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Identification of Efficient Cropping Systems for Cauvery New Delta Zone

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Rice- Rice- Blackgram or Rice-Rice-Sesame is the existing cropping pattern followed in Cauvery New delta zone of Tamil Nadu. Alternate method of cultivation like Drum Seeded Rice and alternate short duration crops like Maize, Pulse during *kharif* season have been identified as an alternative to face the scarcity of water with higher profitability to the farming community. Among the different cropping systems, Drum Seeded Rice- Transplanted Rice-Maize + Black gram system has registered the highest economic efficiency of 319.41 Rs./ha/year and Rice-Rice- Brinjal recorded the economic efficiency of 303.94 Rs./ha/year over the existing system of Rice-Rice-Sesame sequence. Similarly both the sequence recorded the highest system productivity of 48.20 and 48.49 kg/ha/year respectively. The cropping sequence of Drum Seeded Rice – Transplanted Rice – Maize + Black gram and Rice-Rice-Brinjal as an alternate cropping system, instead of existing Rice- Rice – Pulse / Oilseed cropping systems in Cauvery New Delta Zone to achieve higher income, higher productivity and profitability.

Key words: Rice equivalent yield, Alternate crops, Drum Seeded Rice, System Productivity

Rice (*Oryza sativa*) is one of the world's most important food crops, particularly in Asia. Rice and wheat provide approximately 50 per cent of the calories consumed by the human population. The projected increase of human population from 6 billion in 2000 to 9 billion in 2050 requires increase in the production of rice (2.1 billion tones). Rice is the principal crop extensively cultivated in all the districts of Tamil Nadu state having a unique three-season pattern *viz*., *Kar/Kuruvai /Sornavari* (April to July), *Samba/Thaladi/Pishanam* (August to November) and *Navarai/ Kodai* (December to March). Cauvery Delta Zone (CDZ) lies in the Eastern part of Tamil Nadu. In this zone, rice is the principal crop. In the rice based cropping system, it is either single or double cropped.

Rice- Rice- Blackgram or Rice-Rice-Sesame is the existing cropping pattern followed in Cauvery New delta zone of Tamil Nadu. Continuous and intensified rice cultivation deteriorates the soil fertility and results in lower productivity and profitability. The cultivation of rice during *kharif* and water availability for raising nursery and field preparation depends on the release of water from Mettur Dam. The delayed release of water leads to non cultivation of rice due to the lack of water availability during particular season. Alternate method of establishment and alternate crops pave the way to solve these problems. Jagadish *et al.* (2010) reported that Rice-Maize are grown in sequence on the same land in the same year either in double or triple crop systems to meet the rice demand of a rapidly expanding human population and maize demand of livestock and poultry.

In this circumstance, alternate method of cultivation like drum seeded rice and alternate short duration crops like maize, pulse during *kharif* season have been identified as an alternative to the face the scarcity of water with higher profitability to the farming community.

Materials and Methods

The field experiments were conducted for a period of three consecutive years during the *kharif, rabi* and *summer* seasons at Soil and Water Management Research Institute, Kattuthottam, Thanjavur, Tamil Nadu, India, with the objectives to identify efficient cropping systems for Cauvery delta zone, to assess the biological and economical efficiency of the different systems and to assess the impact of different systems on soil fertility with eight different cropping sequences *viz*., Rice-Rice-Sesame, Rice-Rice- Black gram(seed & residue incorporation), Rice-Rice-Brinjal, Drum Seeded Rice-Rice-Maize+Blackgram, Maize+Blackgram-Rice- Blackgram, Onion-Rice-Blackgram, Bhendi-Rice- Green manure and Black gram-Rice-Cowpea in randomized block design with three replications.

The intervention systems were compared with the existing sequence of Rice-Rice-Sesamum based on production efficiency in terms of system productivity and economic efficiency of the mean value (3 years) over a period of time. System

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productivity was worked out by dividing the total Rice Equivalent Yield (REY) (kg/ha) of the cropping system with 365 days and expressed as kg/ha/day. Net Income (Rs./ha) of the cropping system was divided by 365 days and obtained Economic Efficiency in Rs./ha/day.

Results and Discussion

The detailed analysis has been carried out for the eight cropping sequence on different indices like production and economic efficiencies.

Table 1. Efficiency of cropping sequence on total rice equivalent yield, net income and benefit cost ratio

Treatment	Cropping sequence	Total REY(kg/ha/ year)				Net income (Rs/ha)				Benefit Cost Ratio			
		I year	II year	IIIyear	Mean	I year	II year	IIIyear	Mean	I year	II year	IIIyear	Mean
T_1	Rice - Rice – Sesame	14108	12996	13406	13503	52434	90458	97363	80085	2.20	2.96	2.18	2.45
T_2	Rice -Rice -Blackgram	14750	13120	16033	14634	54500	89460	122904	88955	2.18	2.85	2.62	2.55
T_3	Rice - Rice – Brinjal	20322	16088	16683	17698	89889	115624	127299	110937	2.86	3.16	2.60	2.87
T_4	Drum seeded rice - Rice - Maize + Blackgram	19471	14732	18577	17593	89402	107686	152667	116585	3.07	3.39	3.45	3.30
T_5	Maize + Blackgram- Rice - Blackgram	16105	12033	18084	15407	73264	87096	154192	104851	3.02	3.21	4.12	3.45
T_6	Onion - Rice - Blackgram	17276	15305	16070	16217	67677	107903	119293	98291	2.35	3.04	2.34	2.58
T_7	Bhendi- Rice - Green manure	15808	12156	9405	12456	65954	83098	56908	68653	2.58	2.86	1.34	2.26
T_8	Blackgram - Rice - Cowpea	9876	8276	12458	10203	32876	49618	96530	59675	1.95	2.33	2.72	2.33
	CD (P=0.05)	704.50	548.25	686		980	1012	1028					

Rice equivalent yield and economic efficiency

Among the cropping sequence, Rice - Rice - Brinjal and Drum seeded rice - Rice – Maize + Blackgram have registered significantly higher total rice equivalent yield of 17,698 and 17,593 kg/ha/yr, respectively than the other cropping sequences (Table 1) (Fig. 1). Whereas, when compared with the net income worked out to Rs 1, 16,585/- in Drum Seeded Rice - Rice – Maize + Blackgram and Rs. 1,10,937/- in Rice - Rice – Brinjal and performed superior than other cropping sequence. But, the computed benefit cost ratio was higher in Maize + Blackgram- Rice –Blackgram (3.45) followed by Drum seeded rice - Rice – Maize + Blackgram (3.30) because due to the involvement of high cost of production. Pandey and Velasco (2002) have

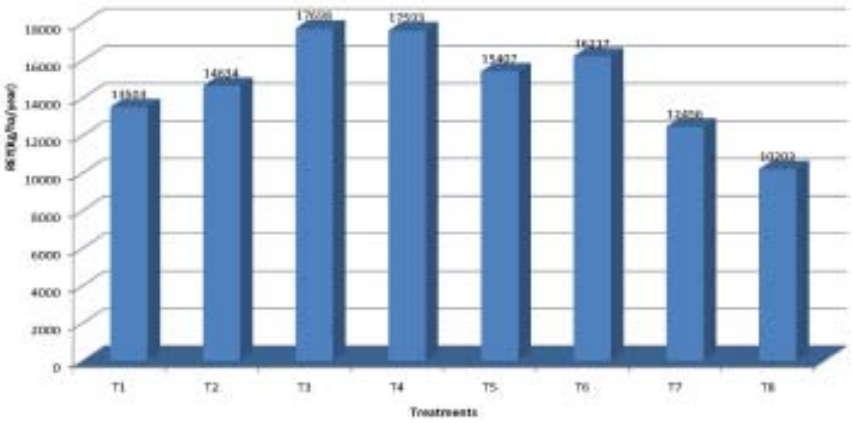

Fig.1. REY of yearly cropping sequences (kg/ha/year)

reported that direct-seeding methods produce higher income relative to transplanting, despite a slightly lower average yield than that of transplanted rice. A higher net profit arises since savings in labor costs outweigh the value of loss in output. The productivity of the direct-seeded crop is on a par with transplanting and the net profit higher (Singh *et al*., 2005).

System productivity

With respect to system productivity, Rice-Rice-Brinjal recorded the highest value of 48.49 kg/ha/day followed by Drum seeded rice - Rice – Maize + Blackgram (48.20 kg/ha/day) and was insignificant difference. Similarly, Drum seeded rice - Rice – Maize + Blackgram registered highest economic efficiency of 319.41 Rs/ha/day followed by Rice – Rice –Brinjal (303.94 Rs/ha/day) (Table 2). The market price of produce decides the more income on horticultural crops during summer crops. Among method of rice cultivation, drum seeded rice record less cost of production and intercropping resulted in higher system productivity and economic efficiency. Wang and Sun (1990) also noticed that duration can be shortened by 7-15 days in direct-seeded rice compared to transplanted rice. Shekar and Singh (1991) have stated that direct seeding of sprouted seeds under puddled condition results in significant improvement in yield attributes like number of effective tillers and grain yield.

Table 2. Efficiency of cropping sequence on system productivity and economic efficiency

Treatment	Cropping sequence	Total rice equivalent yield (kg/ha/year)	Net income (Rs/ha)	System productivity (kg/ha/day)	Economic efficiency (Rs/ha/day)
T_1	Rice - Rice – Sesame	13503	80085	36.99	219.41
T_2	Rice -Rice -Blackgram	14634	88955	40.09	243.71
T_3	Rice - Rice – Brinjal	17698	110937	48.49	303.94
T_4	Drum seeded rice - Rice - Maize + Blackgram	17593	116585	48.20	319.41
T_5	Maize + Blackgram- Rice -Blackgram	15407	104851	42.21	287.26
T_6	Onion - Rice - Blackgram	16217	98291	44.43	269.29
T_7	Bhendi- Rice - Green manure	12456	68653	34.13	188.09
T_8	Blackgram - Rice - Cowpea	10203	59675	27.95	163.49

Productivity and profitability

Instead of conventional planting of rice (puddled) during *Kharif* season alternate method of cultivation or an alternate crop, which requires less water and higher REY to be included for the higher productivity and higher profitability for the farming community. Drum seeded rice- rice-maize + black gram system is the best cropping sequence instead of rice-rice-blackgram/sesame. Similarly, instead of rice fallow pulse, a horticultural crop may be cultivated as summer irrigated crop for getting higher productivity as well better soil nutrient cycle. .

Conclusion

The cropping sequence of Drum seeded Rice - Rice – Maize + Blackgram could be recommended instead of existing Rice- Rice – Pulse / Oilseed and Rice-Rice-Brinjal as an alternate cropping sequence in Cauvery New Delta Zone to increase the income, higher system productivity and profitability. The result revealed that the production efficiency and system productivity is higher by the integration of changing in the method of cultivation in rice (Drum seeded rice/Maize-Rice- Blackgram) and inclusion of alternate crops like maize, pulse and brinjal instead of rice. The soil fertility and profitability were achieved by changing the method of cultivation and altering the crop sequence.

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