## Economics

Data on net returns and benefit cost ratio revealed significant increase in both the factors due to rhizobial inoculation. Among the different cultures tried TNAU 14, IGR 40 and IGR 6 were found to be more remunerative. At the recommended dose of fertiliser application ($N_1$), rhizobial inoculation recorded mean increase (over different strains of Rhizobium) in net returns to the tune of Rs.2,749/ha in case of variety Co.2 and Rs.2,831/ha in case of VRI.1 compared to untreated control; At $N_2$ fertiliser level the increase in net returns was Rs.2,347/ha (Co.2) and Rs.2.529/ha (VRI.1) over untreated control. However, benefit cost ratio was higher when rhizobial seed treatment was combined with 7.5 kg N/ha application (4.3).

The foregoing results show that rhizobial inoculation significantly increased groundnut pod yield, yield and quality attributes and returns. Performance of Rhizobium cultures TNAU 14, IGR 40 and IGR 6 were superior to other cultures tried. Though there was response to rhizobial inoculation even at the higher nitrogen rate (15 kg/ha), higher benefit cost ratio was observed when seed inoculation of Rhizobium was combined with soil application of 7.5 kg N/ha.

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# INFLUENCE OF SINGLE RICE BASED CROPPING SYSTEMS ON SOIL HEALTH IN CAUVERY DELTA ZONE OF TAMIL NADU

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### ABSTRACT

Field experiment conducted at the Tamil Nadu Rice Research Institute, Aduthurai, Tamil Nadu for two years (1985-87) revealed that the computed nitrogen balance was positive (20.8 kg $ha^{-1}$) in the system of rice-cotton. Net loss of nitrogen was observed in system encompassing rice-soybean (-24.4 kg $ha^{-1}$) and -214.6 kg $ha^{-1}$ in systems of finger millet -rice -cotton. The computed balance for phosphorus was positive in all the systems and the highest was 196.3 kg $ha^{-1}$ in system possessing rice -soybean. The potassium balance was very much negative (-441.8 kg $ha^{-1}$) in the system of maize-rice-cotton. Wherever cotton constituted a component in the sequence, there was considerable enhancement in soil nutrient status (system 5 and 6) Cotton and finger millets are not less efficient than legume crop in enhancing soil nutrient status especially nitrogen balance.

KEYWORDS : Cropping System, Rice-based, Influence, Soil, Cauvery Delta Zone

Against the back drop of escalating demographic pressure, multiple cropping has gained importance. Various agricultural institutes have been perfecting techniques and exploring more remunerative crop sequences (Singh and Nair, 1973). Maintenance of soil health is primarily important while proposing any new or alternate cropping systems to any particular location. Over revealed that nutrient supplying power of many soils declined stadily under intensive cropping and soil fertility stablised at a low level (Nambiar and Abrol, 1989). Biswas and Benbi (1989) observed that both wheat and maize responded positively to application of nitrogen, phosphorus and potassium over the years. Meena *et al.* (1993) observed that application of N to preceeding wheat had a

gram crop. Such nutrients balances were reported by several authors (Aggarwal and Ventakeswaralu, 1989). Therefore, under the circumstances, it is thought worthwhile to account for the resultant soil health due to adoption of various single rice based cropping systems in Cauvery Delta Zone of Tamil Nadu.

## MATERIALS AND METHODS

Field experiments were conducted at the Tamil Nadu Rice Research Institute. Aduthurai, Tamil Nadu to evolve appropriate single rice based cropping sequences which cares the soil health. The soil type of the experimental site is Entric chromustert (Adanur series) - clay loam type with pH value of 6.8. The initial available N. P and K were 300, 35 and 127 kg $ha^{-1}$ respectively. The experiment was laid out in randomised block design with eight cropping systems as treatments. The nutrients were supplied to each component crops in the system, as per the recommendation *viz.* for the rice (100:50:50): finger millet and cotton (60:30:30); maize (125:62.5:50); barnyard millet (40:20:20); black gram (12.5:25:0); soybean (20:80:40); gingelly (23:13:13) and chillies (75:35:35) kg NPK $ha^{-1}$. Sil and plant samples after harvest of each component crop in a system were analysed for chemical constitutents and NPK balances were worked out for each cropping system as per the procedure suggested by Sadanandan and Mahapatra (1973a,b;1974).

The actual balance is the actual soil nutrients status in soil after two years in each sequence. The computed balance is worked out as the total added nutrients in two years minus the actual quantity of nutrients removed. Whereas, the change in nutrients status is worked out as the initial nutrients status minus computed balance.

## RESULTS AND DISCUSSION

### Nitrogen balance

The computed balance was positive only in system of rice-cotton (20.8 kg $ha^{-1}$ and 24.4 kg $ha^{-1}$ in system 2 to 214.6 kg $ha^{-1}$ in system 5 (Table 1). The system possessing finger millet - rice - cotton has changed the soil status with higher residual N (+33.9 kg $ha^{-1}$) than the other systems. This might be because of the residual addition by both of the component crops such as finger millet and rice.

### Phosphorus balance

The computed balance was positive in all systems without exception. The gain varied from 48 . 2kg $ha^{-1}$ in system 7 to 196.3 kg $ha^{-1}$ in system 2 (Table 1). This might be because of the P mobilising capacity and uptake pattern of the component crops in the systems.

The pulse component though requires higher quantity of P which have higher mobilising capacity whereas the cereals require less P and hence the balance of P in the soil was considerable.

### Potassium balance

The computed balance was negative in all the systems and the loss ranged from 44.0 kg in system 2 to 441.8 kg $ha^{-1}$ in system 6 (Table 1). Intensive croppings were invariably accompanied by higher potassium removal from the soil (Biswas *et al.*, 1977; De Datta, 1988). Consistent with this observation, potassium balance was negative in all systems except systems 4, 5 and 6. This may be due to lesser uptake by cotton which constituted a component in these systems. System 5 excelled others with regard to available nitrogen and potassium. This may be attributed to the presence of finger millet in the system unlike others. Finger millet crop residues are easily decomposable (Venugopal, 1978; Purushothaman, 1979). The residual addition in cropping system is an improvement over the earlier work and was evident from the current study also since addition of potassium through crop residues was maximum in system 5 (Table1). The enhanced nitrogen availability may also be ascribed to the presence of finger millet whose role in enhancing nitrogen status was well documented. It is generally suggested that inclusion of legume crop in the rotation following rice improves soil fertility (Reddy *et al.* 1986). It is observed that wherever cotton constituted a component in the sequence, there was considerable enhancement in soil nutrient status especially nitrogen and potassium as evident in system 5 and 6. This was in accordance with findings of Biswas *et al.* (1977). Thus, cotton and finger millet are not less efficient than legume crop

Table 1. Nutrients blance after two years of cropping in single rice based cropping system (kg ha$^{-1}$)

| Cropping System | Nutrients added through fertilizers in two years | | | Nutrients addition through crop residues in two years | | | Nutrients removed in two years | | | Actual nutrients balance in soil at end of two years of experimentation | | | Computed Balance | | | Changes in nutrients status in soil. Net gain (+) or loss (-) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | P | K | N | P | K | N | P | K | N | P | K | N | P | K | N | P | K |
| R-B | 225 | 150 | 100 | 11.5 | 2.8 | 5.3 | 285.8 | 64.2 | 208.8 | 325.3 | 27.2 | 125.6 | -49.3 | 88.6 | -103.5 | 25.3 | -7.8 | -1.4 |
| R-S | 240 | 260 | 180 | 12.4 | 2.7 | 5.8 | 276.8 | 66.4 | 229.8 | 329.2 | 28.1 | 110.3 | -24.4 | 198.3 | -44.0 | 29.2 | -6.9 | -16.7 |
| R-B-BM | 305 | 190 | 200 | 10.9 | 2.5 | 5.5 | 475.8 | 121.3 | 325.6 | 292.3 | 27.9 | 123.6 | -159.9 | 71.2 | -120.1 | -7.7 | -7.1 | -3.4 |
| R-C | 320 | 160 | 160 | 6.6 | 4.8 | 10.2 | 305.8 | 72.6 | 349.2 | 324.5 | 53.2 | 156.4 | +20.8 | 92.2 | -179.0 | 24.5 | 18.2 | 29.4 |
| FM-R-C | 440 | 220 | 220 | 7.4 | 5.9 | 11.5 | 662.0 | 158.7 | 581.6 | 333.9 | 46.4 | 247.2 | -214.6 | 67.2 | -350.1 | 33.9 | 11.4 | 120.2 |
| M-R-C | 570 | 285 | 260 | 6.5 | 5.4 | 9.6 | 702.4 | 138.9 | 711.4 | 322.4 | 49.6 | 169.7 | -125.9 | 151.5 | -441.8 | 22.4 | 14.6 | 42.7 |
| R-B-G | 271 | 172 | 126 | 10.6 | 2.6 | 9.4 | 494.0 | 126.4 | 393.4 | 302.4 | 28.1 | 121.4 | -212.4 | 48.2 | -258.0 | 2.4 | -6.9 | -5.6 |
| R-B-Ch | 375 | 220 | 170 | 10.8 | 2.7 | 9.8 | 495.6 | 104.4 | 401.2 | 286.6 | 25.3 | 116.5 | -109.8 | 118.3 | -221.4 | -13.2 | -9.7 | -10.5 |
| SE | NA | NA | NA | NA | NA | NA | 9.5 | 1.6 | 7.7 | 5.3 | 2.8 | 5.8 | NA | NA | NA | NA | NA | NA |
| CD (P=0.05) | -- | -- | -- | -- | -- | -- | 27.8 | 4.8 | 22.9 | 30.4 | 6.2 | 16.9 | -- | -- | -- | -- | -- | -- |

: Rice; BM : Barnyard millet; M : Maize; NA : Not analysed; B : Black gram; C : Cotton; G : Gingelly; S : Soybean; FM : Finger millet; Ch : Chillies

in enhancing soil nutrient status especially nitrogen balance because of the additions of easily decomposable crop residues.

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# ECONOMICS OF POTASSIUM MANAGEMENT IN RICE BASED CROPPING SYSTEMS

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**ABSTRACT**

Field experiments were conducted consecutively for three seasons at the Tamil Nadu Agricultural University, Coimbatore. Four rice based cropping systems were evaluated. Application of either half or full dose of K fertilizer was tested for the respective crops. Skipping of K application to any two of the component crops of the cropping systems and K application to all the three crops were included. Rice - rice - rice system registered the highest net return . However, rice - rice - soybean system recorded higher net return as well as BC ratio. Application of half the recommended dose of K was remunerative.

KEY WORDS : Rice Based Cropping Systems, Potassium Fertilizer, Gross Return, Net Return, BC ratio.

Systems approach of nutrient supply to a cropping system as a whole is the best for increasing the fertilizer use efficiency and economising the use of costly chemical fertilizers (Swaminathan, 1981). The production potentials of the cropping systems could be exploited with proper nutrient management practices. While research works on N and P management in rice based cropping systems are many, very little work has been done on potassium (K) management. Hence, a study was undertaken to determine the