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Crop Sequence Studies Under Different Irrigation Regimes and Manuring for Vaigai Periyar Command Area

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Attempts were made to evolve suitable crop sequence for Vaigai Periyar Command Area to maximise the production under resource constraints. An early maturing rice variety for the Ist crop (June-September) followed by a medium duration for the IInd crop (September-October to January-February) was found to be the best fit. Irrigation of 5 cm submergence to hairline crack which approximate to 0.3 atmospheric tension was as good as continuous submergence resulting in a saving of 41 per cent in irrigation water. This alternate wetting and drying resulted in increased water use efficiency with grain production of 52 kg/ha cm water used. Among the three levels of manuring tried 100:50:50; kg N. P_2O_5 and K_2O/ha was found to be more economic.

In Canal Command Area of Periyar and Vaigai over 1.2 lakh ha are cropped with rice both under single crop and double crop wetlands. The introduction of high yielding photoinsensitive early maturing varieties has opened up new vistas in crop production. Thus, even in single crop wetlands there is possibility of fitting in a double cropping programme by resorting to an early maturing variety followed by medium duration variety. Better utilization of resources like fertilizers and water will go a long way in increasing the production potential per unit area. At attempt was made to study the crop sequence for the Periyar Vaigai river Command Area for fuller exploitation of the resources.

MATERIALS AND METHODS

Field experiment was conducted at the Agricultural College and Research Institute, Madurai under the New Cropping Patterns and Water Use Project sponsored by the Indian Council of Agricultural Research to study the pattern of double cropping with economic use of water and fertilizer.

The experiment was laid out in a split-plot design, replicated four times. The main plot treatments consisted of the three crop sequence viz.,

S_1 : Rice IR 8 — Rice IR 20
S_2 : Rice Kanchi — Rice IR 20
S_3 : Rice IR 20 — Rice IR 20

The sub-plot treatments consisted of three fertilizer levels viz.,

M_1 : 100:50:50 kg N, P_2O_5 & K_2O/ha
M_2 : 150:75:75 kg N, P_2O_5 & K_2O/ha
M_3 : 200:100:100 kg N, P_2O_5 & K_2O/ha

tried at three irrigation regimes allotted to the sub-sub-plots. The three irrigation regimes were

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I_1 : Continuous submergence 3 ± 2 cm
I_2 : 5 cm submergence to hairline crack
I_3 : 5 cm submergence to hairline crack except during active tillering, panicle initiation and grain formation when submergence to saturation was maintained.

The soil type was sandy clay loam with low availability of nitrogen (252.0 kg/ha), and phosphorus (18.0 kg/ha) and high availability of potassium (400 kg/ha). The pH of the soil was 7.6, the E.C. was 0.20 m mhos/cm and the water holding capacity was 35.7 per cent.

Since this experiment involved irrigation treatments, buffer channels were provided on either side of the irrigation channels to control lateral seepage. The bunds of the buffer channels and irrigation channels were periodically strengthened by plestering with mud. The Periyar Canal water was used for irrigation and the water was gauged through 90° V notch for each irrigation. The conveyance loss was worked out to be 20 per cent and therefore the irrigation efficiency was 80 per cent and the quantum of irrigation water was calculated accordingly. At the time of harvest, one guard row was discarded in each plot to eliminate the border effect.

The experiments was conducted for three consecutive years from 1973-'74 to 1975-'76. In the same field the treatments were allotted to the same plot season after season and year after year. The cropping season and dates of sowing and planting were as follows:

1973-'74 :	Sowing	Planting	Harvesting
S_1 IR.8	20.6.73	14.7.73	5.11.73
IR.20	18.10.73	10.11.73	18.2.74
S_2 Kanchi	20.6.73	14.7.73	10.10.73
IR.20	11.10.73	29.10.73	8.2.74
S_3 IR.20	20.6.73	14.7.73	30.10.73
IR.20	18.10.73	10.11.73	18.2.74
1974-75 :			
S_1 IR.8	16.6.74	15.7.74	30.10.74
IR.20	12.10.74	23.11.74	Failure
S_2 Kanchi	16.6.74	15.7.74	9.10.74
IR.20	12.10.74	23.11.74	Failure
S_3 IR.20	16.6.74	15.7.74	26.10.74
IR.20	12.10.74	23.11.74	Failure
1975-76 :			
S_1 IR.8	1.7.75	28.7.75	1.12.75
IR.20	29.10.75	10.12.75	Failure
S_2 Kanchi	1.7.75	28.7.75	18.10.75
IR.20	9.10.75	7.11.75	26.2.76
S_3 IR.20	1.7.75	28.7.75	11.11.75
IR.20	29.10.75	29.11.75	Failure

RESULTS AND DISCUSSION

Sequence : During all the three years as in seen from(Table I)Kanchi the early maturing rice variety (110 days) recorded higher grain yield and in the pooled analysis also the yield of Kanchi was significantly higher (6956 kg/ha) than the medium duration variety IR.20 (6183 kg/ha) (135 days) which in turn was superior to IR. 8 (5072 kg/ha) (140 days).

The early maturing variety planted soon after receipt of freshes in the canal comes to maturity during September which is relatively a period of bright sunshine whereas the medium duration variety planted during the same period comes to harvest about 20 to 25 days

TABLE I. Effect of Rotation on the grain yield of rice (kg/ha) (1973—'74 to 1975—'76)

Years	Sequence 1		Sequence 2		Sequence 3	
	IR. 8	IR. 20	Kanchi	IR. 20	IR. 20	IR. 20
1973—74	5362	3394	6885	3809	5026	3458
1974-75	3202	F*	6423	F	6022	F
1975—76	6698	F	7615	4250	7502	F
Mean	5072		6956		6183	
SEm	320					
CD at P = 0.05 : 657						

F* Denotes failure of crop due to want of irrigation water.

TABLE II. Effect of Rotation on the grain yield of rice in 1973-74 (I and II crop pooled)

Rotation	IR. 8 – IR. 20	Kanchi – IR. 20	IR. 20 – IR. 20	SEm	CD at P=0.05
Yield (kg/ha)	8756	10694	8484	426	873

later and thus, caught in the grip of monsoon rains. Hence the better performance of the early maturing variety may be attributed to a bright sunshine and a higher relative temperature disparity during the maturity period of the crop. This is in conformity with the findings of Subbarayalu (1975).

During 1973-1974 the sequence Kanchi followed by IR.20 recorded the maximum grain yield of 10694 kg/ha as compared with the other two sequences IR. 8 - IR. 20 and IR. 20 - IR.20 (8756 kg and 8484 kg/ha respectively) (Table II). During 1974–1975 only the first crop could be successfully raised and the second crop had to be abondened in the middle due to stoppage of irrigation water for the ayacut when the crop was in flowering stage. During 1975-1976 only the crop following Kanchi could come to maturity and the crop from other two sequences did not attain maturity since water supply was totally stopped when they were in flowering (Table I). The rice following Kanchi escaped this drought thus, it may be concluded that for the Command area a sequence of early maturing variety like Kanchi followed by medium duration variety may be a best fit.

Irrigation : During all the three years the irrigation treatments did not show any significant difference on the yield of the crop thus, scheduling intermittant irrigation of 5 cm submergence

TABLE IIIa. Water requirement of rice in crop sequence (I and II Crop of 1973–74)

Crop sequence		Duration (Days)		Production (kg/ha)			Water used (cm)			Grain production in kg/cm of water used
I Crop	II Crop	I Crop	II Crop	I Crop	II Crop	Total	I Crop	II Crop	Total	
IR. 8	IR. 20	136	130	5362	3394	8756	160	158	318	28
Kanchi	IR. 20	115	120	6885	3809	10694	96	102	198	54
IR. 20	IR. 20	132	130	5026	3458	8484	120	118	238	36

TABLE. IIIb. Effect of irrigation regimes on rice and water use efficiency

Treatments	Yield of grain (kg/ha)	Water used (cm)	Water use efficiency (kg/ha/cm)	SEm	CD at P = 0.05
I_1	4512	141	32		
I_2	4316	83	52	426	873
I_3	4545	101	45		

to hairline crack which approximate to 0.3 atmospheric tension was as good as continuous submergence. Continuous submergence consumed maximum water (141cm)whiie 5cm submergence to hairline crack consumed the least (83 cm). The water use efficiency was the highest (52 kg/ha cm) with submergence to hairline crack followed by submergence to saturation(45kg/ha cm Table IIIb). The water use for the sequence Kanchi-IR. 20 (238 cm) and the grain production per cm of water also maximum (54 kg/ha cm) with sequence Kanchi-IR.20 (Table IIIa). Besides there was economy in water use to the extent of 41 per cent with irrigation scheduled at hairlinecrack compared to that of continuous submergence (Table IIIb). These results corroborate the findings in this station earlier reported by Subramanian *et.al.* (1974). The non-response to higher water regime may be attributed to the contribution from shallow water table (0.5 to 1.0 m) that existed during the cropping period.

Manuring: The pooled analysis of manuring revealed the non-response of any one of the varieties to higher fertilization than 100:50:50 kg N, P_2O_5 and K_2O/ha indicating the economic level to be the minimum level tried (Table IV). However the second crop responded upto 200:100:100 kg N, P_2O_5 and K_2O/ha. The net income was barely Rs. 60/- for the first increasing level. Which is not remunerative against the expenditure of

TABLE IV. Economics of fertilizer application for I Crop (1973–74)

Manurial level (Kg/ha) N	P_2O_5	K_2O	Yield (kg/ha)	Income Rs. Ps.	Cost of manures Rs. Ps.	Addl. yield (kg/ha)	Addl. income Rs. Ps.	Addl. cost of manures Rs. Ps.	Net expenditure Rs. Ps.	Net income Rs. Ps.
100 :	50 :	50	6494	4870.50	514.00	—	—	—	—	—
150 :	75 :	75	5603	4202.25	771.00	−891	−668.25	257.00	771.00	— 905.25
200 :	100 :	100	5177	3882.75	1028.00	−1317	−987.75	514.00	1028.00	−1501.75
Economics of fertilizer application for II Crop (1973—74)										
100 :	50 :	50	3191	2393.25	514.00	—	—	—	—	—
150 :	100 :	100	3614	2710.50	771.00	+423	+317.25	257.00	771.00	+63.25
200 :	150 :	150	3857	2892.50	1028.00	+666	+499.50	514.00	1028.00	−14.50
Economics of fertilizer application Mean of pooled for I and II Crop (1973—74)										
100 :	50 :	50	4843	3632.25	514.00	—	—	—	—	—
150 :	100 :	100	4609	3456.75	771.00	−234	−175.50	257.00	771.00	−432.50
200 :	150 :	150	4517	3387.75	1028.00	−326	−244.50	514.00	1028.00	−755.50

Rs. 257/- on the fertilizers input over the minimum dose of 100:50:50 kg N, P_2O_5 and K_2O/ha. The net income for the second increasing level was negative (Table IV). Gopal Rao *et al.* (1974) and Sadayappan *et al.* (1974) from Madurai and Michael Raj *et al.*, (1974) from Coimbatore have reported similarly.

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