Chapter VI

Household study

6.1 Population structure and farming systems

Table 6.1 showed Kinh ethnic group occupied 13 percent, all of them doing double cropping systems. Chinese ethnic group occupied 35 percent but in that had 57 percent doing traditional rice and 43 percent doing double cropping systems. Khmer ethnic group was largest group in the community, occupied 52 percent in that had 10 percent producing mono-cropping system and 90 percent doing double cropping systems.

Table 6.1 Population structure and farming system in Dai An village

Ethnic group	MTRS	MR-TRS	MB-TRS	T-TRS	Total	%
Kinh	0	8	4	4	16	13
Chinese	24	7	4	7	42	35
Khmer	6	15	22	19	62	52
Total	30	30	30	30	120	100

6.1.1 Education level of household members

Educational levels of the farmer was very important factor, means it to decide the successfully of farm households, because that was closely linking with the applying of new technologies in the production. If which farmers have high education level then those farmers easy get successfully than farmers have lower education levels. Table 6.2 showed that people in study site had 13.7 percent illiterate, the most of them were only at primary school level, next high school, illiterate and last other level, were 60.2 percent, 24.8 percent, 13.7 percent and 1.3 percent.

Table 6.2 Education levels of household members

Farm type	Household Class				
	Illiterate	Primary school	High school	Other	Total
MTRS	10	80	58	0	148
MR-TRS	19	102	25	4	150
MB-TRS	19	74	56	4	153
T-TRS	35	110	12	0	157
Total	83	366	151	8	608
%	13.7	60.2	24.8	1.3	100

6.1.2 Land holding

6.1.2.1 Land holding of farmers in mono traditional rice system

I divided land holding of farmers into four groups: smallest group for farm household having 0.1-1ha, smaller group far farm household having 1.1-2ha, medium group for farm household having 2.1-3 ha and large group for farm household having greater than 3 ha.

The smaller group occupied highest than other groups at 40 percent in term 1976-1985 and increased to 50 percent in term 1986-1995 and decreased to 47 percent in term 1996-2000. Medium group changed from 23 percent in term 1976-1985 to 30 percent in term 1986-1995 and to 27 percent in term 1996-2000. Large group fluctuated between 10 percent and 3 percent overtime from 1976 to 2000 and smallest group occupied 27 percent in term 1976-1985, decreased to 17 percent in term1986-1995 and increased to 23 percent in term 1996-2000. In the MTRS, the most of landuse systems changed little bit through 1976 to 2000 (Figure 6.1).
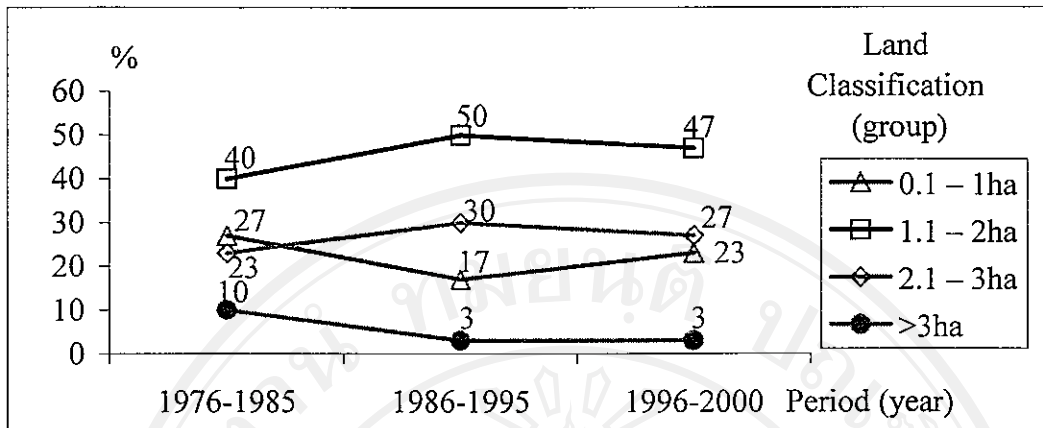
Figure 6.1 Change in land holding during 1976-2000 of MTRS

Source: District Statistic Department, 1995; District Statistic Department, 2000

6.1.2.2 Land holding of farmers in modern rice-traditional rice system

Land holding of farmers of MR-TRS also had four groups. Smallest group occupied largest percent and also higher fluctuated than other groups during 1976-2000, smaller group rapidly changed on the same with smallest group but it followed oppositional way. Group 0.1-1 changed so much decreased 57 percent in 1976-1985 to 37 percent in 1986-1995 and increased to 74 percent in 1996-2000, group 1.1-2 increased 17 percent in 1976-1985 to 40 percent in 1986-1995 and decreased to 13 percent in 1996-2000. Other groups changed little bit during 1976-2000 (Figure 6.2).

Figure 6.2 Change in land holding during 1976-2000 of MR-TRS

Source: District Statistic Department, 1995; District Statistic Department, 2000

6.1.2.3 Land holding of farmers in mung bean - traditional rice system

Group 1.1-2 changed so much increased 50 percent in 1976-1985 to 63 percent in 1986-1995 and decreased to 40 percent in 1996-2000, group 0.1 −1 decreased to 27 percent in 1976-1985 to 13 percent in 1986-1995 and increased to 37 percent in 1996-2000. Other groups changed little bit during 1976-2000 (Figure 6.3).
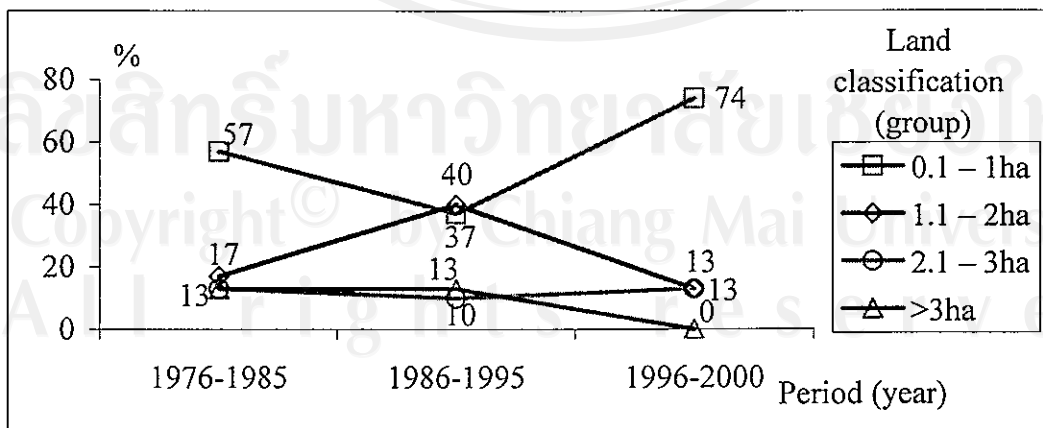

Figure 6.3 Change in land holding during 1976-2000 of MB-TRS

Source: District Statistic Department, 1995; District Statistic Department, 2000

6.1.2.4 Land holding of farmers in taro-traditional rice system

Land holding of farmers in the T-TRS had only two groups that were smallest and smaller group and figure 6.4 showed that group 1.1-2 unchanged during 1976-2000, group 0.1 −1 increased little bit from 1976- 2000.
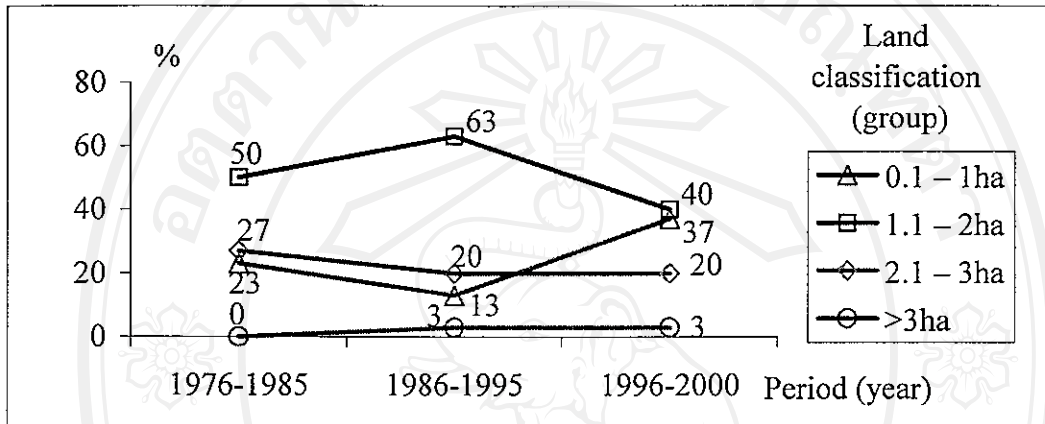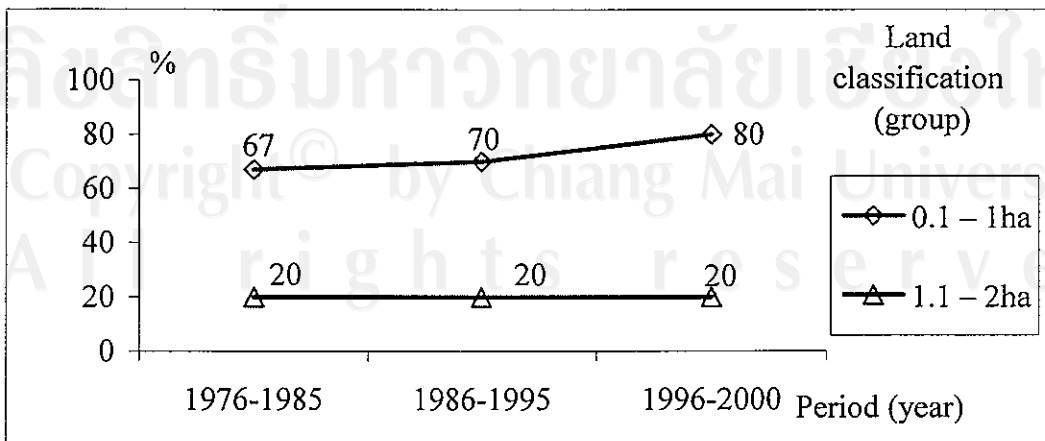

Figure 6.4 Change in land holding during 1976-2000 of T-TRS

Source: District Statistic Department, 1995; District Statistic Department, 2000

Finally, the changed of land holding of farmers in MTRS, MD-TRS, MB-TRS and R-TRS, we can say that the major reasons affect upon the changed of the land holding of farm households in the study area that were some elements as: Successfully farm households bought more agricultural land, while no-successfully farmers sold their farm, heads of households divided agricultural land for households' members and etc. Otherwise, the changed policies of government as land law in 1993 and 1994, Doi Moi policy in 1986 affected on the changed of landuse system in the study side.

6.2 The farm performance of rice-based farming systems in the partially irrigated lowland

6.2.1 Mono traditional rice system in period 1996-2000

6.2.1.1 Productivity

Productivity was conventionally measured in terms of such units, etc., as tons, kilograms or litters of output respectively per acre, hectare. Productivity was an appropriate measure of system and activity performance. In the study, we would calculated average land side of family in this system and the productive value was measured some aspects as: yield per ha, gross margin per ha, return to family labor cost, total return labor cost, gross margin per ha, and benefit and cost ratio. We can evaluate economic efficiency of this system through all mentioned aspects. The gross margin per ha was calculated by gross income minus by total variable cost. The return to family labor cost per ha was equal the gross margin to divide by total family labor and total variable cost was total of seeds, fertilizers, insecticides, hired labor and family labor for per hectare.

Table 6.3 showed that productivity value of yield per ha of the system was equal 3,841 kg. Gross margin, benefit and cost ratio, return to family cost and the return to labor cost were equal 4,488,000 VND, 1.85, 118,730 VND and 70,350 VND. For getting among of this productivity values, average input used per ha in this

system as like: seed = 316,00 VND, fertilizer = 534,000 VND, insecticides = 96,000 VND, hired labor = 718,000 VND and family labor was 758,000 VND. The return to family labor cost was 118,730 VND, means farmer worked in this system on man-day, she or he would get 118,730 VND.

Besides, I calculated benefit cost ratio of the system at about 1.85 that means the farmer to invest 1 VND for the system, she or she would get 1.85 VND return.

Table 6.3 Worksheet for deriving rice productivity values in MTRS of household during 1996-2000 (n=30)

Item	Quantity	Unit	Price/Unit (VND)	Value (1000VND)
Average land area	1.57	ha		
Yield	3,841.00	kg	1,799	6,910
Variable cost				
- Seed	175.65	kg	1,799	316
- Fertilizer				534
- Insecticide				96
- Hired labor	36.77	MD	19,527	718
- Family labor	37.80	MD	19,527	758
Total variable cost				2,422
Gross margin				4,488
Return to family labor cost		MD		118.73
Return to labor cost		MD		70.35

Note: MD = Man-day

Relation of the area with yield of traditional rice of each farm in MTRS

Relation of the area of farm household with average rice yield (kg/ha) of the traditional rice in MTRS during 1975 to 2000 showed us to know, the farm side in-group between 0.2 and 1 hectare had rice yield at average level from 4.5 tons per hectare. The most farm side in-group between 1 and 2.7 hectare had yield at highest-level about 5.5 tons per hectare while little number farms in this group also had lowest yield about 2.2 tons per hectare. Finally, three farms have side greater than 2.7 hectare; the yields were at under average level at about 2.8 to 3.5 tons per hectares (Figure 6.5).
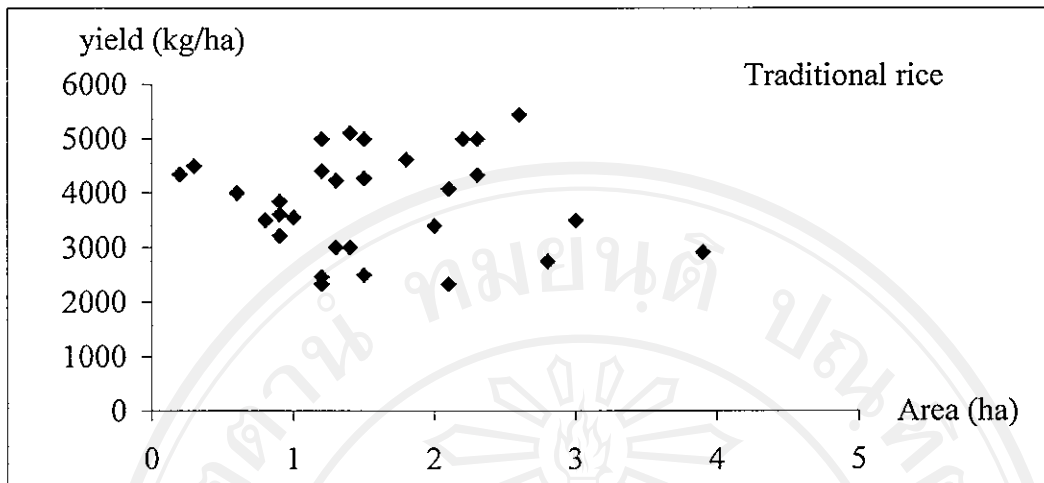
Figure 6.5 Relationship between farm holding size and average rice yield of traditional rice in MTRS

6.2.1.2 Stability

System stability refers to the absence or minimization of year-to-year fluctuations in either production or value of output.

In the study, I measured two aspects such as time dispersion and income stability of system by CV indicator. Because, CV was used to compare the relative stability of different activities/systems and the time dispersion showed us to know income distribution of the system in term of year and the income stability showed average income monthly of the system.

Time dispersion of each household income in the MTRS is important criteria in evaluating crops composition for one. The total annual incomes or outputs of the farm households were concentrated within a single harvest month or in could be perfectly dispersed uniformly of over 12 months.

Income diversity of each farm

Table 6.4 showed CV values of each farm household fluctuated between 199.2 and 379.5. If CV value were big number then this income stability of farm households in this system were less stability and else. The most of farms in system have CV values greater than 300 at 50 percent in the system, which means income stability of farm households in this system, were less stability.

Average monthly income between farms also had the difference that fluctuated from 130.1 of household number seven to 1730.6 of household number thirty. Because this fluctuation depends on area of farms and it also showed the efficiency of farms. Which farms had large areas then it would get high income than smaller farms (Table 6.4).

SD fluctuated from 493.7 of farm number seven to 3824.1 of household number eight that means the income of households of the system were very different (Table 6.4).

Table 6.4 showed that, in MTRS had fifteen farm households to sell their products at one month, four farm households had income at two months and finally eleven farms' income were distributed on three months per year.

Table 6.4 Average monthly incomes of time dispersion and income stability of 30 farm households in MTRS during 1996-2000 (x1000VND)

Farm	Jan	Nov	Dec	Mean	SD	CV
1	4,658.7	0.0	0.0	388.2	1,473.2	379.5
2	4,795.8	0.0	6,318.3	926.2	2,370.4	255.9
3	5,726.7	1,064.5	6,480.2	1,105.9	2,545.3	230.1
4	0.0	4,831.8	0.0	402.7	1,527.9	379.5
5	5,212.4	968.9	5,898.2	1,006.6	2,316.7	230.1
6	4,859.4	0.0	0.0	405.0	1,536.7	379.5
7	0.0	1,561.1	0.0	130.1	493.7	379.5
8	7,737.1	0.0	10,193.3	1,494.2	3,824.1	255.9
9	0.0	6,294.1	0.0	524.5	1,990.4	379.5
10	6,066.0	1,127.5	6,864.1	1,171.5	2,696.1	230.1
11	4,922.0	913.5	5,553.7	949.1	2,184.1	230.1
12	8,459.0	1,572.3	9,572.0	1,633.6	3,759.7	230.1
13	2,814.7	0.0	3,708.2	543.6	1,391.2	255.9
14	0.0	6,117.9	0.0	509.8	1,934.6	379.5
15	7,595.2	1,411.8	8,594.6	1,466.8	3,375.8	230.1
16	2,970.4	0.0	3,913.4	573.7	1,468.2	255.9
17	0.0	2,591.4	0.0	216.0	819.5	379.5
18	8,659.0	4,609.5	6,798.3	1,672.2	3,369.4	201.5
19	0.0	7,247.7	0.0	604.0	2,291.9	379.5
20	10,932.1	6,032.0	8,370.5	2,111.2	4,239.7	200.8
21	6,375.2	1,185.0	7,214.0	1,231.2	2,833.6	230.1
22	0.0	0.0	10,649.7	887.5	3,367.7	379.5
23	5,388.4	2,199.3	4,899.7	1,040.6	2,167.6	208.3
24	8,382.5	0.0	0.0	698.5	2,650.8	379.5
25	6,478.5	0.0	0.0	539.9	2,048.7	379.5
26	0.0	0.0	9,556.6	796.4	3,022.1	379.5
27	0.0	0.0	4,259.9	355.0	1,347.1	379.5
28	0.0	5,102.9	0.0	425.2	1,613.7	379.5
29	0.0	0.0	11,929.4	994.1	3,772.4	379.5
30	8,961.1	5,665.7	6,140.2	1,730.6	3,447.6	199.2

Note: Other months had no income

Income diversity of MTRS

Time dispersion of the household incomes in the MTRS was important criteria in evaluating crops composition. The total annual incomes or outputs of the farm

households were concentrated within a single harvest month or in could be perfectly dispersed uniformly of over 12 months.

Table 6.5 showed income of MTRS concentrated on three months as: January, November and December. In the December, income had among largest than other with 4,732,000 VND and income dispersion had CV of 192.70 percent. Income stability depended on CV value, if the system had CV of high value that means this system had instability about income.

Income stability of MTRS

There was variation in average monthly income distribution of MTRS. Table 6.5 showed rice provides of average monthly income at about 922,000 VND per hectare.

Table 6.5 Average monthly income of time dispersion and income stability of MTRS during 1996-2000

Month and Statistic	Income (1000 VND)
January	4,275
February	0
March	0
April	0
May	0
June	0
July	0
August	0
September	0
October	0
November	2,054
December	4,732
Mean	922
SD	1,775.9
CV	192.7

6.2.1.3 Profitability

In this case, I calculated about gross incomes, total variable costs, gross margin, benefit and cost ratio, return to labor cost and return to family cost, because we want to know success of each farm in the system through profitability of farm household.

Table 6.6 indicated that hold land of farmers fluctuated between 0,2ha and 3.9ha per household. The largest farm in the system belonged 12th household with 3.9ha while smallest farm was 7th household with 0.2 ha. All farm of the had values of benefit and cost ratio that was plus number, farmers got profitability from their cropping cultivation. Table 6.6 showed that the return variable cost fallen down plus income because all of interviewed farmers had the benefit and cost ratio was between 0.73 and 3.52. That means for every 1 VND invested in this system farmer would get 0.73 and 3.52 VND return. Farm household had smallest return to family labor cost with 45,610 VND and farm household 18 had largest return to family labor cost with 205,260 VND, means farmer of 1 worked in their farm on man-day, she or he would get 45,610 VND and 205,260 VND for farm household 18. While return to labor cost of the farm household varied 22,620 VND for farm household number 1 to 127,010 VND for farm household 20, means he or she would get 32,710 VND or 127,010 VND for each man-day worked in their farm.

Table 6.6 Gross margin of the traditional rice among 30 farm households in MTRS during 1996-2000

Farm	APR (ha)	GI (1000VND)	TVC (1000VND)	GM (1000VND)	BCR (1000VND)	RFLC (1000VND)	RLC (1000VND)
1	1.2	4,658.7	2,697.5	1,961.2	0.7	45.6	32.7
2	2.0	11,114.1	4,760.5	6,353.6	1.3	97.8	55.4
3	2.8	13,271.3	5,876.9	7,394.5	1.3	75.5	50.6
4	1.2	4,831.8	2,606.7	2,225.1	0.9	47.3	36.5
5	1.4	12,079.5	2,976.3	9,103.2	3.1	162.6	106.2
6	0.8	4,859.4	2,251.9	2,607.5	1.2	89.9	49.9
7	0.2	1,561.1	633.9	927.2	1.5	103.0	56.4
8	2.3	17,930.3	5,588.9	12,341.4	2.2	162.4	90.7
9	1.0	6,294.1	3,176.9	3,117.2	1.0	91.7	48.1
10	1.8	14,057.6	4,740.2	9,317.4	2.0	172.5	84.1
11	1.3	11,389.2	3,323.8	8,065.4	2.4	192.0	101.9
12	3.9	19,603.3	9,663.4	9,939.9	1.0	91.6	53.4
13	0.9	6,522.9	1,953.4	4,569.5	2.3	145.3	84.0
14	0.9	6,117.9	2,220.8	3,897.1	1.8	102.6	75.2
15	3.0	17,601.6	6,842.0	10,759.6	1.6	109.8	63.8
16	1.3	6,883.8	3,305.7	3,578.2	1.1	62.8	47.2
17	0.3	2,591.4	755.4	1,836.0	2.4	114.8	77.0
18	2.2	20,066.8	4,467.4	15,599.4	3.5	205.3	113.0
19	1.4	7,247.7	3,302.0	3,945.7	1.2	75.9	48.8
20	2.6	25,334.6	5,602.9	19,731.7	3.5	201.3	127.0
21	2.1	14,774.2	3,718.4	11,055.7	3.0	145.5	86.9
22	1.2	10,649.7	2,648.8	8,000.8	3.0	177.8	94.7
23	1.5	12,487.5	3,956.9	8,530.6	2.2	123.0	83.4
24	2.1	8,382.5	4,957.2	3,425.3	0.7	51.9	36.9
25	1.5	6,478.6	3,001.3	3,477.3	1.2	65.6	44.3
26	1.2	9,556.6	2,448.1	7,108.5	2.9	126.9	92.4
27	0.6	4,259.9	1,444.7	2,815.2	2.0	117.3	73.5
28	0.9	5,103.0	2,237.5	2,865.5	1.3	84.3	46.0
29	1.5	11,929.4	3,655.7	8,273.7	2.3	153.2	90.0
30	2.3	20,766.9	5,846.5	14,920.4	2.6	196.3	107.7

Note: APR = Area planted to rice; GI = Goss Income; TVC = Total variable cost; GM = Gross margin; BCR= Benefit cost ratio; RFLC = Return to family labor cost; and RLC = Return to labor cost.

6.2.1.4 Diversity

As exemplified in Simpson's DI can also be fluctuated relative to income. The calculated DI values of income indicate the farm was more diversified in physical terms than it was in economic terms. Another convenient measure of income diversity was given by the income diversity ratio.

Diversity referred to the number of species/activities and economic income in system or in each farm. A high diversity level was conductive to system stability because it may help to reduce system risk and increase productivity and profitability.

Income diversity of each farm

DI of monthly income of farms in MTRS varied on interval 0.0 and 0.7. Which farms got 0.0 values that means those farms only had monthly income on one month, had no diversity about income. Table 6.7 also proved that the most farms in this system those were less income diversity. This system was not good income diversity.

Table 6.7 Calculation of DI and R of farm households in MTRS during 1996-2000 (x1000VND)

Farm	Jan	Nov	Dec	Sum	ID	R
1	4,658.7	0.0	0.0	1.00	0.0	1.00
2	4,795.8	0.0	6,318.3	0.51	0.5	1.96
3	5,726.7	1,064.5	6,480.2	0.43	0.6	2.32
4	0.0	4,831.8	0.0	1.00	0.0	1.00
5	5,212.4	968.9	5,898.2	0.43	0.6	2.32
6	4,859.4	0.0	0.0	1.00	0.0	1.00
7	0.0	1,561.1	0.0	1.00	0.0	1.00
8	7,737.1	0.0	10,193.3	0.51	0.5	1.96
9	0.0	6,294.1	0.0	1.00	0.0	1.00
10	6,066.0	1,127.5	6,864.1	0.43	0.6	2.32
11	4,922.0	913.5	5,553.7	0.43	0.6	2.32
12	8,459.0	1,572.3	9,572.0	0.43	0.6	2.32
13	2,814.7	0.0	3,708.2	0.51	0.5	1.96
14	0.0	6,117.9	0.0	1.00	0.0	1.00
15	7,595.2	1,411.8	8,594.6	0.43	0.6	2.32
16	2,970.4	0.0	3,913.4	0.51	0.5	1.96
17	0.0	2,591.4	0.0	1.00	0.0	1.00
18	8,659.0	4,609.5	6,798.3	0.35	0.6	2.83
19	0.0	7,247.7	0.0	1.00	0.0	1.00
20	10,932.1	6,032.0	8,370.5	0.35	0.6	2.84
21	6,375.2	1,185.0	7,214.0	0.43	0.6	2.32
22	0.0	0.0	10,649.7	1.00	0.0	1.00
23	5,388.4	2,199.3	4,899.7	0.37	0.6	2.69
24	8,382.5	0.0	0.0	1.00	0.0	1.00
25	6,478.5	0.0	0.0	1.00	0.0	1.00
26	0.0	0.0	9,556.6	1.00	0.0	1.00
27	0.0	0.0	4,259.9	1.00	0.0	1.00
28	0.0	5,103.0	0.0	1.00	0.0	1.00
29	0.0	0.0	11,929.4	1.00	0.0	1.00
30	8,961.1	5,665.7	6,140.2	0.35	0.7	2.87

Note: Other months had no income

Income diversity of MTRS

I used Simpson Diversity index to measure diversity of MTRS. As showed on the table, DI of monthly income of MTRS was equal 0.63. The value of R in this

system was 2.73 at normal level that means the higher the degree of income diversity of MTRS be normal (Table 6.8).

Table 6.8 Calculation of DI and R of MTRS during 1996-2000

Month and Statistic	Annual income (1000VND)	$(n/N)^2$
January	4,275	0.15
November	2,054	0.03
December	4,732	0.18
Sum		0.37
DI		0.63
R		2.73

Note: Other months had no income

6.2.1.5 Sustainability

Sustainability was meant the capacity of a system to maintain its productivity/profitability at a satisfactory level over a long or indefinite time period regardless of year-to-year fluctuations. In an agricultural production context, the concept involves of sustainability was evaluated based on farm activities and systems in terms of their ecological, economic and socio-cultural sustainability over long time periods of many years.

Sustainability of each farm in the system

In the case, I evaluated sustainable of farm household base on total scores of each farm. Table 6.9 showed 26 had highest sustainable farm than other with total points was equal 26, while 10, 11, 17 and 23 with total points were equal 24 and lowest sustainable farms were farm number 1 and 24 at 14 points. Table 6.9 showed the sustainable of farms that were divided into 6 group: first had 1 household at best sustainability, second had four households at better, third was largest group with 15 households, next group had 3 households, 5 households and last one had 2 households.

Table 6.9 Sustainability levels of 30 farms of the MTRS during 1996-2000

Farm	Yield	FU	DC	WC	WM	SNM	Total	Ranking
1	1	3	3	1	5	1	14	6
24	1	3	5	3	1	1	14	6
9	3	5	1	1	3	3	16	5
19	3	3	3	3	3	1	16	5
4	1	3	3	3	1	5	16	5
25	1	1	5	3	3	3	16	5
21	5	1	3	1	3	3	16	5
29	5	3	5	1	3	1	18	4
7	5	5	1	3	1	3	18	4
14	3	3	3	3	5	1	18	4
2	3	3	5	3	3	3	20	3
28	3	3	5	1	3	5	20	3
3	3	3	3	3	3	5	20	3
8	5	3	3	3	5	1	20	3
12	3	5	5	1	3	3	20	3
18	5	3	5	1	5	1	20	3
27	3	3	3	3	3	5	20	3
30	5	3	1	3	5	3	20	3
22	5	1	5	1	5	3	20	3
6	3	3	3	5	3	3	20	3
20	5	3	3	1	5	3	20	3
13	3	5	3	5	3	3	22	3
15	3	3	5	3	5	3	22	3
5	5	3	3	5	3	3	22	3
16	3	3	5	3	5	3	22	3
17	5	5	5	1	5	3	24	2
11	5	5	3	5	1	5	24	2
23	5	5	3	5	5	1	24	2
10	5	5	5	5	3	3	26	2
26	5	3	5	5	5	3	26	1

Note: Farmer ID = farmer identification; FU= Fertilizer Using; DC= Disease control; WT= Weed control; WM= Water management; and SNM= Soil nutritional management.

6.2.2 Modern rice - traditional rice system in period 1996-2000

6.2.2.1 Productivity

In the MR-TRS, productivity of the system was also fluctuated the same way as the MTRS.

Productivity of traditional rice in MR-TRS

Table 6.10 showed that productivity value of yield per ha of the system was equal 4064 kg. Gross margin, return to family cost and the return to labor cost were equal 5,179,000 VND, 165,100 VND and 91,400 VND. For receive the yield of grain rice per hectare, farmers must to invest total variable cost about 2,098,000 VND, Total variable cost compared of total of: Seed was 312,000 VND, Fertilizer was 427,000 VND, Insecticide was 86,000 VND, Hired labor was 645,000 VND and Family labor was 628,000 VND. The benefit cost ratio of traditional rice was equal 2.47 that means the farmer to invest 1 VND for the system, she or she would get 2.47 return.

Table 6.10 Worksheet for deriving rice productivity values on the traditional rice in MR-TRS of household during 1996-2000 (n=30)

Item	Quantity	Unit	Price/Unit (VND)	Value (1000VND)
Average land area	1.36	ha		
Yield	4,064.00	kg	1,790	7,277
Variable cost				
- Seed	174.00	kg	1,790	312
- Fertilizer				427
- Insecticide				86
- Hired labor	32.19	MD	20,030	645
- Family labor	31.36	MD	20,030	628
Total variable cost				2,098
Gross margin				5,179
Return to family labor cost				165.1
Return to labor cost				91.4

Note: MD = Man-day

Relation of the area with yield of traditional rice of each farm in MR-TRS

Figure 6.6 showed that the area of farm households' in-group between 0.4 and 2 hectare had rice yield more than 3 tons per hectare to 6 tons per hectare with high frequency and had 2 farms in its group had yield less than 3 tons per hectare. Finally, farms group had side greater than 2 hectare the yields were under medium level about 1.8 to 3 tons per hectares with high frequency, and only two farms had yield greater than 4 tons per hectare.

Figure 6.6 Relationship between farm holding size and average rice yield of traditional rice in MR-TRS

Productivity of Modern rice in MR-TRS

Table 6.11 showed that productivity value of yield per ha of the system was equal 3,340 kg. Gross margin, return to family cost and the return to labor cost were equal 3,318,000 VND, 90,300 VND and 56,500 VND. For getting among of this productivity values, average input used per ha of farm like as: seed was 366,00 VND, fertilizer was 550,000 VND, insecticides was 871,000 VND, hired labor was 693,000 VND and family labor was 730,000 VND. The return to family labor cost was 90,300 VND, means farmer worked in this system on man-day, she or he would get 90,300 VND. The benefit cost ratio was 1.03 that means the farmer to invest 1 VND for the system, she or she would get 1.03 VND return.

Table 6.11 Worksheet for deriving rice productivity values on the modern rice in MR-TRS of household during 1996-2000 (n=30)

Item	Quantity	Unit	Price/Unit (VND)	Value (1000VND)
Average land area	1.00	ha		
Yield	3340.00	kg	1,950	6,528
Variable cost				
- Seed	188.00	kg	1,950	366
- Fertilizer				550
- Insecticide				871
- Hired labor	34.89	MD	19,900	693
- Family labor	36.74	MD	19,900	730
Total variable cost				3,210
Gross margin				3,318
Return to family labor cost				90.3
Return to labor cost				56.5

Note: MD = Man-day

Relation of the area with yield of modern rice of each farm in MR-TRS

The group had farm side between 0.2 and 1.2 hectare to occupy more than 82 percent of MR-TRS and this group also had rice yield to fluctuate from 1.5 tons per hectare to 5.5 tons per hectare. Finally, farms group had side greater than 1.2 hectare the yields at medium level at about 1.8 to 3 tons per hectares with high frequency, and only two farms had yield greater than 4 tons per hectare (Figure 6.7)
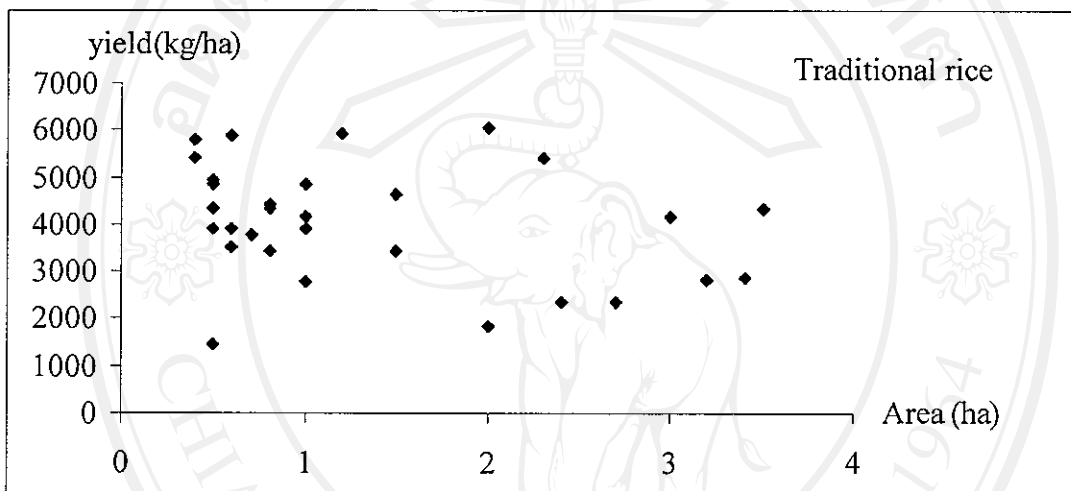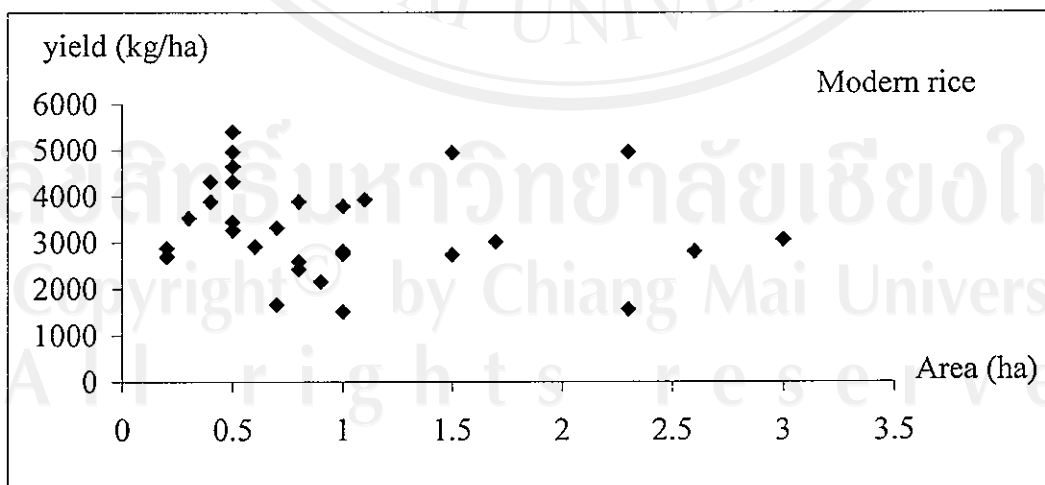

Figure 6.7 Relationship between farm holding size and average rice yield of modern rice in MR-TRS.

6.2.2.2 Stability

Like as MTRS, time dispersion of each household income in the MR-TRS was fluctuated monthly income mean, SD and CV of the monthly incomes within a single harvest month or in could be perfectly dispersed uniformly of over 12 months.

Time dispersion and income stability of farm households in MR-TRS

Mean of monthly incomes mean of farms very depend on the farm side, sometimes it high varied in different farm households. Table 6.12 showed that monthly incomes mean of farms were about from 480,500 VND of household number 15 to 3,502,800 VND of household number 6. Monthly incomes of farms 6 and 15 were greater than 3,000,000 VND; 3 farms were greater than 2,000,000 VND and remaining farms were less than 2,000,000 VND.

SD of income stability of farm households in MR-TRS varied from 728.29 of farm number twenty-one to 4869.14 of household number seventeen. But also showed that, three farms number 5, 6 and 17 had highest SD with values: 4,418.65, 4,603.09 and 4869.14 means those farms had lowest the income stability in term of year than other and farm number 21 was best the income stability with 728.29 of SD (Table 6.12).

Table 6.12 showed, CV values of each farm household fluctuated between 131.4 and 274.0, with CV of 10 farms were greater than 200 while CV of 20 farms were greater than 100 to less than 200. That means income stability of farm households in this system was higher stability than in MTRS.

Farms in MDTRS had least two months for getting of the income; means farm households to sell their products at two months and 12 farms to get income on 6 months per year (Table 6.12).

Table 6.12 Average monthly incomes of time dispersion and income stability of 30 farm households in MR-TRS during 1996-2000 (x1000VND)

Farm	Jan	Feb	Jun	Jul	Aug	Dec	Mean	SD	CV
1	4,555.5	0.0	3,470.9	0.0	0.0	0.0	668.9	1,579.2	236.1
2	5,199.6	4,176.9	1,079.8	4,199.6	1,513.7	1,287.3	1,454.8	1,950.3	134.1
3	4,554.4	3,658.6	945.0	0.0	0.0	1,127.5	857.1	1,580.5	184.4
4	0.0	0.0	0.0	0.0	4,819.5	4,633.2	787.7	1,840.2	233.6
5	12,680.6	10,186.5	0.0	3,780.0	0.0	3,139.4	2,482.2	4,418.7	178.0
6	10,474.1	8,414.0	3,266.9	12,705.7	4,579.7	2,593.1	3,502.8	4,603.1	131.4
7	6,256.0	5,025.6	0.0	2,646.0	0.0	1,548.8	1,289.7	2,212.2	171.5
8	0.0	0.0	2,011.0	0.0	0.0	4,375.8	532.2	1,341.4	252.0
9	3,421.8	2,748.8	1,348.3	5,243.9	1,890.1	847.2	1,291.7	1,728.1	133.8
10	7,313.9	5,875.4	2,699.6	10,499.1	3,784.3	1,810.7	2,665.3	3,540.5	132.8
11	4,377.4	3,516.4	1,939.6	7,543.3	2,718.9	1,083.7	1,764.9	2,400.3	136.0
12	7,906.9	6,351.7	0.0	5,222.9	0.0	1,957.5	1,786.6	2,949.1	165.1
13	5,774.2	4,638.5	1,304.7	5,074.3	1,829.0	1,429.5	1,670.9	2,219.7	132.8
14	10,911.2	8,765.1	1,143.9	4,449.0	1,603.6	2,701.3	2,464.5	3,741.2	151.8
15	4,498.2	0.0	0.0	0.0	1,267.2	0.0	480.5	1,316.7	274.0
16	0.0	0.0	0.0	5,670.0	0.0	4,315.7	832.1	1,964.8	236.1
17	13,952.8	11,208.5	1,914.8	7,447.2	2,684.3	3,454.4	3,388.5	4,869.1	143.7
18	3,693.6	0.0	431.9	1,679.9	605.5	0.0	534.2	1,111.6	208.1
19	0.0	1,255.1	0.0	4,968.0	0.0	0.0	518.6	1,446.9	279.0
20	1,674.2	1,344.9	987.1	3,839.1	1,383.8	414.5	803.6	1,154.5	143.7
21	1,885.2	1,514.4	432.6	1,682.5	606.5	466.7	549.0	728.3	132.7
22	3,241.8	2,604.2	639.7	2,487.8	896.7	802.6	889.4	1,200.2	134.9
23	0.0	0.0	1,087.7	4,230.4	1,524.8	6,022.1	1,072.1	1,997.2	186.3
24	2,177.7	1,749.4	0.0	3,349.7	0.0	539.1	651.3	1,137.1	174.6
25	4,411.7	3,543.9	6,48.9	2,523.8	909.7	1,092.2	1,094.2	1,551.1	141.8
26	4,247.6	0.0	0.0	3,334.0	0.0	0.0	631.8	1,488.4	235.6
27	3,747.0	3,010.0	1,141.6	4,440.0	1,600.4	927.6	1,238.9	1,627.1	131.3
28	3,931.2	0.0	0.0	0.0	3,974.4	0.0	658.8	1,538.7	233.6
29	3,222.8	2,588.9	1,944.0	0.0	0.0	797.9	712.8	1,183.5	166.0
30	5,944.3	0.0	6,92.2	2,692.1	970.3	0.0	858.2	1,787.9	208.3

Note: Other months had no income

Time dispersion and income stability of MR-TRS

Table 6.13 showed income of the traditional rice concentrated on three months as: January, November and December. In the January, income was highest than other at about 4,957,000 VND and income dispersion had CV of 199.81 percent. The

income of modern rice distributed on June was 1,068,000 VND, July was 4,023,000 VND and August was 1,436,000 VND and income dispersion had CV of 220.59 percent. The income dispersion CV of the traditional rice smaller than income dispersion CV of the modern rice that means the income distribution of the traditional rice was more stable than the income distribution of modern crop in the system.

There was variation in average monthly income distribution of system. The traditional rice contributes production average income at about 825,000 VND and the modern rice was 544,000 VND per month (Table 6.13).

Table 6.13 Average monthly income of time dispersion and income stability of MR-TRS during 1996-2000

Month and Statistic	Annual Income of Traditional Rice (1000VND)	Annual Income of Modern Rice (1000VND)
January	4,957	0
February	3,263	0
March	0	0
April	0	0
May	0	0
June	0	1,068
July	0	4,023
August	0	1,436
September	0	0
October	0	0
November	0	0
December	1,677	0
Mean	825	544
SD	1,648	1,200
CV	199.81	220.59

6.2.2.3 Profitability

Gross margin analysis of traditional rice of MR-TRS

Farm side of farm households fluctuated between 0.4ha and 3.5ha for each farm, largest farm number 5 was 3.5ha and smallest farm number 28 was 0.4ha. Benefit and cost ratio of farm households in the system showed us to know

successfully levels of farmer about profitability. If the farm had highest the benefit cost ratio then this farm get highest income if we compare with other farms that also had the same meaning with highest investment efficiency of the farm households (Table 6.14).

Table 6.14 indicated that the benefit cost ratio of this crop was greater than or equal 0.7, means all farms of production had efficiencies about economic aspects. 22nd farm had best returning for benefit cost ratio than other farms, its the benefit cost ratio was 4.8, means farmer of 22nd farm invested 1 VND for production they would get 4.8 VND, while 9th farm had lowest the benefit cost ratio with 0.7. Return to family labor cost of this crop fluctuated between 38,300 VND and 417,500 VND, while the return to labor cost varied between 30,000 VND and 211,700 VND.

Table 6.14 Gross margin of traditional rice among 30 farm households in MR-TRS during 1996-2000

Farm	APR (ha)	GI (1000VND)	TVC (1000VND)	GM (1000VND)	BCR (1000VND)	RFLC (1000VND)	RLC (1000VND)
1	0.8	4,555.5	1,734.1	2,821.4	1.6	111.0	73.0
2	2.7	10,663.8	4,152.1	6,511.7	1.6	100.2	50.7
3	2.4	9,340.5	3,573.0	5,767.6	1.6	88.7	54.1
4	1.0	4,633.2	2,127.1	2,506.1	1.2	71.6	42.6
5	3.5	26,006.4	7,399.6	18,606.8	2.5	241.6	126.5
6	2.3	21,481.2	4,650.3	16,830.9	3.6	263.0	141.3
7	1.2	12,830.4	2,392.8	10,437.6	4.4	417.5	211.7
8	0.5	4,375.8	1,240.9	3,134.9	2.5	149.3	74.2
9	2.0	7,017.8	4,016.9	3,001.0	0.7	41.1	30.0
10	3.2	15,000.0	4,852.4	10,147.6	2.1	152.4	78.7
11	1.5	8,977.5	2,986.2	5,991.3	2.0	111.6	64.5
12	3.4	16,216.2	6,534.2	9,682.0	1.5	127.8	70.8
13	1.5	11,842.2	3,347.1	8,495.1	2.5	242.7	122.4
14	2.0	22,377.6	4,157.6	18,220.0	4.4	299.7	132.1
15	0.7	4,498.2	1,826.3	2,671.9	1.5	106.9	58.9
16	0.6	4,315.7	1,280.7	3,035.0	2.4	106.1	69.2
17	3.0	28,615.7	5,185.6	23,430.1	4.5	280.8	138.2
18	0.5	3,693.6	944.5	2,749.1	2.9	161.7	82.0
19	0.5	1,255.1	641.7	613.5	1.0	38.3	40.6
20	0.5	3,433.5	852.0	2,581.5	3.0	215.1	119.5
21	0.4	3,866.4	1,040.2	2,826.2	2.7	115.8	95.6
22	0.6	6,648.5	1,142.6	5,505.9	4.8	305.9	171.3
23	0.8	6,022.1	2,264.8	3,757.3	1.7	178.9	87.8
24	0.6	4,466.2	1,472.1	2,994.2	2.0	124.8	85.6
25	1.0	9,047.8	2,187.4	6,860.4	3.1	257.3	116.8
26	0.5	4,247.6	1,184.1	3,063.5	2.6	161.2	87.4
27	1.0	7,684.6	1,580.7	6,103.9	3.9	254.3	147.0
28	0.4	3,931.2	1,030.6	2,900.6	2.8	193.4	92.6
29	1.0	6,609.6	2,073.1	4,536.5	2.2	216.0	99.1
30	0.8	5,944.3	2,222.1	3,722.2	1.7	161.8	88.5

Note: APR = Area planted to rice; GI = Goss Income; TVC = Total variable cost; GM = Gross margin; BCR= Benefit cost ratio; RFLC = Return to family labor cost; and RLC = Return to labor cost.

Gross margin analysis of modern rice of MR-TRS

Farm side of households fluctuated between 0.2 ha and 3.0 ha, largest farm was farm number 10 with 3.0 ha and smallest farm was farm number 15. Benefit cost

ratio of farm households in the system, showed us to know successfully levels of farmer about profitability. If the farm had highest the benefit cost ratio then this farm get highest income that also had the same meaning with highest investment efficiency of the farm households and then else (Table 6.15).

Table 6.15 indicates that the benefit and cost ratio of this crop had minus number for the benefit and cost ratio; means that farm households gets no income from their farms. Benefit cost ratio of farm number 29 was –0.3, while farm number 2 was –0.1 and farm number 7 was –0.1, means three farm households fall down the situation gross income less than input costs. If we compare this crop with the traditional rice of the farming system, we can conclude that the efficiencies of modern rice were less than the traditional rice in this farming system. Farm number 27 had best benefit cost ratio than other farms, its the benefit cost ratio was 3.5, means farmer of farm number 27 invested 1 VND for production they would get 3.5 VND. Return to family labor cost of this crop fluctuated between –26,200 VND and 404,000 VND, while the return to labor cost varied between –2,900 VND and 221,300 VND.

Table 6.15 Gross margin of modern rice among 30 farm households in MR-TRS during 1996-2000

Farm	APR (ha)	GI (1000VND)	TVC (1000VND)	GM (1000VND)	BCR (1000VND)	RFLC (1000VND)	RLC (1000VND)
1	0.9	3,470.9	2,295.8	1,175.1	0.5	58.8	33.6
2	2.3	6,793.2	7,643.5	-850.3	-0.1	-12.3	3.9
3	0.2	945.0	537.4	407.6	0.8	45.3	33.9
4	1.0	4,819.5	1,547.3	3,272.2	2.1	86.1	57.9
5	0.7	3,780.0	2,177.8	1,602.2	0.7	66.8	45.5
6	2.3	20,552.3	8,895.3	11,656.9	1.3	147.6	86.0
7	1.0	2,646.0	2,878.9	-232.9	-0.1	-6.3	8.6
8	0.3	2,011.0	704.1	1,306.9	1.9	81.7	59.6
9	1.7	8,482.3	3,350.4	5,131.9	1.5	131.6	75.9
10	3.0	16,983.0	8,282.6	8,700.4	1.1	97.8	59.0
11	1.5	12,201.8	2,101.7	10,100.0	4.8	404.0	221.3
12	1.0	5,222.9	3,546.1	1,676.8	0.5	43.0	33.2
13	1.1	8,208.0	3,596.2	4,611.8	1.3	121.4	76.2
14	1.5	7,196.5	3,342.3	3,854.2	1.2	142.7	87.7
15	0.2	1,267.2	436.4	830.8	1.9	103.8	61.5
16	0.5	5,670.0	2,374.7	3,295.3	1.4	131.8	73.1
17	2.6	12,046.3	8,460.2	3,586.1	0.4	52.0	35.9
18	0.5	2,717.3	2,242.6	474.7	0.2	27.9	22.5
19	0.5	4,968.0	1,819.3	3,148.7	1.7	149.9	75.2
20	0.5	6,210.0	2,534.2	3,675.8	1.5	175.0	81.0
21	0.4	2,721.6	1,382.5	1,339.1	1.0	89.3	62.9
22	0.6	4,024.1	2,459.9	1,564.2	0.6	42.3	39.2
23	0.8	6,842.9	3,331.7	3,511.2	1.1	135.0	73.8
24	0.5	3,349.7	1,666.7	1,683.0	1.0	81.7	64.5
25	0.8	4,082.4	1,528.0	2,554.4	1.7	102.2	68.4
26	0.5	3,334.0	1,323.1	2,010.9	1.5	101.6	54.2
27	1.0	7,182.0	1,585.5	5,596.5	3.5	266.5	112.4
28	0.4	3,974.4	1,579.7	2,394.7	1.5	133.0	70.2
29	0.7	1,944.0	2,651.0	-707.0	-0.3	-26.2	-2.9
30	0.8	4,354.6	3,685.9	668.7	0.2	19.7	19.6

Note: APR = Area planted to rice; GI = Goss Income; TVC = Total variable cost; GM = Gross margin; BCR= Benefit cost ratio; RFLC = Return to family labor cost; and RLC = Return to labor cost.

6.2.2.4 Diversity

Diversity refers to the number of species/activities and economic income in system. A high diversity level was conductive to system stability because it may help to reduce system risk and increase productivity and profitability.

Income diversity of each farm

Table 6.16 indicates DI of monthly income of farms in MR-TRS varied on interval 0.3 and 0.8. Which farms had highest values of DI of monthly income those farms had more income diversity than other. Table 6.16 also proved that the most farms in this system had good income diversity with 12 farms' ID at about 0.8.

R of degree of income diversity of farms in system varied from 1.47 to 4.65. Total farms had R of degree of income diversity greater than 4 to occupy 12 over 30 farms, those farms had good income diversity. While farms had R of degree of income diversity less than 2, was 6 farms and greater than 2 and less than 4, was 6 farms. Finally, farms had R of degree of income diversity greater than 1 and less than 3, was 6 farms.

Table 6.16 Calculation of DI of MR-TRS during 1996-2000 (x1000VND)

Farm	Jan	Feb	Jun	Jul	Aug	Dec	Sum	DI	R
1	4,555.5	0.0	3,470.9	0.0	0.0	0	0.51	0.5	1.96
2	5,199.6	4,176.9	1,079.8	4,199.6	1,513.7	1,287.3	0.22	0.8	4.53
3	4,554.4	3,658.6	945.0	0.0	0.0	1,127.5	0.34	0.7	2.92
4	0.0	0.0	0.0	0.0	4,819.5	4,633.2	0.50	0.5	2.00
5	12,680.6	10,186.5	0.0	3,780.0	0.0	3,139.4	0.33	0.7	3.07
6	10,474.1	8,414.0	3,266.9	12,705.7	4,579.7	2,593.1	0.22	0.8	4.65
7	6,256.0	5,025.6	0.0	2,646.0	0.0	1,548.8	0.31	0.7	3.25
8	0.0	0.0	2,011.0	0.0	0.0	4,375.8	0.57	0.4	1.76
9	3,421.8	2,748.8	1,348.3	5,243.9	1,890.1	847.2	0.22	0.8	4.54
10	7,313.9	5,875.4	2,699.6	10,499.1	3,784.3	1,810.7	0.22	0.8	4.58
11	4,377.4	3,516.4	1,939.6	7,543.3	2,718.9	1,083.7	0.22	0.8	4.45
12	7,906.9	6,351.7	0.0	5,222.9	0.0	1,957.5	0.29	0.7	3.43
13	5,774.2	4,638.5	1,304.7	5,074.3	1,829.0	1,429.5	0.22	0.8	4.58
14	10,911.2	8,765.1	1,143.9	4,449.0	1,603.6	2,701.3	0.26	0.7	3.86
15	4,498.2	0.0	0.0	0.0	1,267.2	0.0	0.66	0.3	1.52
16	0.0	0.0	0.0	5,670.0	0.0	4,315.7	0.51	0.5	1.96
17	13,952.8	11,208.5	1,914.8	7,447.2	2,684.3	3,454.4	0.24	0.8	4.15
18	3,693.6	0.0	431.9	1,679.9	605.5	0.0	0.41	0.6	2.42
19	0.0	1,255.1	0.0	4,968.0	0.0	0.0	0.68	0.3	1.47
20	1,674.2	1,344.9	987.1	3,839.1	1,383.8	414.5	0.24	0.8	4.15
21	1,885.2	1,514.4	432.6	1,682.5	606.5	466.7	0.22	0.8	4.59
22	3,241.8	2,604.2	639.7	2,487.8	896.7	802.6	0.22	0.8	4.50
23	0.0	0.0	1,087.7	4,230.4	1,524.8	6,022.1	0.35	0.7	2.87
24	2,177.7	1,749.4	0.0	3,349.7	0.0	539.1	0.32	0.7	3.16
25	4,411.7	3,543.9	648.9	2,523.8	909.7	1,092.2	0.24	0.8	4.22
26	4,247.6	0.0	0.0	3,334.0	0.0	0.0	0.51	0.5	1.97
27	3,747.0	3,010.0	1,141.6	4,440.0	1,600.4	927.6	0.22	0.8	4.65
28	3,931.2	0.0	0.0	0.0	3,974.4	0.0	0.50	0.5	2.00
29	3,222.8	2,588.9	1,944.0	0.0	0.0	797.9	0.29	0.7	3.40
30	5,944.3	0.0	692.2	2,692.1	970.3	0.0	0.41	0.6	2.41

Note: *Other months had no income*

Income diversity of MR-TRS

As other farming systems, we used Simpson Diversity index to measure income diversity of MR-TRS and R to mean degree of income diversity, DI of monthly income of the MR-TRS was 0.79 and R was 4.70 (Table 6.17).

Table 6.17 Calculation of DI and R of MR-TRS during 1996-2000

Month and Statistic	MDTRS (1000VND)	(n/N)2	R^2
January	4,957	0.09	24,575,484
February	3,263	0.04	10,645,255
June	1,068	0.00	1,141,319
July	4,023	0.06	16,188,036
August	1,436	0.01	2,062,782
December	1,677	0.01	2,811,144
Sum		0.21	
DI		0.79	
R			4.70

Note: Other months had no income

6.2.2.5 Sustainability

Table 6.18 showed 8 groups about sustainable, 18th farms was best sustainability with 28 scores of this system, while 27th farm was at second level with 26 scores, next 6th, 8th and 9th farms had with 24 scores and etc, and finally, household number 13 was lowest sustainable than other of the system with 14scores. If we compare two groups: one was highest sustainable and other was most less sustainable, showed us to know, the most farm household success about high yield, efficiency disease management, and good weed control, while knowledge in fertilizer using and water management were at medium level.

Table 6.18 Sustainability levels of 30 farms of the MR-TRS during 1996-2000

Farm	Yield	FU	DM	WC	WM	SNM	Total	Ranking
13	5	1	1	3	1	3	14	8
4	3	3	3	3	1	3	16	7
7	5	1	3	3	1	3	16	7
23	5	1	3	1	3	3	16	7
28	5	3	3	3	1	1	16	7
12	3	5	1	1	3	5	18	6
25	5	1	5	5	1	1	18	6
3	1	5	5	5	3	1	20	5
19	1	5	5	5	3	1	20	5
10	1	5	5	5	3	1	20	5
15	3	1	5	3	3	5	20	5
16	3	5	5	3	1	3	20	5
24	3	1	5	5	3	3	20	5
29	3	1	5	5	3	3	20	5
30	5	1	3	3	3	5	20	5
5	5	1	3	3	3	5	20	5
20	3	3	5	3	3	3	20	5
2	1	5	5	5	3	3	22	4
1	3	1	5	5	3	5	22	4
11	3	5	5	5	3	1	22	4
17	5	3	5	5	3	1	22	4
14	5	3	5	5	3	1	22	4
21	5	1	5	5	1	5	22	4
22	5	5	3	5	3	1	22	4
26	5	3	5	5	3	1	22	4
9	1	5	5	5	3	5	24	3
6	5	3	5	5	5	1	24	3
8	5	3	5	5	3	3	24	3
27	5	3	5	5	3	5	26	2
18	5	5	5	5	3	5	28	1

Note: Farmer ID = identification; FU= Fertilizer Using; DC= Disease control; WT= Weed control; WM= Water management; and SNM= Soil nutritional management.

6.2.3 Mung bean - traditional rice system in period 1996-2000

6.2.3.1 Productivity

Productivity of traditional rice in MB-TRS

Average yield per ha of the traditional rice in the farming system was equal 3,930 kg. Farm households got high income at about 5,050,000 VND for gross margin and return to family labor cost and the return to labor cost were about 181,800 VND for family labor cost and 74,300 VND for labor cost, means farmer worked in this system on man-day, she or he would get 181,800 VND. For getting among of this productivity values, average input costs used per ha in this system as like: seed was 306,00 VND, fertilizer was 332,000 VND, insecticides was 263,000 VND, hired labor was 989,000 VND and family labor was 567,000 VND (Table 6.19). Benefit and cost ratio of this system was so high at about 2.06, means farmers would get 2.06 VND after 1 VND invested for their production.

Table 6.19 Worksheet for deriving rice productivity values on traditional rice production in MB-TRS of household during 1996-2000 (n=30)

Item	Quantity	Unit	Price/Unit (VND)	Value (1000VND)
Average land area	1.44	ha		
Yield	3,930.00	kg	1,910	7,507
Variable cost				
- Seed	160.00	kg	1,910	306
- Fertilizer				332
- Insecticide				263
- Hired labor	47.81	MD	20,700	989
- Family labor	27.78	MD	20,700	567
Total variable cost				2,457
Gross margin				5,050
Return to family labor cost				181.8
Return to labor cost				74.3

Note: MD = Man-day

Relation of the area with yield of traditional rice of each farm in MB-TRS

Figure 6.8 showed, the relation of the area with average rice yield of farm households of this system that was stable between different groups about land holding. But areas of group between 0.2 ha per farms and 2.7 ha per household had yield from 3 tons per hectare to 5.5 tons per hectare. Finally, group had areas greater than 2.5 ha per farm, was yield about 4.5 tons per hectare.
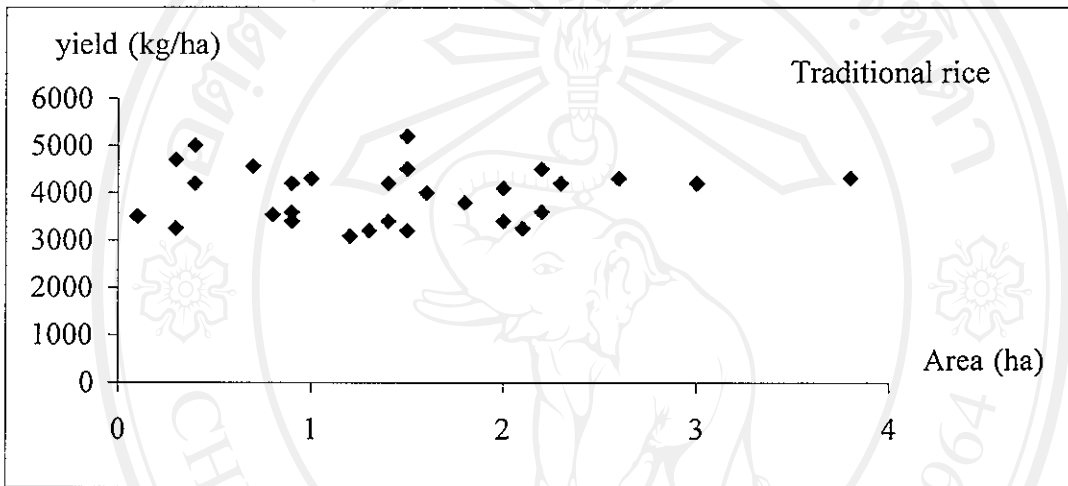
Figure 6.8 Relationship between farm holding size and average rice yield of traditional rice in MB-TRS

Productivity of mung bean in MB-TRS

Mung bean was an important crop to improve nutritional soil of commune by nitrogen fixation bacteria help to increase nitrogen dosage of the soil.

As the traditional rice production of this farming system, average landside for planted mung bean of per farm household was at about 0.69 ha. Productivity value of yield per ha, gross margin per ha was not yet high yield at about 1400 kg, but the farmer sell the mung bean product with higher price than grain rice products at about 4,995 VND per kilogram. Gross margin was at about 4,670,000 VND; Return to family labor cost was at about 100,900 VND and return to labor cost was at about 64,600 VND while the farmers must to invest with total variable cost at about 2,323,000 VND for their field that comprised of total input costs of as: seed was

217,000 VND, fertilizers were 364,000 VND, insecticide was 265,000 VND, hired labor cost was 672,000 VND, and family labor cost was 805,000 VND (Table 6.20).

Benefit and cost ratio of the system was at about 2.01; means after invested 1 VND farmers would get 2.01 VND return.

Table 6.20 Worksheet for deriving productivity values of mung bean production in MB-TRS of household during 1996-2000 (n=30)

Item	Quantity	Unit	Price/Unit (VND)	Value (1000VND)
Average land area	0.69	ha		
Yield	1400.00	kg	4,995	6,993
Variable cost				
- Seed		kg		217
- Fertilizer				364
- Insecticide				265
- Hired labor	38.54	MD	17,436	672
- Family labor	46.27	MD	17,436	805
Total variable cost				2,323
Gross margin				4,670
Return to family labor cost				100.9
Return to labor cost				64.6

Source: survey, 2003; Note: MD = Man-day

Relation of the area with yield of mung bean of each farm in MB-TRS

Figure 6.9 showed the most farm size fall down group between 0.5 ha and 0.9 ha per household and yield varied from 1 tone to 2.8 tons per hectare. Finally, this crop had not different about relations of the area of farm household with yield.

yield (kg/ha)

Mung bean

Area (ha)
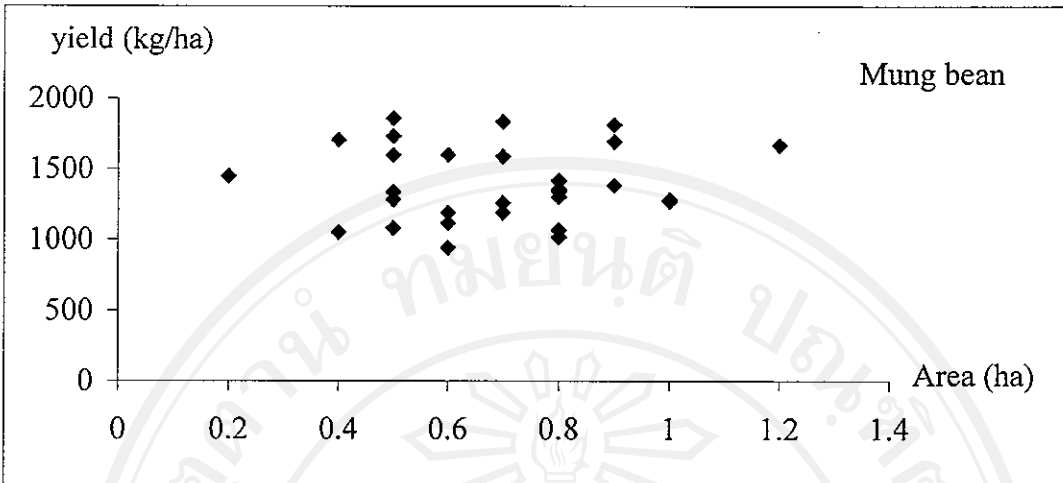
Figure 6.9 Relationship between farm holding size and average mung bean yield in

MB-TRS

6.2.3.2 Stability

Income diversity of each farm

SD of income stability of farm households in MB-TRS varied from 645 to 4708. Finally, the difference about the fluctuation of SD of income stability of MB-TRS and other systems that was no significant (Table 6.21).

Table 6.21 showed, CV of 7 farms were greater than 200 and less than 300, while 23 farms had CV values between 115 and 198, means income stability of farm households in this system was so stability.

Table 6.21 Average monthly incomes of time dispersion and income stability of 30 farm households in MB-TRS during 1996-2000 (x1000VND)

Farm	Jan	Feb	Mar	Apr	May	Jun	Dec	Mean	SD	CV
1	11,701.0	3,771.0	637.0	1,513.0	2,074.0	0.0	5,373.0	2,089.0	3,498.0	167.0
2	4,500.0	1,450.0	0.0	0.0	3,426.0	0.0	2,067.0	954.0	1,580.0	166.0
3	7,519.0	2,423.0	681.0	1,619.0	1,618.0	600.0	3,453.0	1,493.0	2,208.0	148.0
4	4,358.0	1,404.0	3,863.0	0.0	0.0	0.0	2,001.0	969.0	1,613.0	167.0
5	0.0	0.0	809.0	1,922.0	2,266.0	369.0	6,993.0	1,030.0	2,040.0	198.0
6	0.0	1,753.0	0.0	0.0	0.0	1,551.0	0.0	275.0	645.0	234.0
7	5,401.0	1,741.0	0.0	2,031.0	0.0	0.0	2,480.0	971.0	1,683.0	173.0
8	14,661.0	4,725.0	1,293.0	3,074.0	3,624.0	589.0	6,732.0	2,892.0	4,337.0	150.0
9	6,972.0	2,247.0	1,468.0	3,489.0	4,113.0	669.0	3,202.0	1,847.0	2,230.0	121.0
10	5,859.0	0.0	0.0	0.0	3,004.0	0.0	0.0	739.0	1,829.0	248.0
11	10,582.0	3,410.0	666.0	1,584.0	1,868.0	304.0	4,859.0	1,939.0	3,142.0	162.0
12	15,757.0	5,078.0	740.0	1,760.0	2,075.0	337.0	7,235.0	2,748.0	4,708.0	171.0
13	0.0	4,251.0	492.0	1,393.0	1,378.0	0.0	0.0	626.0	1,259.0	201.0
14	3,271.0	1,054.0	907.0	2,157.0	2,542.0	413.0	1,502.0	987.0	1,147.0	116.0
15	6,309.0	2,033.0	756.0	1,573.0	2,118.0	569.0	2,897.0	1,355.0	1,863.0	138.0
16	3,970.0	1,279.0	572.0	1,359.0	1,602.0	260.0	1,823.0	905.0	1,194.0	132.0
17	4,072.0	1,312.0	0.0	3,976.0	0.0	0.0	1,870.0	936.0	1,570.0	168.0
18	11,271.0	3,632.0	802.0	1,907.0	2,248.0	366.0	5,176.0	2,117.0	3,340.0	158.0
19	2,866.0	923.0	936.0	2,225.0	2,623.0	426.0	1,316.0	943.0	1,088.0	115.0
20	7,922.0	2,553.0	900.0	2,140.0	2,523.0	410.0	3,638.0	1,674.0	2,351.0	140.0
21	0.0	0.0	0.0	0.0	0.0	3,524.0	2,697.0	518.0	1,224.0	236.0
22	3,252.0	0.0	3,246.0	0.0	0.0	0.0	0.0	542.0	1,265.0	234.0
23	0.0	615.0	0.0	0.0	2,863.0	0.0	0.0	290.0	829.0	286.0
24	9,807.0	3,160.0	928.0	2,205.0	2,600.0	423.0	4,503.0	1,969.0	2,901.0	147.0
25	5,934.0	1,912.0	927.0	2,204.0	2,598.0	422.0	2,725.0	1,394.0	1,800.0	129.0
26	6,903.0	2,224.0	0.0	0.0	0.0	4,778.0	3,170.0	1,423.0	2,358.0	166.0
27	7,442.0	2,398.0	0.0	3,541.0	0.0	0.0	3,417.0	1,400.0	2,371.0	169.0
28	7,995.0	2,576.0	731.0	1,738.0	2,049.0	333.0	3,671.0	1,591.0	2,365.0	149.0
29	5,292.0	1,706.0	796.0	1,893.0	2,232.0	363.0	2,430.0	1,226.0	1,599.0	130.0
30	0.0	0.0	1,260.0	2,996.0	3,532.0	574.0	6,230.0	1,216.0	2,010.0	165.0

Note: Other months had no income

Income diversity and Income stability of MB-TRS

Income of Traditional Rice of the system concentrated on three months as: January, November and December. In the January, income had among largest than other with 5,779,900 VND and income dispersion had CV of 203.27 percent, while income of mung beans fallen down on March, April, May and June, but the most

income concentrated on April and May, at about 1,618,700 VND for April and 1,842.600 VND for May, and income dispersion had CV of 168.11 percent. Income stability depends on CV value of each crop, in the system income stability of the mung bean was better than income stability of the traditional rice, because CV of income stability of the mung bean was less than CV of income stability of the traditional rice (Table 6.22).

There was variation in average monthly income distribution of MB-TRS, monthly average income of traditional rice production was at about 900,840 VND and the monthly average income of mung bean production was at about 402,100 VND, means the traditional rice product was major income of this farming system (Table 6.22).

Table 6.22 Average monthly income of time dispersion and income stability of MB-TRS during 1996-2000

Month and Statistic	Annual Income of Traditional Rice (1000VND)	Annual Income of Mung bean (1000VND)
January	5,779.9	0.0
February	1,985.3	0.0
March	0.0	784.7
April	0.0	1,618.7
May	0.0	1,842.6
June	0.0	579.2
July	0.0	0.0
August	0.0	0.0
September	0.0	0.0
October	0.0	0.0
November	0.0	0.0
December	3,044.9	0.0
Mean	900.84	402.10
SD	1,831.1	676.0
CV	203.27	168.11

6.2.3.3 Profitability

Gross margin analysis of traditional rice of MB-TRS

Like as other farming systems, for evaluating the success of farm households about profitability, i concentrate upon some major factors such as the benefit and cost ratio. Otherwise, values of the return to family labor cost and the return labor cost to told us to know economic efficiencies of the different kinds of labor in production service of farmer. Table 6.23 showed that 12th farm had highest profitable at about 3.30 while farm number 23 had the lowest profitable at about −0.01, means more input cost this farm than outcome. Farm number 23 was also smallest farm than other at about 0.1ha and largest farm was farm number 12 at about 3.8ha. Farm side that was also important reason to relate the success of the farm household, because if farmers had large farm that can bring back more income and ensure livelihood for farm households, they would take care their crop better than farmer owned small farm side. The return to family labor cost fluctuated between −1,000 VND and 406,000 VND and the return to labor cost was from 15,000 VND to 116,000 VND.

Table 6.23 Gross margin of traditional rice among 30 farm households in MB-TRS during 1996-2000

Farm	APR (ha)	GI (1000VND)	TVC (1000VND)	GM (1000VND)	BCR (1000VND)	RFLC (1000VND)	RLC (1000VND)
1	2.6	20,845.0	7,365.0	13,480.0	1.83	187	68
2	1.0	8,017.0	2,302.0	5,715.0	2.48	238	84
3	2.0	13,394.0	4,249.0	9,145.0	2.15	157	70
4	0.9	7,764.0	1,993.0	5,772.0	2.90	200	81
5	1.3	6,993.0	2,874.0	4,118.0	1.43	123	44
6	0.3	1,753.0	719.0	1,034.0	1.44	77	54
7	1.4	9,622.0	2,507.0	7,115.0	2.84	174	83
8	3.0	26,118.0	7,574.0	18,544.0	2.45	216	78
9	1.8	12,421.0	3,528.0	8,892.0	2.52	178	77
10	0.7	5,859.0	1,589.0	4,270.0	2.69	225	94
11	2.3	18,851.0	5,090.0	13,761.0	2.70	260	77
12	3.8	28,070.0	6,528.0	21,542.0	3.30	220	91
13	0.4	4,251.0	1,201.0	3,050.0	2.54	254	93
14	0.8	5,827.0	1,384.0	4,444.0	3.21	231	87
15	1.5	11,240.0	3,189.0	8,052.0	2.53	230	86
16	1.3	7,073.0	3,086.0	3,987.0	1.29	133	56
17	1.2	7,255.0	2,255.0	5,000.0	2.22	129	67
18	2.2	20,079.0	5,578.0	14,501.0	2.60	309	94
19	0.9	5,105.0	1,852.0	3,253.0	1.76	129	63
20	2.2	14,113.0	5,390.0	8,723.0	1.62	161	65
21	0.3	2,697.0	795.0	1,902.0	2.39	317	95
22	0.4	3,252.0	1,006.0	2,246.0	2.23	281	92
23	0.1	615.0	623.0	-7.0	-0.01	-1	15
24	2.0	17,471.0	5,416.0	12,055.0	2.23	208	79
25	1.4	10,572.0	3,786.0	6,785.0	1.79	172	64
26	1.6	12,297.0	3,633.0	8,665.0	2.39	226	81
27	2.1	13,257.0	6,121.0	7,136.0	1.17	129	44
28	1.5	14,242.0	3,307.0	10,935.0	3.31	456	116
29	1.5	9,428.0	3,186.0	6,242.0	1.96	160	67
30	0.9	6,230.0	1,781.0	4,448.0	2.50	230	84

Note: APR = Area planted to rice; GI = Goss Income; TVC = Total variable cost; GM = Gross margin; BCR= Benefit cost ratio; RFLC = Return to family labor cost; and RLC = Return to labor cost.

Gross margin analysis of mung bean of MB-TRS

As the profitable value of the traditional rice of the system, commonly, all farm households produce mung bean to get the profitability from their crops better than the traditional rice. Table 6.24 can prove us to know about that, the benefit and

cost ratio was plus number to fluctuated between 0.93 of farm number 17 and 4.05 of farm number 30, and the return to family labor cost varied from 41,300 VND of farm number 7 to 222,900 VND of farm number 30, while the return to labor cost varied from 35,500 VND of farm number 7 to 108,500 VND of farm number 30.

Table 6.24 Gross margin of mung bean among 30 farm households in MB-TRS during 1996-2000

Farm	APR (ha)	GI (1000VND)	TVC (1000VND)	GM (1000VND)	BCR (1000VND)	RFLC (1000VND)	RLC (1000VND)
1	0.5	4,223.2	1,259.8	2,963.4	2.35	147.7	80.9
2	0.6	3,426.4	1,198.6	2,227.8	1.86	80.8	61.8
3	0.5	4,517.9	1,560.2	2,957.8	1.90	78.6	53.0
4	0.8	3,862.5	1,443.0	2,419.4	1.68	80.4	45.9
5	0.7	5,365.8	1,547.7	3,818.2	2.47	126.9	98.3
6	0.2	1,551.3	578.8	972.5	1.68	62.5	56.6
7	0.4	2,031.3	995.6	1,035.7	1.04	41.3	35.5
8	0.9	8,580.1	1,828.0	6,752.1	3.69	269.2	110.4
9	1.2	9,738.1	3,098.0	6,640.1	2.14	129.8	64.9
10	0.4	3,004.0	909.7	2,094.2	2.30	104.4	62.2
11	0.7	4,421.7	1,652.2	2,769.5	1.68	92.0	53.8
12	0.6	4,911.8	1,428.0	3,483.9	2.44	126.3	71.7
13	0.5	3,263.2	1,322.6	1,940.6	1.47	77.4	47.9
14	1.0	6,019.6	2,031.3	3,988.3	1.96	106.0	71.7
15	0.8	5,014.9	1,581.2	3,433.8	2.17	97.8	75.7
16	0.5	3,792.5	1,221.7	2,570.8	2.10	85.4	77.1
17	0.8	3,975.7	2,064.9	1,910.8	0.93	76.2	33.7
18	0.7	5,322.8	1,518.2	3,804.6	2.51	106.8	78.2
19	0.9	6,209.5	1,920.9	4,288.5	2.23	142.5	76.0
20	1.0	5,974.5	2,085.2	3,889.4	1.87	129.2	55.1
21	0.5	3,524.0	1,138.3	2,385.7	2.10	73.2	70.3
22	0.6	3,246.0	1,198.9	2,047.1	1.71	58.3	57.7
23	0.5	2,863.2	1,471.5	1,391.7	0.95	69.4	35.5
24	0.7	6,154.9	1,286.5	4,868.4	3.78	149.3	104.5
25	0.8	6,151.2	1,908.6	4,242.6	2.22	120.8	68.3
26	0.7	4,777.8	1,599.1	3,178.8	1.99	88.0	60.2
27	0.6	3,540.5	1,667.6	1,872.9	1.12	74.7	46.1
28	0.8	4,852.2	1,906.7	2,945.6	1.54	91.8	65.9
29	0.8	5,283.8	1,692.4	3,591.4	2.12	127.9	63.5
30	0.9	8,362.3	1,655.3	6,706.9	4.05	222.9	108.5

Note: APR = Area planted to rice; GI = Goss Income; TVC = Total variable cost; GM = Gross margin; BCR= Benefit cost ratio; RFLC = Return to family labor cost; and RLC = Return to labor cost.

6.2.3.4 Diversity

Income diversity of each farm

MB-TRS had indicates DI of monthly income of farms that varied between 0.29 and 0.82 (Table 6.25). This table also showed, the most farms of the system had DI of monthly income greater than 0.7 at 70 percent of total farms, means income diversity of the system that was very stably and it was proved by values R of degree of income diversity in system, it varied from 1.81 to 5.41 and total farms had R of degree of income diversity greater than 3 to occupy 80 percent. Finally, income diversity of system was very stably.

Table 6.25 Calculation of DI and R of each farm of MB-TRS during 1996-2000 (x1000VND)

Farm	Jan	Feb	Mar	Apr	May	Jun	Jul	Sum	DI	R
1	11,701.1	3,770.8	636.5	1,513.0	2,073.7	0.0	5,373.1	0.30	0.70	3.36
2	4,500.2	1,450.3	0.0	0.0	3,426.4	0.0	2,066.5	0.29	0.71	3.41
3	7,518.5	2,422.9	681.0	1,618.5	1,618.1	600.3	3,452.5	0.25	0.75	3.99
4	4,358.2	1,404.5	3,862.5	0.0	0.0	0.0	2,001.3	0.30	0.70	3.39
5	0.0	0.0	808.8	1,922.3	2,266.2	368.5	6,993.0	0.38	0.62	2.61
6	0.0	1,753.0	0.0	0.0	0.0	1,551.3	0.0	0.50	0.50	1.99
7	5,401.2	1,740.6	0.0	2,031.3	0.0	0.0	2,480.2	0.31	0.69	3.20
8	14,661.0	4,724.7	1,293.2	3,073.8	3,623.8	589.2	6,732.3	0.26	0.74	3.92
9	6,972.4	2,246.9	1,467.8	3,488.7	4,112.9	668.8	3,201.7	0.19	0.81	5.14
10	5,859.0	0.0	0.0	0.0	3,004.0	0.0	0.0	0.55	0.45	1.81
11	10,581.8	3,410.1	666.5	1,584.1	1,867.5	303.7	4,859.1	0.28	0.72	3.52
12	15,756.7	5,077.8	740.3	1,759.7	2,074.5	337.3	7,235.5	0.31	0.69	3.25
13	0.0	4,251.0	491.8	1,393.1	1,378.2	0.0	0.0	0.39	0.61	2.55
14	3,270.9	1,054.1	907.3	2,156.5	2,542.4	413.4	1,502.0	0.19	0.81	5.36
15	6,309.4	2,033.3	755.9	1,572.5	2,118.0	568.5	2,897.3	0.23	0.77	4.39
16	3,970.3	1,279.5	571.6	1,358.7	1,601.8	260.5	1,823.2	0.22	0.78	4.62
17	4,072.5	1,312.4	0.0	3,975.7	0.0	0.0	1,870.1	0.30	0.70	3.35
18	11,271.1	3,632.2	802.3	1,906.9	2,248.1	365.5	5,175.7	0.27	0.73	3.66
19	2,865.6	923.5	935.9	2,224.6	2,622.6	426.4	1,315.9	0.18	0.82	5.41
20	7,922.1	2,553.0	900.5	2,140.4	2,523.3	410.3	3,637.9	0.23	0.77	4.27
21	0.0	0.0	0.0	0.0	0.0	3,524.0	2,697.0	0.51	0.49	1.97
22	3,252.0	0.0	3,246.0	0.0	0.0	0.0	0.0	0.50	0.50	2.00
23	0.0	615.0	0.0	0.0	2,863.2	0.0	0.0	0.71	0.29	1.41
24	9,807.1	3,160.5	927.7	2,205.0	2,599.5	422.7	4,503.4	0.25	0.75	4.01
25	5,934.4	1,912.5	927.1	2,203.7	2,598.0	422.4	2,725.1	0.21	0.79	4.74
26	6,902.8	2,224.5	0.0	0.0	0.0	4,777.8	3,169.7	0.29	0.71	3.41
27	7,441.6	2,398.2	0.0	3,540.5	0.0	0.0	3,417.2	0.30	0.70	3.31
28	7,994.6	2,576.3	731.3	1,738.3	2,049.3	333.2	3,671.1	0.25	0.75	3.97
29	5,292.3	1,705.5	796.4	1,892.9	2,231.6	362.9	2,430.2	0.21	0.79	4.69
30	0.0	0.0	1,260.4	2,995.8	3,531.8	574.3	6,230.0	0.29	0.71	3.42

Note: Other months had no income

Income diversity of MB-TRS

Diversity income of this system was fluctuated based on economic income in system. A high diversity level was conductive to system stability because it may help to reduce system risk and increase productivity and profitability. We used Simpson Diversity index to measure income diversity of MB-TRS and R to mean degree of income diversity, DI of monthly income of the system was equal 0.78 and R of MB-TRS was 4.56 (Table 6.26).

Table 6.26 Calculation of DI and R of MB-TRS system during 1996-2000

Month and Statistic	(1000VND)	$(n/N)^2$	R^2
January	5,779.9	0.137	33,407,753
February	1,985.3	0.016	3,941,285
March	784.7	0.003	615,681
April	1,618.7	0.011	2,620,262
May	1,842.6	0.014	3,395,131
June	579.2	0.001	335,480
December	3,044.9	0.038	9,271,227
Sum		0.22	
DI		0.78	
R			4.56

Note: Other months had no income

6.2.3.5 Sustainability

Table 6.27 showed that farm number 30, farm number 29, farm number 28, farm number 27, farm number 24 and farm number 22 had best sustainable than other with total score at 26, next had 6 farms with 24 scores, while farm was lowest sustainable with 12 scores of 6th farm of the system.

Table 6.27 Sustainability level of 30 farms of the MB-TRS during 1996-2000

Farm	Yield/ha	Yield	FU	DC	WC	WM	SNM	Total	Ranking
6	3,500	3	3	1	1	3	1	12	8
1	3,594	3	3	3	3	1	1	14	7
2	4,200	5	3	1	1	1	3	14	7
3	3,250	3	1	5	3	1	1	14	7
4	4,200	5	5	1	1	1	3	16	6
5	5,000	5	3	1	1	3	3	16	6
7	3,400	3	5	1	1	3	3	16	6
8	3,252	5	5	1	1	1	3	16	6
12	4,700	5	5	1	1	1	3	16	6
9	3,200	3	3	5	3	1	3	18	5
10	4,100	5	1	5	1	3	3	18	5
14	4,320	5	5	5	1	1	1	18	5
11	3,600	3	1	5	5	3	3	20	4
15	3,540	3	5	5	1	3	3	20	4
17	4,000	3	3	3	3	5	3	20	4
13	3,800	3	5	5	3	3	3	22	3
16	4,500	5	1	5	3	3	5	22	3
26	3,200	3	3	3	5	5	3	22	3
18	3,200	5	5	3	5	3	3	24	2
19	4,200	5	1	5	3	5	5	24	2
20	4,300	5	3	5	3	5	3	24	2
21	4,300	5	3	5	5	3	3	24	2
23	3,400	3	5	3	3	5	5	24	2
25	5,200	5	5	3	5	3	3	24	2
22	3,400	3	5	5	5	3	5	26	1
24	4,560	5	5	3	3	5	5	26	1
27	4,200	5	5	5	5	3	3	26	1
28	4,510	5	5	5	3	3	5	26	1
29	4,200	5	5	5	3	5	3	26	1
30	3,083	3	5	5	5	5	3	26	1

Note: Farmer ID = identification; FU= Fertilizer Using; DC= Disease control; WT= Weed control; WM= Water management; and SNM= Soil nutritional management.

6.2.4 Taro - traditional rice system in period 1996-2000

6.2.4.1 Productivity

Productivity of traditional rice in T-TRS

Yield of the traditional rice of T-TRS was 3,778 kg per ha. Gross margin, return to family cost and the return to labor cost was equal 4,563,000 VND, 110,000 VND and 68,500 VND. Input costs used per ha in this system as: seed was 312,000 VND, fertilizers were 799,000 VND, insecticides were 518,000 VND, hired labor was 578,000 VND and family labor was 677,000 VND (Table 6.28).

Benefit cost ratio of this system was so high at about 1.89, means farmers would get 1.89 VND after 1 VND invested for their production.

Table 6.28 Worksheet for deriving productivity values of traditional rice production in T-TRS of household during 1996-2000 (n=30)

Item	Quantity	Unit	Price/Unit (VND)	Value (1000VND)
Average land area	0.66	ha		
Yield	3,778.00	kg	1,850	6,981
Variable cost				
- Seed	168.00	kg	1,850	312
- Fertilizer				799
- Insecticide				518
- Hired labor	35.02	MD	16,330	578
- Family labor	41.47	MD	16,330	677
Total variable cost				2,417
Gross margin				4,563
Return to family labor cost				111
Return to labor cost				68.5

Note: MD = Man-day

Relation of the area with yield of traditional rice of each farm in T-TRS

Figure 6.10 expressed that the relation of the area and yield of traditional rice in the system was not different between different farm sides.
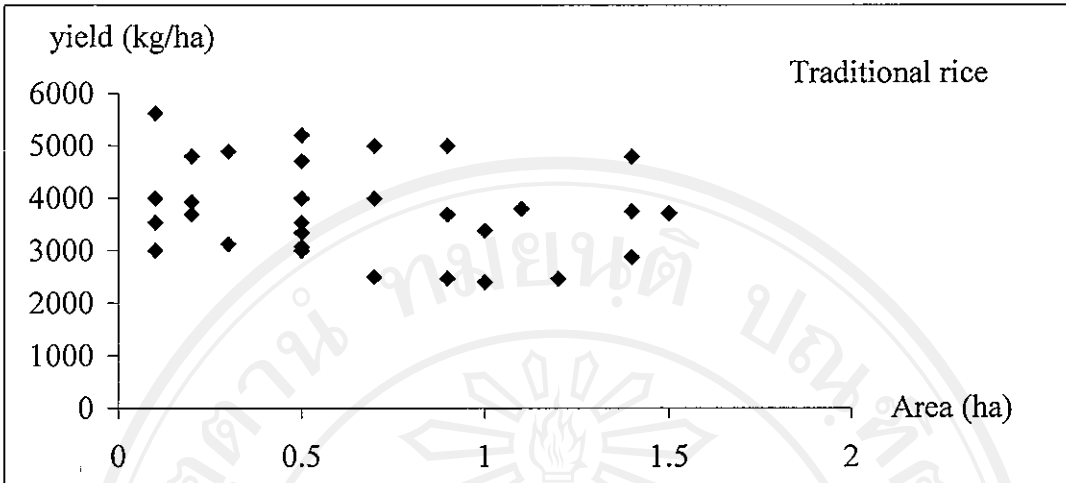
Figure 6.10 Relationship between farm holding size and average rice yield of

traditional rice in T-TRS

Productivity of taro in T-TRS

Average farm side of the taro was small at about 0.24, but taro was high yield about 12,850 kg per hectare. Table 6.29 showed that gross margin of taro was about 6,500,000 VND per hectare, return to family cost was 94,900 VND and the return to labor cost was, 44,000 VND. Average input used per ha in this system as like: seed was 1,840,000 VND, fertilizers were 4,480,000 VND, insecticides were 1,120,000 VND, hired labor was 1,778,000 VND and family labor was 1,149,000 VND.

Table 6.29 Worksheet for deriving productivity values of taro production in T-TRS of household during 1996-2000 (n=30)

Item	Quantity	Unit	Price/Unit (VND)	Value (1000VND)
Average land area	0.24	ha		
Yield	12,850.00	kg	1,312	16,867
Variable cost				
- Seed	1,402.00	kg	1,312	1,840
- Fertilizer				4,480
- Insecticide				1,120
- Hired labor	105.78	MD	16,800	1,778
- Family labor	68.48	MD	16,800	1,149
Total variable cost				10,367
Gross margin				6,500
Return to family labor cost				94.9
Return to labor cost				44

Note: MD was Man-day

Relation of the area with yield of taro of each farm in T-TRS

Like as the relation of the area and yield of traditional rice in the system, the relation of the area and yield of the taro was also not different between farm sides and yield (Figure 6.11).
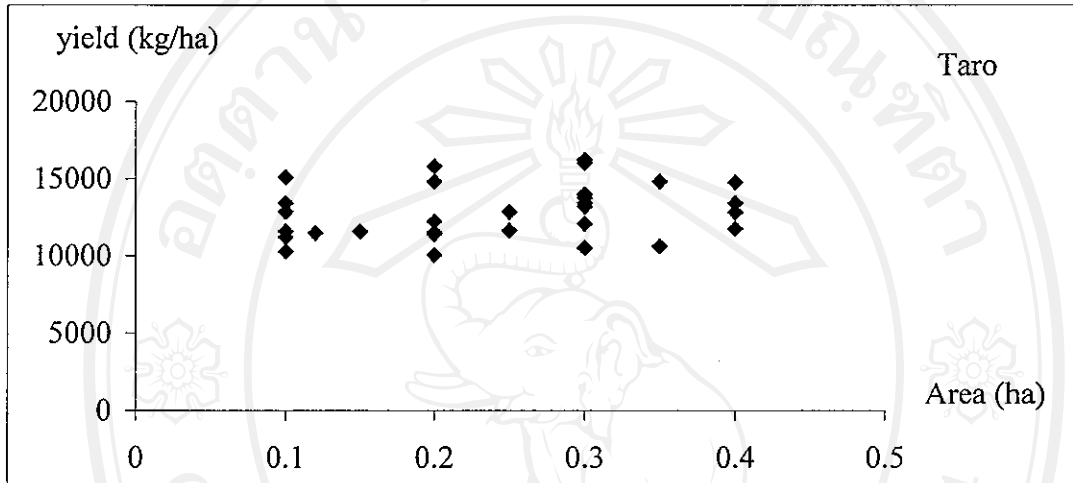

Figure 6.11 Relationship between farm holding size and average taro yield in T-TRS

6.2.4.2 Stability

Income diversity of each farm of T-TRS

Table 6.30 showed that SD of income stability of farm households in T-TRS varied from 440.6 to 2190.6 and CV value varied between 140.6 and 270.6 percent. Finally, income stability of farm households in the system was normal stability.

Table 6.30 Average monthly incomes of time dispersion and income stability of 30 farm households in T-TRS during 1996-2000 (x1000VND)

Farm	Jan	Feb	May	Jun	Jul	Aug	Dec	Mean	SD	CV
1	3,296.1	0.0	0.0	0.0	0.0	1,593.8	1,140.4	502.5	1,030.2	205.0
2	3,752.2	0.0	0.0	3,150.0	0.0	0.0	1,298.2	683.4	1,351.2	197.7
3	3,456.8	0.0	1,536.6	986.9	4,239.1	887.6	1,196.0	1,025.2	1,441.5	140.6
4	4,019.7	0.0	2,426.7	1,558.6	6,694.5	1,401.8	1,390.7	1,457.7	2,082.3	142.8
5	0.0	1,871.6	619.2	0.0	0.0	0.0	0.0	207.6	553.4	266.6
6	3,486.4	0.0	1,110.9	713.5	3,064.6	641.7	1,206.2	851.9	1,222.8	143.5
7	6,295.3	0.0	1,008.6	647.8	2,782.5	582.6	2,178.1	1,124.6	1,876.1	166.8
8	2,663.3	0.0	0.0	0.0	1,283.7	0.0	0.0	328.9	822.6	250.1
9	5,586.3	0.0	2,846.2	0.0	0.0	0.0	1,932.7	863.8	1,760.4	203.8
10	0.0	0.0	1,134.7	728.8	3,130.4	655.5	3,047.6	724.7	1,169.0	161.3
11	0.0	3,583.6	1,497.4	961.7	4,131.0	865.0	0.0	919.9	1,466.9	159.5
12	0.0	3,940.7	847.2	544.1	2,337.3	489.4	0.0	679.9	1,232.1	181.2
13	3,159.3	0.0	836.6	537.3	2,307.9	483.2	1,093.1	701.4	1,036.6	147.8
14	0.0	0.0	0.0	984.4	0.0	0.0	1,590.1	214.5	517.4	241.2
15	2,397.4	0.0	758.8	487.4	2,093.4	438.3	0.0	514.6	850.5	165.3
16	0.0	2,710.7	1,972.0	1,266.5	5,440.1	1,139.1	0.0	1,044.0	1,669.3	159.9
17	4,556.8	0.0	1,068.6	686.3	2,947.9	617.3	1,576.6	954.5	1,446.1	151.5
18	0.0	0.0	0.0	0.0	0.0	920.0	1,304.3	185.4	440.6	237.7
19	4,926.7	0.0	781.8	502.1	2,156.8	451.6	1,704.5	877.0	1,466.8	167.3
20	0.0	0.0	693.0	445.1	1,911.7	400.3	1,498.1	412.3	653.5	158.5
21	2,634.2	0.0	604.8	388.4	1,668.4	349.3	911.4	546.4	831.7	152.2
22	4,710.0	0.0	2,463.7	1,582.3	6,796.6	1,423.1	1,629.6	1,550.4	2,190.6	141.3
23	1,649.1	0.0	682.9	438.6	1,884.0	394.5	0.0	420.8	671.4	159.6
24	3,161.0	0.0	0.0	1,494.7	0.0	0.0	0.0	388.0	973.3	250.9
25	4,683.9	0.0	1,041.6	669.0	2,873.5	601.7	1,620.5	957.5	1,468.3	153.3
26	0.0	1,895.5	576.0	0.0	0.0	0.0	0.0	206.0	557.2	270.6
27	0.0	0.0	0.0	0.0	0.0	2,569.9	3,897.1	538.9	1,290.1	239.4
28	2,271.3	0.0	0.0	0.0	1,248.4	0.0	0.0	293.3	718.9	245.1
29	3,551.0	0.0	1,586.9	1,019.2	4,377.7	916.6	1,228.6	1,056.7	1,485.7	140.6
30	5,571.9	0.0	1,265.4	812.7	3,491.0	731.0	1,927.8	1,150	1,754.9	152.6

Note: Other months had no income

Table 6.31 showed income of Traditional Rice of this system concentrated on three months as: January, February and December. Income of this system had among largest at about 2,833,500 VND in January and income dispersion of the traditional

rice had CV of 223.4 percent. The Taro of this system had income to fall down four months from May to August, speak of income was 2,029,000 VND in July and income dispersion of the Taro had CV of 182.1 percent. There was variation in average monthly income distribution of Traditional Rice of this system that was 384,00 VND and of Taro was 337,000 VND (Table 6.31).

Table 6.31 Average monthly income of time dispersion and income stability of T-TRS during 1996-2000

Month and Statistic	Income of Traditional Rice (1000VND)	Income of Taro (1000VND)
January	2,833.5	0
February	526.5	0
March	0.0	0
April	0.0	0
May	0.0	830
June	0.0	625
July	0.0	2,029
August	0.0	563
September	0.0	0
October	0.0	0
November	0.0	0
December	1,247.0	0
Mean	384	337
SD	857.70	614.22
CV	223.4	182.1

6.2.4.3 Profitability

Gross margin analysis of traditional rice in T-TRS

Table 6.32 showed that the benefit and cost ratio of the traditional rice of this system was highest at 5.13 of farm number 13 and lowest at 0.66 of farm number 12, while the return to family labor cost varied between 35,700 VND of farm number 21 and 280,500 VND of farm number 8 and the return to labor cost fluctuated between 30,100 of farm number 12 and 126,600 VND of farm number 8.

Table 6.32 Gross margin of traditional rice among 30 farm households in T-TRS during 1996-2000

Farm	APR (ha)	GI (1000VND)	TVC (1000VND)	GM (1000VND)	BCR (1000VND)	RFLC (1000VND)	RLC (1000VND)
1	0.3	1,593.8	637.1	956.7	1.50	105.0	61.9
2	0.7	3,150.0	1,056.4	2,093.6	1.98	98.8	58.9
3	0.9	7,650.0	1,739.1	5,910.9	3.40	193.6	118.1
4	1.4	12,081.3	3,528.8	8,552.5	2.42	239.7	114.4
5	0.1	619.2	244.3	374.9	1.53	128.4	67.3
6	1.0	5,530.5	1,720.2	3,810.2	2.21	124.3	68.0
7	1.2	5,021.5	1,878.9	3,142.7	1.67	86.8	49.9
8	0.2	1,283.7	234.3	1,049.4	4.48	280.5	126.6
9	0.5	2,846.2	1,119.5	1,726.6	1.54	55.0	42.0
10	0.9	5,649.2	2,254.3	3,394.9	1.51	103.3	61.7
11	1.4	7,455.0	2,440.9	5,014.1	2.05	90.0	54.6
12	1.0	4,218.0	2,542.1	1,675.9	0.66	43.1	30.1
13	0.5	4,164.9	679.6	3,485.3	5.13	169.4	104.7
14	0.1	984.4	538.9	445.5	0.83	164.5	80.5
15	0.9	3,777.9	1,740.7	2,037.2	1.17	70.7	41.6
16	1.4	9,817.5	2,912.0	6,905.5	2.37	149.8	81.3
17	0.7	5,320.0	2,795.9	2,524.1	0.90	51.2	44.7
18	0.1	920.0	202.6	717.4	3.54	142.7	80.2
19	0.5	3,892.3	1,353.5	2,538.8	1.88	113.3	67.7
20	0.5	3,450.0	1,741.7	1,708.3	0.98	49.7	41.8
21	0.5	3,010.9	1,610.9	1,400.0	0.87	35.7	39.3
22	1.5	12,265.5	3,743.3	8,522.2	2.28	121.2	90.7
23	0.5	3,400.0	1,050.0	2,350.0	2.24	110.8	70.6
24	0.2	1,494.7	529.6	965.1	1.82	86.4	58.6
25	0.5	5,185.7	1,628.6	3,557.1	2.18	88.4	77.6
26	0.1	576.0	227.9	348.1	1.53	72.9	44.3
27	0.3	2,569.9	960.2	1,609.7	1.68	145.9	80.8
28	0.2	1,248.4	363.5	884.9	2.43	189.5	85.6
29	1.1	7,900.2	2,404.3	5,495.9	2.29	276.1	77.6
30	0.7	6,300.0	1,387.7	4,912.3	3.54	195.4	118.6

Note: APR = Area planted to rice; GI = Goss Income; TVC = Total variable cost; GM = Gross margin; BCR= Benefit cost ratio; RFLC = Return to family labor cost; and RLC = Return to labor cost.

Gross margin analysis of taro in T-TRS

As other farming systems, the success of each farm household were evaluated based on the productivity through the benefit and cost ratio and efficiencies of labor that was pended for the production by the return to family labor cost and the return to

labor cost. The Taro had the benefit and cost ratio to fluctuate between 0.13 of farm number 15 and 1.46 of farm number 17. The return to family labor cost varied from 18,300 VND of farm number 15 to 203,000 VND of 28th farm and the return to labor cost 13,500 VND of farm number 15 to 79,000 VND of farm number 28 (Table 6.33).

Table 6.33 Gross margin of taro among 30 farm households in T-TRS during 1996-2000

Farm	APR (ha)	GI (1000VND)	TVC (1000VND)	GM (1000VND)	BCR (1000VND)	RFLC (1000VND)	RLC (1000VND)
1	0.30	4,441.0	2,727.5	1,713.4	0.63	80.8	44.1
2	0.30	5,055.6	3,021.8	2,033.8	0.67	114.7	54.3
3	0.35	4,657.5	3,660.5	997.0	0.27	40.9	23.4
4	0.30	5,416.0	3,434.7	1,981.3	0.58	86.2	37.1
5	0.10	1,871.6	1,128.5	743.1	0.66	100.5	46.1
6	0.30	4,697.5	3,454.8	1,242.8	0.36	56.3	28.5
7	0.40	8,482.1	4,767.1	3,715.0	0.78	149.7	58.0
8	0.15	2,663.3	1,655.9	1,007.5	0.61	93.5	41.9
9	0.40	7,526.7	4,809.4	2,717.3	0.56	131.3	55.7
10	0.20	3,047.6	1,993.5	1,054.0	0.53	92.1	48.3
11	0.30	3,583.6	2,836.7	746.9	0.26	47.5	26.1
12	0.25	3,940.7	2,673.5	1,267.2	0.47	70.3	35.3
13	0.20	4,256.7	2,137.4	2,119.3	0.99	131.5	56.7
14	0.10	1,590.1	1,034.2	555.9	0.54	62.0	31.1
15	0.20	2,397.4	2,117.8	279.5	0.13	18.3	13.5
16	0.20	2,710.7	1,971.3	739.4	0.38	49.6	25.8
17	0.30	6,139.6	2,500.3	3,639.3	1.46	149.6	71.0
18	0.10	1,304.3	964.6	339.7	0.35	46.7	25.1
19	0.40	6,638.0	3,973.2	2,664.8	0.67	108.6	52.2
20	0.10	1,498.1	1,193.4	304.6	0.26	42.9	25.6
21	0.25	3,549.2	2,566.4	982.8	0.38	61.3	33.1
22	0.30	6,346.1	2,668.4	3,677.6	1.38	173.5	69.4
23	0.10	1,649.1	985.0	664.1	0.67	94.3	43.8
24	0.20	3,161.0	2,162.4	998.5	0.46	80.3	38.1
25	0.30	6,310.9	2,920.1	3,390.8	1.16	201.7	72.1
26	0.12	1,895.5	1,320.9	574.5	0.43	63.8	34.0
27	0.20	3,897.1	2,155.7	1,741.3	0.81	145.2	59.0
28	0.10	2,271.3	985.7	1,285.6	1.30	203.0	79.0
29	0.40	4,784.5	3,799.7	984.8	0.26	40.4	21.8
30	0.35	7,507.3	3,506.2	4,001.1	1.14	155.9	69.2

Note: APR = Area planted to rice; GI = Goss Income; TVC = Total variable cost; GM = Gross margin; BCR= Benefit cost ratio; RFLC = Return to family labor cost; and RLC = Return to labor cost.

6.2.4.4 Diversity

Income diversity of each farm

Table 6.34 showed DI of monthly income of farms in T-TRS varied on interval 0.25 and 0.77. Which farm had small values about DI of monthly income consisted of farm number 8, farm number 5, farm number 14, farm number 18, farm number 24, farm number 26, farm number 27and farm number 28 those farms only had two months of income and had less diversity about income. Other farms had DI of monthly income from 0.6 to less than 0.8 that had good Income diversity.

R of degree of income diversity of farms in system varied from 1.56 to 4.27. Total farms had R of degree of income diversity greater than 6 to occupy 20 percent, those farms had good income diversity. While farms had R of degree of income diversity less than 2, was 6 farms and greater than 2 and less than 4, was 18 farms. Finally, R of degree of income diversity of this system was good stable.

Table 6.34 Calculation of DI and R of each farm of T-TRS during 1996-2000 (x1000VND)

Farm	Jan	Feb	May	Jun	Jul	Aug	Dec	Sum	DI	R
1	3,296.1	0.0	0.0	0.0	0.0	1,593.8	1,140.4	0.40	0.60	2.47
2	3,752.2	0.0	0.0	3,150.0	0.0	0.0	1,298.2	0.38	0.62	2.62
3	3,456.8	0.0	1,536.6	986.9	4,239.1	887.6	1,196.0	0.23	0.77	4.27
4	4,019.7	0.0	2,426.7	1,558.6	6,694.5	1,401.8	1,390.7	0.24	0.76	4.18
5	0.0	1,871.6	619.2	0.0	0.0	0.0	0.0	0.63	0.37	1.60
6	3,486.4	0.0	1,110.9	713.5	3,064.6	641.7	1,206.2	0.24	0.76	4.15
7	6,295.3	0.0	1,008.6	647.8	2,782.5	582.6	2,178.1	0.30	0.70	3.38
8	2,663.3	0.0	0.0	0.0	1,283.7	0.0	0.0	0.56	0.44	1.78
9	5,586.3	0.0	2,846.2	0.0	0.0	0.0	1,932.7	0.40	0.60	2.50
10	0.0	0.0	1,134.7	728.8	3,130.4	655.5	3,047.6	0.28	0.72	3.55
11	0.0	3,583.6	1,497.4	961.7	4,131.0	865.0	0.0	0.28	0.72	3.60
12	0.0	3,940.7	847.2	544.1	2,337.3	489.4	0.0	0.33	0.67	2.99
13	3,159.3	0.0	836.6	537.3	2,307.9	483.2	1,093.1	0.25	0.75	4.00
14	0.0	0.0	0.0	984.4	0.0	0.0	1,590.1	0.53	0.47	1.90
15	2,397.4	0.0	758.8	487.4	2,093.4	438.3	0.0	0.29	0.71	3.42
16	0.0	2,710.7	1,972.0	1,266.5	5,440.1	1,139.1	0.0	0.28	0.72	3.59
17	4,556.8	0.0	1,068.6	686.3	2,947.9	617.3	1,576.6	0.26	0.74	3.87
18	0.0	0.0	0.0	0.0	0.0	920.0	1,304.3	0.51	0.49	1.94
19	4,926.7	0.0	781.8	502.1	2,156.8	451.6	1,704.5	0.30	0.70	3.37
20	0.0	0.0	693.0	445.1	1,911.7	400.3	1,498.1	0.28	0.72	3.63
21	2,634.2	0.0	604.8	388.4	1,668.4	349.3	911.4	0.26	0.74	3.84
22	4,710.0	0.0	2,463.7	1,582.3	6,796.6	1,423.1	1,629.6	0.24	0.76	4.24
23	1,649.1	0.0	682.9	438.6	1,884.0	394.5	0.0	0.28	0.72	3.60
24	3,161.0	0.0	0.0	1,494.7	0.0	0.0	0.0	0.56	0.44	1.77
25	4,683.9	0.0	1,041.6	669.0	2,873.5	601.7	1,620.5	0.26	0.74	3.80
26	0.0	1,895.5	576.0	0.0	0.0	0.0	0.0	0.64	0.36	1.56
27	0.0	0.0	0.0	0.0	0.0	2,569.9	3,897.1	0.52	0.48	1.92
28	2,271.3	0.0	0.0	0.0	1,248.4	0.0	0.0	0.54	0.46	1.84
29	3,551.0	0.0	1,586.9	1,019.2	4,377.7	916.6	1,228.6	0.23	0.77	4.27
30	5,571.9	0.0	1,265.4	812.7	3,491.0	731.0	1,927.8	0.26	0.74	3.83

Note: Other months had no income

Income diversity of T-TRS

As other farming systems, we used Simpson Diversity index to measure income diversity of T-TRS and R to mean degree of income diversity, DI of monthly income of T-TRS was equal 0.79 and R of T-TRS was 4.87 (Table 6.35).

Table 6.35 Calculation of DI and R of T-TRS during 1996-2000

Month and Statistic	T-TRS (1000VND)	$(n/N)^2$	R^2
January	2,833.5	0.11	8,028,722.25
February	526.5	0.00	277,202.25
May	830	0.01	689,523.28
June	625	0.01	391,095.72
July	2,029	0.05	4,117,773.77
August	563	0.00	317,079.70
December	1,247.0	0.02	1,555,009.00
Sum		0.21	
DI		0.79	
R			4.87

Note: Other months had no income

6.2.4.5 Sustainability

Table 6.36 showed that farm number 6, farm number 7 and farm number 13 were highest sustainable at 24 scores, next sustainable farms were farm number 29, farm number 26, farm number 11, farm number 8, farm number 28, farm number 27 and farm number 23 at the same 22 scores, and farm was lowest sustainable at 10 scores of farm number 12.

Table 6.36 Sustainability level of 30 farms of the T-TRS during 1996-2000

Farmer ID	Yield	FU	DC	WC	WM	SNM	Total	Ranking
12	1	1	1	1	5	1	10	7
4	5	1	1	3	1	3	14	6
19	3	1	5	1	3	1	14	6
1	3	1	1	5	3	3	16	5
10	3	1	3	3	5	1	16	5
15	1	1	5	3	1	5	16	5
20	3	1	5	3	1	3	16	5
22	3	1	5	1	3	3	16	5
25	5	1	5	3	1	3	18	4
3	5	1	5	3	3	1	18	4
9	3	1	5	3	3	3	18	4
17	3	1	5	5	3	1	18	4
24	3	3	5	1	5	1	18	4
2	1	5	5	3	1	5	20	3
14	5	3	5	3	3	1	20	3
16	3	1	5	5	3	3	20	3
5	3	1	5	5	3	3	20	3
18	3	5	5	3	1	3	20	3
21	3	1	5	5	5	1	20	3
30	5	1	5	1	3	5	20	3
23	3	1	5	5	3	5	22	2
27	5	1	3	5	3	5	22	2
28	3	3	5	3	3	5	22	2
8	5	5	5	3	3	1	22	2
11	3	5	5	5	1	3	22	2
26	3	3	5	5	3	3	22	2
29	3	3	5	5	5	1	22	2
13	5	5	5	3	3	3	24	1
6	3	5	5	5	3	3	24	1
7	3	5	5	5	3	3	24	1

Note: Farmer ID was identification; FU = Fertilizer Using; DC = Disease control; WT = Weed control; WM = Water management; and SNM = Soil nutritional management.