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

Table 1. Gross returns (Rs.ha^{-1}) from the cropping systems, Coimbatore

Cropping system	K level	S_1	S_2	S_3	S_4	Mean
Rice-Rice-Rice	K_1	40150	40596	40636	41314	40674
(C_1)	K_2	39092	38943	38325	40633	39249
	Mean	39621	39770	39480	40974	39962
	K_0					37517
Rice-Rice-Soybean	K_1	38861	37670	38630	39110	38568
(C_2)	K_2	37302	39782	37832	39976	38723
	Mean	38082	38726	38231	39543	38646
	K_0					36112
Rice-Rice-Finger millet	K_1	29469	30064	29581	30594	29927
(C_3)	K_2	29080	28583	29539	30393	29399
	Mean	29274	29324	29560	30494	29663
	K_0					29043
Rice-Rice-Cotton	K_1	28764	30048	30345	30678	29969
(C_4)	K_2	28797	29453	29219	29992	29365
	Mean	28780	29750	29782	30335	29662
	K_0					28178
	Mean	33939	34393	34263	35336	

	SE_D	CD (P = 0.05)
Cropping systems	647	1583
K levels	193	387
Season of application	274	547
K levels x Season	387	NS
C at K	739	1762
K at C	387	773
C at S	834	NS
S at C	547	NS
Control vs Rest	290	580
C at control vs Rest	1108	NS
Control vs Rest at C	580	NS

S_1 - K applied during SWM season, 1984
S_2 - K applied during NEM season, 1984
S_3 - K applied during Summer, 1985
S_4 - K applied during all the three seasons
K_1 - 50 per cent recommended dose of K
K_2 - 100 per cent recommended dose of K

economics of potassium management in rice based cropping systems of Western Tamil Nadu.

MATERIALS AND METHOD

Field experiments were conducted for three seasons consecutively *viz.*, *kharif* season of 1984 (Jun.-Sep. 1984), *rabi* season of 1984-85 (Oct. 1984-Feb.1985) and summer season of 1985 (Feb.-May, 1985) at the Central Farm Wetlands, to assess the economics of K management in rice based cropping systems. The soil of the experimental field was deep clay loam with low in available N (264 kg/ha), medium in available P (17.2 kg/ha) and high in available K (453 kg/ha). The pH of the soil was 8.1 and EC was 0.19 dSm^{-1}. Field experiments were laid out in split plot design with three replications. The details of the three season experiment are :

Main plot treatments : Cropping Systems

I Crop South West Monsoon (SWM) season	II Crop North East Monsoon (NEM) season	III Crop Summer
JUN-SEP. 1984	OCT.1984-JAN.1985	FEB-MAY 1985

C_1 Rice (IR 50) - Rice (Co 43) - Rice (IR 50)

C_2 Rice (IR 50) - Rice (Co 43) - Soybean (Co1)

C_3: Rice(IR 50) - Rice (Co 43) - Finger millet (Co 11)

C_4: Rice (IR 50) - Rice (Co 43) - Cotton (MCU 7)

Sub-Plot treatments : Levels (K) and season of application of K (S)

K_O : Control(No K application)

K_1S_1 : 50% recommended K to the first (SWM) crop alone

K_1S_2 : 50% recommended K to the second (NEM) crop alone

K_1S_3 : 50% recommended K to the third (Summer) crop alone

K_1S_4 : 50% recommended K to all the three crops

K_2S_1 : 100% recommended K to the first (SWM) crop alone

K_2S_2 : 100% recommended K to the second (NEM) crop alone

K_2S_3 : 100% recommended K to the third (Summer) crop alone

K_2S_4 : 100% recommended K to all the three crops

For rice and finger millet, nursery was raised separately and seedlings were planted. In case of cotton, seeds were dibbed in dried banana leaf cups filled with red earth and farm yard manure; then the cotton seedlings were planted in the main field. Soybean was directly sown in the main field. Recommended doses of fertilizers to the different o in s stem were as follows:

Crop	Fertilizer nutrient N	P_2O_5	K_2O (kg ha^{-1})
Rice	100.0	50.0	50.0
Soybean	20.0	80.0	40.0
Finger millet	60.0	30.0	30.0
Cotton	60.0	60.0	60.0

The fertilizers were applied as urea, superphosphate and muriate of potash as detailed below :

	N	P	K
	(of the total dose)		
Rice - Basal dressing	Half	Full	-
Top dressing I (25 DAP)	Quarter	-	Half
Top dressing II (45 DAP)	Quarter	-	Half
Other crops - Basal dressing	Half	Full	Half
Top dressing I (25 DAS/DAP)	Quarter	-	Quarter
Top dressing II (25 DAS/DAP)	Quarter	-	Quarter

Records of all inputs used and labour employed were maintained for all the crops and the total variable cost (TVC) for each cropping system was worked out. In working out the gross returns, the by- products like straw were also included. Prevailing market rates of produce were taken into account. From the gross returns and TVC, net returns and benefit cost (BC) ratio were calculated.

RESULTS AND DISCUSSION

Gross return from the cropping systems is given in Table 1. Among the cropping systems, C_2 (rice-rice-rice) system registered the highest gross return (Rs.38740 ha^{-1}). With rice as component crop in all the three seasons and with inclusion of rice straw in working out the gross return, rice-rice-rice system could register the highest gross return. However, the C_2 (rice-rice- soybean) system was also comparable with gross return of Rs.37379 ha^{-1}. Soybean with higher seed yield and higher price of the seed placed the system in the second position next to rice-rice-rice system.

The data on net return from the cropping systems are furnished in Table 2. K fertilization considerably augmented the net return from the cropping systems.

Net return from the cropping systems followed a similar trend as that of gross returns from the cropping systems except that the C_2 (rice-rice-soybean) system achieved higher net return than in C_1 (rice-rice-rice) system. Even though rice-rice-rice system produced the highest

Table 2. Net returns (Rs.ha^{-1}) from the cropping systems, Coimbatore

Cropping system	K level	S_1	S_2	S_3	S_4	Mean
Rice-Rice-Rice	K_1	23055	23501	23541	24116	23553
(C_1)	K_2	21952	21185	23299	20479	21729
	Mean	22504	22343	23420	22298	22641
	K_0					29479
Rice-Rice-Soybean	K_1	24401	23212	24157	24557	24081
(C_2)	K_2	22791	25612	23512	24629	24136
	Mean	23596	24412	23832	24593	24108
	K_0					21710
Rice-Rice-Finger millet	K_1	15132	15642	15326	16008	15527
C_3)	K_2	15088	15160	15085	16165	15375
	Mean	15110	15401	15206	16087	15451
	K_0					14535
Rice-Rice-Cotton	K_1	14071	15351	14671	15907	15000
(C_4)	K_2	14059	14714	14518	15096	14997
	Mean	14065	15033	14595	15502	14799
	K_0					13549
	Mean	18819	19297	19263	19620	

S_1 - K applied during SWM season, 1984
S_2 - K applied during NEM season, 1984
S_3 - K applied during Summer, 1985
S_4 - K applied during all the three seasons
K_1 - 50 per cent recommended dose of K
K_2 - 100 per cent recommended dose of K

Table 3. Benefit Cost ratio of K management practices in the cropping systems, Coimbatore

Cropping system	K level	S_1	S_2	S_3	S_4	Mean
Rice-Rice-Rice	K_1	2.36	2.37	2.38	2.40	2.38
(C_1)	K_2	2.18	2.22	2.24	2.14	2.28
	Mean	2.32	2.32	2.31	2.37	2.33
	K_0					2.29
Rice-Rice-Soybean	K_1	2.69	2.61	2.67	2.69	2.67
(C_2)	K_2	2.57	2.27	2.62	2.68	2.54
	Mean	2.63	2.44	2.65	2.69	2.61
	K_0					2.51
Rice-Rice-Finger millet	K_1	2.05	2.07	2.05	2.09	2.60
(C_3)	K_2	2.03	2.04	2.03	2.09	2.95
	Mean	2.05	2.06	2.04	2.09	2.06
	K_0					2.00
Rice-Rice-Cotton	K_1	1.95	2.04	2.00	2.08	2.02
(C_4)	K_2	1.95	2.00	1.99	2.01	1.99
	Mean	1.95	2.02	2.00	2.05	2.01
	K_0					1.93
	Mean	2.24	2.21	2.25	2.30	

Data not statistically analysed
S_1 - K applied during SWM season, 1984
S_2 - K applied during NEM season, 1984
S_3 - K applied during Summer, 1985
S_4 - K applied during all the three seasons
K_1 - 50 per cent recommended dose of K
K_2 - 100 per cent recommended dose of K

gross return, the net return was lesser due to higher cost of cultivation. The reduction in cost of cultivation in rice- rice-soybean system by 15 per cent compared to rice-rice-rice system, coupled with remunerative price of soybean seed resulted in the highest net returns from rice-rice-soybean system.

Application of 50 per cent of recommended K to all the three crops in the cropping system resulted in higher gross return as well as net returns than that from K fertilization to anyone crop in the cropping systems. This was primarily due to the increased economic yield of the component crops of the systems.

The BC ratio was the highest in rice-rice-soybean system followed by rice-rice-rice system (Table 4). The results of the study clearly indicated that for high available K soil conditions of Western Tamil Nadu, application of 50 per cent recommended K fertilizer to each of the component crops of rice-rice-soybean system was highly remunerative. In areas with abundant water supply throughout the year, rice-rice-rice system with 50 per cent K fertilizer application to each of the component crops was the best system.

Potassium fertilizer application at 50 per cent recommended dose to each one of the component crops of rice-rice-soybean system in K- rich soils of Western region of Tamil Nadu is highly remunerative. Where abundant water supply throughout the year is available, potash application is recommended at 50 per cent recommended level to each one of the crops of rice-rice-rice system for soils of high available K.

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POTASSIUM MANAGEMENT IN RICE BASED CROPPING SYSTEMS OF WESTERN ZONE OF TAMIL NADU

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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 50 per cent and 100 per cent recommended K fertilizer was included 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. The highest biomass production was recorded in rice-rice-rice system followed by rice-rice-soybean system. Half and full dose of potash produced the same biomass. Rice-rice-soybean system produced the highest rice grain equivalent. Potassium fertilizer application to all the three component crops of the cropping systems resulted in higher rice grain equivalent than that from K fertilization to any one of the crops.

KEY WORDS : Rice Based Cropping Systems, Potassium Fertilization, Biomass Production, Rice Grain Equivalent.

Recent research information amply reveals that high crop yields and intensive cropping can be sustained only through optimum use of nutrients in balanced ratios. On a gross basis, crop uptake of potassium exceeds nitrogen uptake by 60 per cent in Indian Agriculture (NCA, 1976). The entire potash requirements are met from imports. It is imperative to make use of the available potash fertilizers to the most productive use so that each unit gives higher yield response. The FAO has conceptualised the idea of System Approach to Plant Nutrition (SPAN) (Roy and Braun, 1984). Tandon (1983), Pillai *et al.* (1985) and Biswas *et al.* (1987) suggested the fertilizer prescription for a system as a whole is economical and efficient with considerable scope of fertilizer economy. Very