removal had resulted in the increased yield in red gram by 19.4 per cent over the control. Thus, adoption of non-monetary/low-cost inputs such as improved variety (Co.5). optimum time of planting, (planting immediately after the onset of monsoon) increased plant population (100000 plants/ha) and timely weed removal (removal of weeds at 3rd week after planting) were found to record increased yield in red gram. Raghumurthy and Yaragathihar (1987) had obtained the same results under the rainfed condition in Karnataka State.

Thus it could be concluded that combination of non-monetary/low- cost inputs was found to be suitable for getting the increased yield in red gram under rainfed condition.

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

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ABSTRACT

Field experiments were conducted in low lands at Tamil Nadu Rice Research Institute, Aduthurai, Tamil Nadu for two years (1985-87) to study the change in soil nutrient status due to the rice based cropping systems in Cauvery delta zone. The inclusion of legume in the cropping systems resulted in higher soil nitrogen (+95.2 kg ha^{-1}) and higher phosphorus uptake (13.4 per cent increase). As that of legume, cotton in the systems too resulted in higher soil available nitrogen (+117.1 kg ha^{-1}) which might be because of lesser uptake by cotton crop or higher addition of residues by cotton or both. The systems rice-rice-cotton andrice-cotton-cotton second flush possessing cotton as components crop found to leave more phosphorus into the soil because of mining/pumping of phosphorus from deeper soil zone with its deep root system. The systems involving pulses left higher potassium in the soil because of comparatively lesser uptake of potassium by these component crops.

KEY WORDS : Rice Cropping System, Cauvery Delta, Tamil Nadu.

In Intensive crop rotations, it is essential to determine the amount of nutrients removed by various crops, since it would indicate the extent to which the crop in the sequence enriches or exhausts the soil so that it will be helpful in formulating suitable manurial schedule. Under the circums tances. it is a long felt need to assess the change in nutrients status in Cauvery delta zone with the existing and proposed double rice based cropping systems under the blanket fertilisation practices.

MATERIALS AND METHODS

Field experiments were conducted in lowlands at Tamil Nadu Rice Research Institute, Aduthurai, Tamil Nadu for two years(1985-87) to study the change in soil nutrients' status due to the rice based cropping systems in Cauvery delta zone. The experiment was laid out in a randomised block design with the plot size of three cents with seven cropping systems replicated four times. Blanket recommendation of fertiliser was adopted for each component crop in the system. Soil samples were taken prior to start of the experiment and after harvest of each component crop and analysed for available nitrogen, phosphorus and potassium. Plant samples were estimated for chemical constituents such as nitrogen, phosphorus and potassium. The NPK balance in the cropping systems was computed . (Sandanandan and Mahapatra, 1973 a, 1973 b, 1974).

Table 1. Uptake of nutrients in rice based cropping system (kg ha^{-1}).

Cropping system	N uptake			P_2O_5 uptake			K_2O uptake		
	1985-86	1986-87	Mean	1985-86	1986-87	Mean	1985-86	1986-87	Mean
R -R - B (1)	227.6	238.6	233	55.9	63.6	59.7	137.5	147.8	143
R - R - S (2)	239.4	240.6	240	59.7	60.3	60.0	147.4	129.3	143
DR - R - B (3)	194.6	201.2	198	35.3	39.9	37.6	117.9	119.8	119
R - R - C (4)	244.5	244.2	244	55.7	52.4	54.1	250.6	217.1	234
R - R - B - B (5)	261.0	276.5	269	63.5	66.3	64.9	167.0	188.3	178
R - C - CS (6)	189.7	192.5	191	35.7	38.6	37.2	270.4	255.1	263
R - SR - B (7)	207.8	203.6	206	45.2	39.8	42.6	122.0	113.2	118
CD (P=0.05)	18.8	20.2	NA	4.9	5.0	NA	14.6	17.2	NA

R : Rice B : Black gram S : Soybean DR : Direct sown rice C . Cotton CS : Cotton (second flush) SR : Summer rice
NA : Not analysed

Table 2. Available N, P_2O_5 and K_2O in soil due to component crops and cropping systems in double rice based lowland (kg ha^{-1})

Cropping system	1985-86				1986-87			
	Cr 1	Cr 2	Cr 3	Cr 4	Cr 1	Cr 2	Cr 3	Cr 4
Available N								
R -R - B (1)	343.0	266.9	295.5	297.2	325.5	301.0	329.6	352.3
R - R - S (2)	295.8	277.8	201.5	283.4	388.1	290.6	322.5	345.7
DR - R - B (3)	319.4	272.8	270.5	325.4	306.8	294.8	321.6	384.3
R - R - C (4)	310.0	252.9	286.1	297.5	310.3	278.3	317.6	349.0
R - R - B - B (5)	305.4	296.1	275.9	284.6	314.1	280.9	344.8	357.2
R - C - CS (6)	350.9	274.3	278.5	282.4	298.4	301.9	311.8	379.1
R - SR - B (7)	326.4	268.9	291.4	293.2	290.8	315.0	300.1	528.3
CD (P=0.05)	NS	NS	NS	NS	24.3	18.4	11.2	12.7
Available P_2O_5								
R -R - B (1)	39.1	35.3	31.2	32.1	34.2	35.4	32.7	29.4
R - R - S (2)	37.4	31.4	26.7	27.6	28.7	29.3	26.2	24.7
DR - R - B (3)	39.3	35.4	26.6	26.1	31.2	32.4	42.5	24.2
R - R - C (4)	49.4	47.6	51.3	52.1	49.2	50.2	47.8	63.3
R - R - B - B (5)	32.3	34.3	26.7	24.4	26.4	27.9	24.9	21.6
R - C - CS (6)	50.4	51.2	52.6	53.7	48.6	49.6	52.1	69.9
R - SR - B (7)	32.6	33.7	43.1	29.6	34.7	35.6	38.9	29.4
CD (P=0.05)	NS	NS	NS	7.3	8.4	5.6	6.8	6.2
Available K_2O								
R -R - B (1)	163.7	167.2	145.3	152.1	160.4	169.3	138.5	139.4
R - R - S (2)	146.4	149.3	132.7	143.4	154.7	167.4	129.3	130.7
DR - R - B (3)	176.2	179.7	151.4	162.8	184.2	193.9	144.5	143.4
R - R - C (4)	157.2	161.4	172.6	175.3	163.6	176.4	197.8	209.77
R - R - B - B (5)	136.7	140.4	120.3	111.4	113.7	129.6	112.1	106.5
R - C - CS (6)	154.3	157.3	174.4	198.3	162.8	174.3	195.6	241.1
R - SR - B (7)	144.7	146.9	125.8	134.7	126.4	138.6	129.8	131.6
CD (P=0.05)	NS	NS	NS	NS	17.6	16.1	33.0	31.5

R : Rice B : Black gram S : Soybean DR : Direct sown rice C : Cotton CS : Cotton (second flush) SR : Summer rice
Cr : Crop NS : Not Significant Initial N Status : 262 kg ha^{-1} (Low) Initial P_2O_5 Status : 41 kg ha^{-1} (High)
Intital K_2O Status : 272 kg ha^{-1} (Medium)

Table 3. N, P_2O_5 and K_2O balance after two years of cropping in double rice based lowland (kg ha^{-1})

Cropping system	Total Nutrient added through application and residue addition	Total Nutrient removed by crops in two years	Actual balance in soil at the end of two years experimentation	Computed balance	Change in available Nutrient status in soil (or) Net gain / Loss.
N Balance					
R - R - B (1)	389	466	352	78	90
R - R - S (2)	406	460	346	74	84
DR - R - B (3)	390	396	348	6	86
R - R - C (4)	477	489	349	12	87
R - R - B - B (5)	424	538	357	11	95
R - C - CS (6)	449	382	379	67	117
R - SR - B (7)	381	411	328	31	66
CD (P=0.05)	NA	20	13	NA	NA
P_2O_5 Balance					
R - R - B (1)	330	120	29	110	12
R - R - S (2)	339	120	25	219	16
DR - R - B (3)	230	75	24	155	17
R - R - C (4)	243	108	63	135	22
R - R - B - B (5)	203	130	22	73	19
R - C - CS (6)	228	74	70	153	29
R - SR - B (7)	230	85	29	145	12
CD (P=0.05)	NA	5	6	NA	NA
K_2O Balance					
R - R - B (1)	182	285	139	104	133
R - R - S (2)	264	287	131	23	141
DR - R - B (3)	182	238	143	55	129
R - R - C (4)	251	468	210	217	162
R - R - B - B (5)	190	355	107	166	166
R - C - CS (6)	237	526	241	289	31
R - SR - B (7)	181	235	132	55	140
CD (P=0.05)	NA	16	32	NA	NA

NA : Not Analysed R : Rice B : Black gram S : Soybean DR : Direct sown rice C : Cotton CS : Cotton (second flush) SR : Summer rice

RESULTS AND DISCUSSION

Nutrient uptake

Among the systems, maximum nitrogen uptake was evident in system 5 in both years. Uptake was poor in systems 3, 6 and 7. Systems 2 and 4 performed similar to that of system 1 in both years. In the first year, system 5 above exhibited a higher phosphorus uptake than system 1. In the second year, however, no system displayed an uptake higher than that of system 1 (Table 1). Higher potassium uptake was observed in system 6 followed by systems 4 and 5.

Available nutrients in soil

The initial nitrogen status of the soil was 262 kg ha^{-1}. An increase under all systems was registered at the end of the first as well as the second year. At the end of the first year, maximum availability was evident under system 3. Least increase was manifested by system 6. However, at the end of the second year, the trend of result was different as maximum increase was evident under system 6. Least increase was observed in system 7. Compared to system 1, available soil nitrogen registered an increase only under systems 5 and 6. While system 2, 3 and 4 registered a marginal decline, maximum reduction was noticeable in system 7 (Table 2). Except in systems 4 and 6, where there was a progressive increase in the available soil phosphorus over the year in all other systems there was a progressive decline. At the end of the second year, it was so in systems 2 and 7. Greatest exhaustion of phosphorus at the end of the first and second year was observed in system 5. The initial available potassium status decreased under all systems without exception.

Nutrient balance

Available nitrogen status at the end of the second year registered an increase under all systems with higher increase under system 6 (Table 3). which might have resulted either from the lesser uptake by cotton crop (Venugopal, 1978) or higher addition of residues by cotton crop or both. Considering computed balance, however. except in system 6 which indicated a gain, in all other systems there was a net loss. Even in annual crop cycles, several workers have reported positive nitrogen balance (Sarker *et al.*, 1989; Except systems 4 and 6 where there was an increase in available phosphorus, in all other systems there was depletion. But applying the yardstick of computed balance, a net loss in this nutrient was indicated by all systems.

Measured by the parameter of computer balance, maximum removal was seen in system 4 and 6 but these were the two systems which exhibited minimum loss of potassium. The quardruple cropping system 4 involving two pulse crops not only enriched the soil but also produced higher economic produce.

Inclusion of legume in the cropping systems results in higher soil nitrogen and higher uptake of phosphorus. As that of legume, cotton in the systems too resulted in higher soil available nitrogen which might be because of lesser uptake by cotton crop or higher addition of residues by cotton or both. The systems possessing cotton component found to leave more phosphorus from deeper soil zone with its deep root system. The systems involving pulses left higher potassium in the soil because of comparatively lesser uptake of potassium by these component crops.

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LEAF LITTER ACCUMULATION AND MINERALISATION PATTERN OF HILLY SOILS

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ABSTRACT

To study the leaf litter accumulation and mineralisation pattern under different vegetational ecosystem, experiments were conducted at the Horticultural Research Station, Kodaikanal during January, 1992 to June, 1992. Plantations of eucalyptus, acecia (both evergreen), apple (deciduous) and pine (coniferous) were selected for the field experiment. The leaf litters were quantified monthly and these were further used in computation of nutrient addition to the system. An incubation study was also conducted using the leaf litter to investigate the mineralisation pattern by observing the C/N ratio. The results revealed that the leaf litter accumulation was appreciable under pine plantation followed by eucalyptus, while a low accumulation was observed in apple and acacia plantations. The accumulation of leaf litter resulted in soil fertility improvement as quantified by the enrichment of nutrients. Owing to their resistant nature, the pine needles mineralised very slowly as compared to the other leaf litters under the climatic conditions in the hills.

KEY WORDS : Leaf litter, Accumulation, Mineralisation, Hilly Soils.