Chapter 3

MATERIALS AND METHODS

1. Site selection

One farm with 0.5 ha of paddy field on which the rice-prawn system practiced was chosen to conduct the experiment. The field satisfied some major conditions: the surrounding dikes were high enough to prevent prawns from escaping during the flood period; the area of trenches ranged about 10 - 20 % of the enterprise area (rice + trenches); the trenches were about 1 m deep, 2.5 - 3 m wide, and had the advantage of water exchange systems.

2. Experiment

2.1. The field experiment was consisted of 4 treatments[1]

To: Rice-Rice cropping system without raising prawn (rice monoculture).

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[1] Cull harvesting: selective harvesting of prawn of expected size
Batch harvesting: harvest prawn of all size
EWSR: early wet season rice started in April and harvested in July
WSR: wet season rice started in Aug. and harvested in Jan.

T1: Batch-harvesting once at half a month before harvesting of the WSR crop as control treatment.

T2: Cull-harvesting of size 1 and size 2 prawns at the harvest of the EWSR crop, then resupplied with the same number of young prawns as that of harvested. The last harvest was at two weeks before harvesting of the WSR crop.

T3: Batch-harvesting of all size at the harvest of the EWSR crop, then resupplied with the same amount of young prawns as that of the beginning. The last harvest was at two weeks before harvesting of the WSR crop.

The reasons for setting up these treatments are:

1. To investigate whether the cull-harvesting can improve the productivity and net return of prawn culture in rice-prawn system.

2. To measure the effect of cull-harvesting and batch-harvesting management to the prawn production and size of prawn, and

3. To compare net return between rice-prawn culture and rice-monoculture.

2.2. Design

The experiment was laid out in a randomized complete block design (RCB) with 3 replications. Plot size was 325 m^2. Total experiment area was 4875 m^2.

2.3. Cultural practice

Rice cultivation

Early wet season: A modern rice variety, IR 19660 was directly seeded on 5 April at the rate of 200 $kg.ha^{-1}$. Fertilizer 94 kg $N.ha^{-1}$, 54 kg $P_2O_5.ha^{-1}$ and 4 kg $K_2O.ha^{-1}$ was applied at 8, 15, 25, 45 and 70 days after seeding. Weeds control was done by hand. Trebon insecticide was applied to control brown plant-hopper (*Nilaparvata lugens*).

Wet season: A local rice variety (Trang Phuoc) was transplanted at 25x30 cm spacing, with 4 seedlings per hill using 30 day-old seedlings. Fertilizer 57 kg $N.ha^{-1}$, 51 kg $P_2O_5.ha^{-1}$ was applied at 10, 30 and 130 days after transplanting. Weeds control was done by hand. Trebon insecticide was used to control brown plant-hopper (*N. lugens*).

Prawn raising

Trenches and surrounding dikes were prepared in March to meet the technical requirements for the experiment.

Young prawns with average size of 14.7 g was stocked at one prawn per m^2.

The prawns were fed once a day with compound feed composed of 30 % dried fish meal, 30 % broken rice, 20 % bran rice, 18 % coconut-peanut meal, and 2 % additional materials. The amount of feed with a 26 % protein level was monthly estimated by prawn weight. The ratio of 0.03 of total prawn weight was used as the amount of feed required.

Drainage was done before spraying pesticides in order to keep prawns safely down to the trenches. Resupplying fresh water took place 3 days after spraying.

3. Data collection

3.1. Environmental factors:

a. Soil

Soil samples at 0 - 20 cm deep of the experiment were taken for analysis of pH, N, P, K and organic matter before land preparation for the early wet season rice and after

harvest of the wet season rice crop.

b. Dissolved oxygen (DO): ($mg.l^{-1}$)

Water from the trench and the rice field were sampled in the morning (6:00 a.m) and in the afternoon (2:00 p.m) at 10 to 20 cm deep from the water surface twice a month. Wrinkler titration method was used to measure dissolved oxygen.

c. pH of water was estimated once per week by color comparison.

d. Water temperature (°C)

Water temperature was measured in the afternoon (2:00 p.m.) at 20 and 80 - 100 cm deep twice a week.

e. Water transparency

A Secchi disk with two contrast colours (i.e, painted white and painted black) was placed down into water till two colours could not be distinguished, then the depth from water surface to the place where two coloured-disk could not be distinguished was measured. Water transparency was measured once a week.

3.2. Prawn growth

a. Length (cm) and length growth rate ($cm.day^{-1}$)

Every two weeks ten prawns per plot were randomly selected to measure the length of prawn from orbit to telson, using a measuring board with accuracy to mm. The length growth rate of prawn ($cm.day^{-1}$) was then calculated.

b. Weight (g) and weight growth rate ($g.day^{-1}$)

Ten prawns per plot were weighed every two weeks. The weight growth rate of prawn was also determined.

c. Survival percentage (%)

In the control treatment T1, the prawn numbers were determined by seining the trench area of 20 m^2 at the first harvest of early wet season rice, then put them back. In the final harvest of the wet season rice, the prawn population was determined from the whole plot. For other treatments, the prawns were counted from the whole plot at each time of prawn harvest. The survival percentage was determined from the initial and final numbers of prawn.

$$\text{Survival percentage (\%)} = (N_f/N_i)*100$$

Where: N_f = final number N_i = initial number

d. Prawn production

The harvestable production of prawn ($kg.ha^{-1}$) was estimated by weight and the number of prawns per hectare. The marketable sizes were classified as followed:

+ Size 1 > 70 g prawns
+ Size 2 25 - 70 g prawns
+ Size 3 14 - 24 g prawns

3.3. Predators:

The predators in the field was evaluated by their total weight. Amount of harmful fishes such as snake-head fish, silver barb were weighed for the first and the last harvest.

3.4. Rice production:

A sample of 3 m^2 and 5 m^2 of rice area were harvested for measuring rice production in early wet season and wet season respectively in every treatment.

4. Analysis of data:

Statistix 3.5 software program was used to analyze the analysis of variance between treatments, the least

significant difference among means of the treatments for rice and prawn productivity, and environmental condition; and testing the linear regression coefficients among the treatments. Budgeting analysis was calculated for rice and prawn production.

Total cash variable cost of production (TCVC), fixed cost (FC), labor cost (LC) and man-day (MD) for all operations of the whole system in one cycle of rice-prawn system were recorded and calculated.

Gross return (GR), gross margin (GM), net return (NR), rate of return to cash expenditure (RRCE), rate of return (RR), return to labor per season (RLS), return to labor per day (RLD) and cash balance (CB) were calculated by the formula:

a. GR = YIELD X PRICE

b. GM = GR - TCVC

c. NR = GM - LC - FC

d. RRCE = GR / TCVC

e. RR = GR / (TCVC + FC + LC)

f. RLS = GR - TCVC - FC

g. RLD = RLS / MD

h. CB = TLCB + GR - E

Note: TLCB = Transfer of last month cash balance

E = Expenses = TCVC + hired labor cost

CB = cash balance, calculated every month during season