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PERFORMANCE OF PADDY - CUM - PRAWN CULTURE IN RAINFED LOW LAND ECOSYSTEM OF SUNDERBANS

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ABSTRACT

Performance of both paddy (Var. NC 492) and prawn *Penaeus monodon)* were assessed for two years during wet-season in rainfed lowland ecosystem with a view to study the economic viability of paddy-cum-prawn culture in the coastal saline zone of West Bengal. Both mono and dual culture of paddy and prawn were tried in the study. Fingerlings of prawn (@ 35,000 ha^{-1}) of 10-15 mm size were reared for about three and half months with and without fish feed. It was observed that addition of fish feed resulted in higher (57.7%) production of prawn (2.65 $mgha^{-1}$) but not rice. Such increase in prawn production was 1.6 times higher when no feed was provided and 1.4 times higher when grown as sole crop. However, paddy, whether grown as mono or mixed culture, did not differ in yield significantly. In dual culture, the benefit - cost ratio was higher (6.83) when prawn was grown with feed and it was maximum (36.0) when grown without feed as sole crop. The study, therefore, indicates that paddy-cum-prawn culture under low land ecosystem of the coastal saline zone is enterprising particularly for small and marginal farmers who fear to take risk of growing prawn alone at the cost of paddy.

The Indo-Gangetic delta of West Bengal is mostly monocropped with kharif paddy. Cultivation of second crop during rabi season is risk oriented due to rise in soil salinity as well as non availability of good irrigation water. The lands are, therefore, kept fallow after the harvest of kharif paddy. However, the zone has potential for cultivation of fish, prawn in particular, during kharif season and such potentiality for growing prawn lies with its agro-climatic situation, availability of prawn fry and marketing facility (Jhingran, 1975a).

Gopinath (1956), Panikkar and Menon (1956) and George *et al.* (1968) described brackish water fish culture practised in the lowlying paddy fields in Kerala. Similar system of farming is in practice since long back in West Bengal too (Pillay

and Bost, 1957). However, such traditional system of paddy-cum-prawn culture practiced in West Bengal (Kurian and Sebastian, 1986) and Kerala (Kow, 1968) needs further modifications to improve production and income per unit area of farm family.

The experiment was, therefore, conducted to asses the performance and viability of dual culture of paddy and prawn under rainfed deep water ecosystem.

The study was conducted consecutively for two years (1991 and 1992) during kharif season in low land situation at the Regional Research Station, Bidhan Chandra Krishi Viswavidyalaya, Kakdwip, West Bengal, situated 35 km away from the Bay of Bengal.

Mean annual rainfall of the region is 1904.8 mm and mean air temperature varies between 18.7 28.8°C. Rainfall during the period of study was 1893.2 and 1811.7 mm in 1991 and 1992 respectively resulting in variation in depth of water in the field between 0.15 to 0.50 m (Fig. 1).

Physico chemical properties of soil and water are given in Tables 1 and 2.

The field was divided into five blocks with four plots (20x16 m) in each and peripherial mud bunds of 0.75m height were constructed to maintain desired water depth within the plot and to check overflow of water during heavy rain. About 1.5m distance was maintained between the plots. Further, for providing shelter and easy harvest of fish, trenches (1.5m width and 0.5m depth) were dug out all along the bunds within the plots. Details of the plots are given in Fig.2. Moreover, cheaply available nylon nets were fixed with the support of splitted bamboo for preventing migration of fish from one plot to the other. (Fig.3).

Salt resistant paddy variety, NC-492, which performs well even when salinity increases from 4-8 dSm^{-1}, was transplanted without any fertiliser.

Fingerlings of bagda prawn *(Penaeus monodon)* of 2.0g mean weight and 10-15 mm size stocked @ 35,000 ha^{-1} after transplanting of paddy during first week of August were reared for about three and half months. Plot-wise netting was started from 1st week of December, Details of practices followed are given in Table 3.

The study was conducted with four treatments viz. T_1, Paddy + Prawn; T_2, Paddy + Prawn + Feed; T_3, Paddy only and T_4, Prawn only, which were replicated thrice in a Randomised Block Design.

Observations on grain yield and yield attributes were recorded following the harvest of paddy. The length and weight of prawn were also recorded at harvest by standard fish measuring scale and balance respectively.

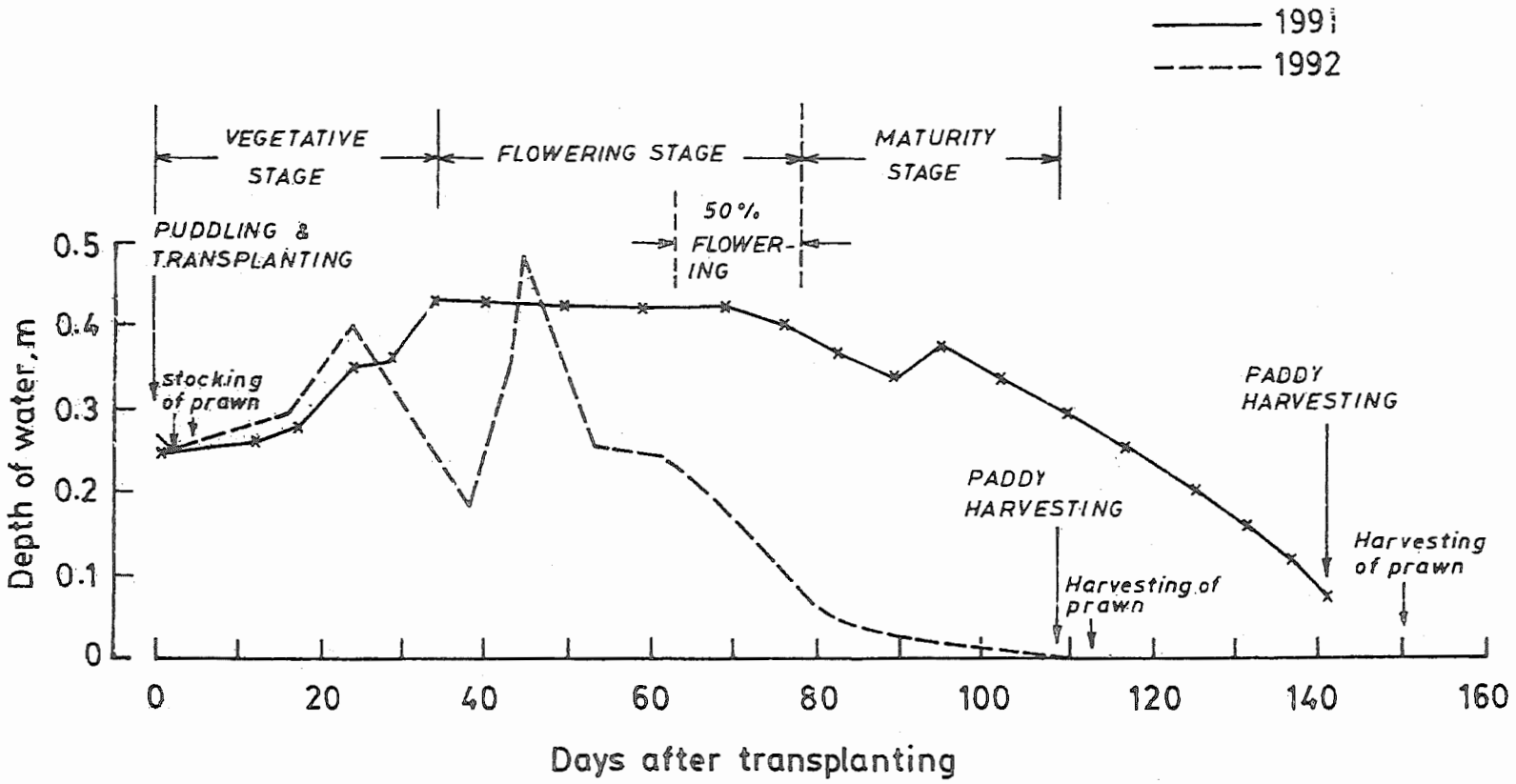

Fig 1 : *Fluctuation of depth of water as a function of rainfall*

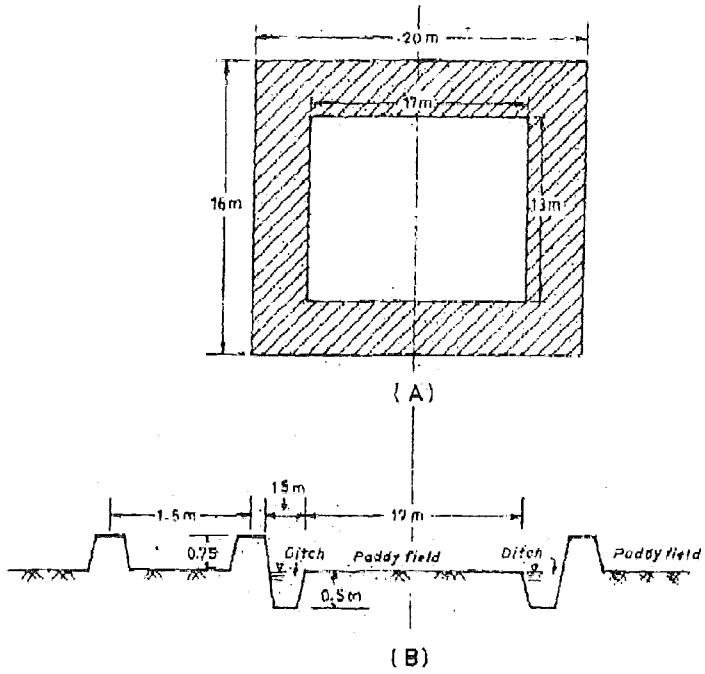

Fig 2 : *Plan (A) and sectional diagram (B) of the plot*

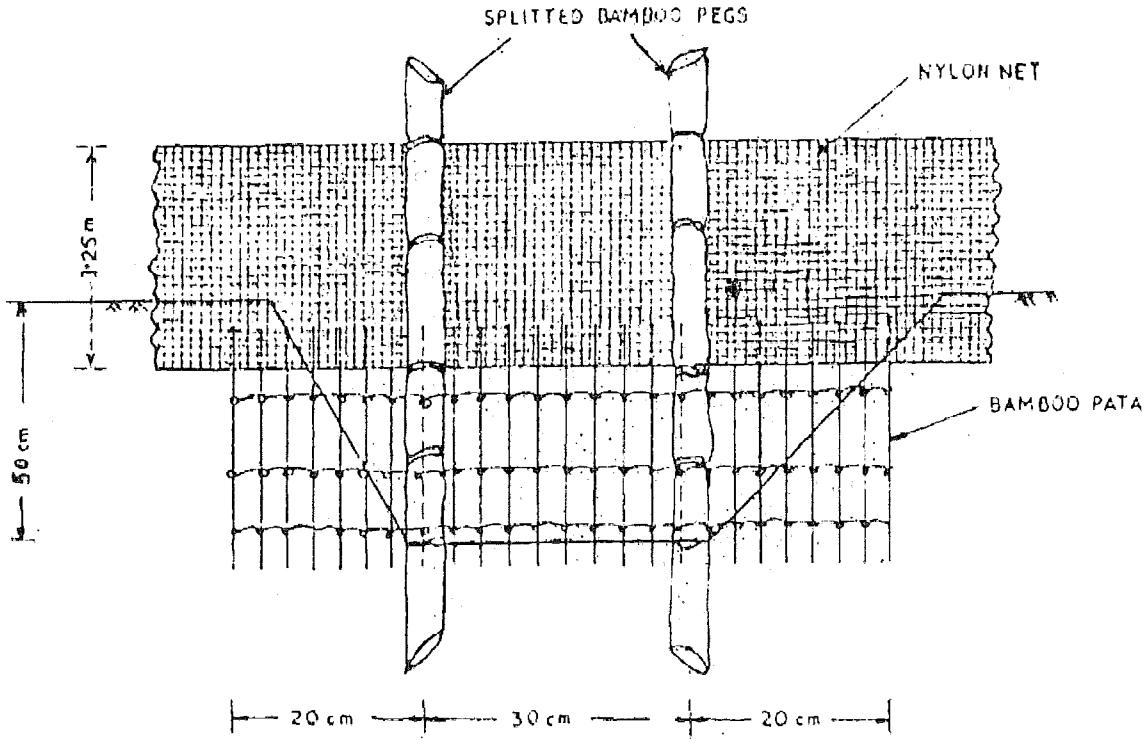

Fig.3 : *Cross section of the trenches fitted with nylon net, bamboo pata and pegs*

Table 1 : *Physical and chemical properties of soil*

Depth of soil cm	Bulk density gcm^{-3}	Soil texture % Sand	Silt	Clay	Textural class	pH	Ec dSm^{-1}	P_2O_5 $kgha^{-1}$	K_2O $Kgha^{-1}$	Oxgenic matter %
0-15	1.3	23.2	40.0	36.8	clay loam	7.1	2.0	286.7	504.1	8.0
15-30	1.3	22.7	39.2	38.1	clay loam	8.2	1.1	-	-	-
30-45	1.4	23.2	37.9	38.9	clay loam	8.0	1.7	-	-	-
45-60	1.5	22.4	34.8	42.8	clay loam	7.5	2.7	-	-	-

Table 2 : *Quality of surface and sub-surface water*

	EC, dSm-1	pH
Surface water	1.5 - 2.9	7.4 - 7.8
Sub-surface	2.5	7.4

Table 3 : *Cultivation details*

No. of bagda fry stocked per hectare	35,000
Average size of the fry	10-15 mm
Date of transplanting of paddy	14.8.92
Date of application of bagda fry	20.8.92
Fertilizer used	Nil
Type of feed used	Rice bran - Fish feed
Proportion of mix of the feed components	1 : 1
No. of application of feed	10 days interval
Amount of feed applied/plot/meal	2 kg
Date of harvesting	
a) Paddy	17.12.92
b) Prawn	01.11.92
Cost of feed	
a) Fish meal	Rs.440/q
b) Rice bran	Rs.100/q
Cost of fish fry	Rs.250/1000

Table 4 : *Two years' weighted mean of yield of paddy and prawn, (Mg ha^{-1})*

Treatments	Paddy			Prawn
	Grain	Straw	Total blomass	
T_1	2.18	3.67	5.85	0.11
T_2	2.19	3.78	5.97	0.27
T_3	2.06	3.69	5.75	-
T_4	-	-	-	0.19
Mean	2.14	3.7	5.86	0.19
LSD(P=0.05)	NS	NS	NS	0.12

It was revealed from Table 4 that there was significant difference in prawn yield but the grain yield of paddy did not differ. Highest production of prawn (2.65 Mg ha^{-1}) was recorded while grown with paddy and fish feed (T_2) followed by T_4 while prawn was grown as sole crop. This increase in production under T_2 was 1.6 and 1.4 times higher than those under T_1 and T_4 respectively. In other words, prawn production was improved considerably while feed was added artificially in addition to available phytoplankton (viz. *Chlorella, Oscillatoria, Volvox,* Blue green algae) and zooplankton (viz. *Daphnia,* larvae of insects, protozoa) in the paddy tield, which formed suitable biological environment for life and growth of prawns (Kurian and Sebastian, 1986). At harvest, prawn attained 25-30g mean weight. The result is in conformity with that obtained at Indian Institute of Technology, Kharagpur (Anonymous, 1992).

Grain yield of paddy although did not vary significantly but its relative improvement through dual culture indicate that cultivation of prawn was beneficial to the crop. On the contrary, neither prawn nor fish feed could help in increasing total biomass of paddy.

Benefit cost ratio (B:C) was exceptionally higher (36.0) under T_4 while prawn was grown as sole crop (Table 5). However, under dual culture, when fish feed was applied, the ratio increased by 69.5 per cent over the culture without feed. It was lowest (0.96) under T_3 while paddy was grown as sole crop. The increase of ratio under dual culture over monoculture of paddy was mostly related to incorporation of higher remunerative crop like prawn with a lower remunerative crop like paddy. It was further revealed from the table that the ratios under T_1 and T_2 increased respectively by 2.8 and 3.2 times higher over T_3 treatment.

Table 5 : *Economic return per hectare*

Treatments	Gross income (Rs.)	Cost of cultivation	Net income (Rs.)	B : C
T_1	36018.0	5255.0	30763.0	5.85
T_2	51626.5	6536.25	45090.3	6.89
T_3	8746.2	4455.0	4291.2	0.96
T_4	29600.0	800.0	28000.0	36.00

Note : The prevailing selling prices of rice grain, straw and prawn were Rs.335, Rs.50 and Rs.16,000 per quintal respectively.

Highest economic return under monoculture of prawn although appears highly remunerative and enterprising, particularly for small and marginal farmers who can not take risk of growing prawn as sole crop, this can not be advocated at the cost of their areas under paddy.

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