Soil plant relations. 1. The quantitative relation of exchangeable K to crop yields and to crop response to K additions. Soil 58 : 305-324.

BRAY,R.H. and KURTZ,L.T. 1945. Determination of total, organic and available phosphorus in soils. Soil Sci. 59 : 39-45.

DHANAPALAN MOSI,A., SOUNDARAJAN,S.K., BASKYAM,N., LAKSHMINARAYANAN,T., ABDUL HAKKIM and GANAPATHY,T. 1976. Studies on the soil test follow-up trials in the Thanjavur district. Paper presented at the 7th Workshop of STCR Project, Hyderabad.

HANWAY,J.J. and HEIDAL,H. 1952. Soil analysis methods as used in Iowa State College Soil testing laboratory. Iowa State College Agric. Bull. 57. p/1-13.

MURUGAPPAN,V. 1985. Soil test crop response studies on sugarcane for efficient fertilizer use. Ph.D. Thesis submitted to Tamil Nadu Agricultural University, Coimbatore.

MURUGAPPAN,V., LEKHA SREEKANTHAN and SP.PALANIAPPAN. 1987. Theoretical basis for making fertilizer recommendation to rice. Madras agric.J. (in press).

PALANIAPPAN,SP. and BALASUBRAMANIYAN,P. 1983. Nitrogen management for rice in Cauvery delta zone. TRRI Bull., TNAU,Aduthurai.

RAMAMOORTHY,B. and VELAYUTHAM,M. 1971. Soil test crop response correlation work in India. Soil resources report No.41. Soil Survey and Soil Fertility Res. in Asia and Far Asia. 14 : 19-105.

RANI PERUMAL, CHANDRASEKARAN,A., NATARAJAN,K., MANI,S. and RAMANATHAN,P. 1982. Soil test-crop response studies in State of Tamil Nadu, TNAU Bull., Coimbatore.

SNEDECOR,G.W. and COCHRON,W.G. 1968. Statistical methods. 6th Edn. Oxford and IBH Publishing Co., Eton. Press, Calcutta.

SUBBIAH,B.V. and ASIJA,G.L. 1956. A rapid procedure for estimation of available nitrogen in soils. Curr. Sci. 25 : 259-260.