CHAPTER 4

PRODUCTION ENVIRONMENT AND CULTURAL PRACTICE

4.1. Production environment.

4.1.1. Climatic condition.

Thua Thien Hue province situated in the North Center Coastal region of Vietnam from 16°12' to 17°5' North latitude and 105^0 37' to 108°06' East longitude. Three distinct agro-ecological zones, could be identified: the coastal sandy soil zone, the delta plain zone, and the mountain zone. This study focuses on the delta plain and the coastal sandy soil areas. The climate of Thua Thien Hue province is characterized by a typical monsoon tropical climate. There are two distinct seasons, the rainy season begins in September and extends into January. More than 80% of the average annual rainfall occurs during those four months, in which summer rice is finished and Winter crops begin. But the heavy rain poses certain problems for harvesting of summer rice and establishment of winter crops. The dry season occurs from February until August. In the early part of the season (especially in February and March) the air temperature is still low and sometimes strongly influences the flowering of winter rice. The hot, dry season occurs from May to July shortages of water could affect summer rice production. The average maximum and minimum monthly temperatures and rainfall during the 10 years period are shown in the Figure 2.

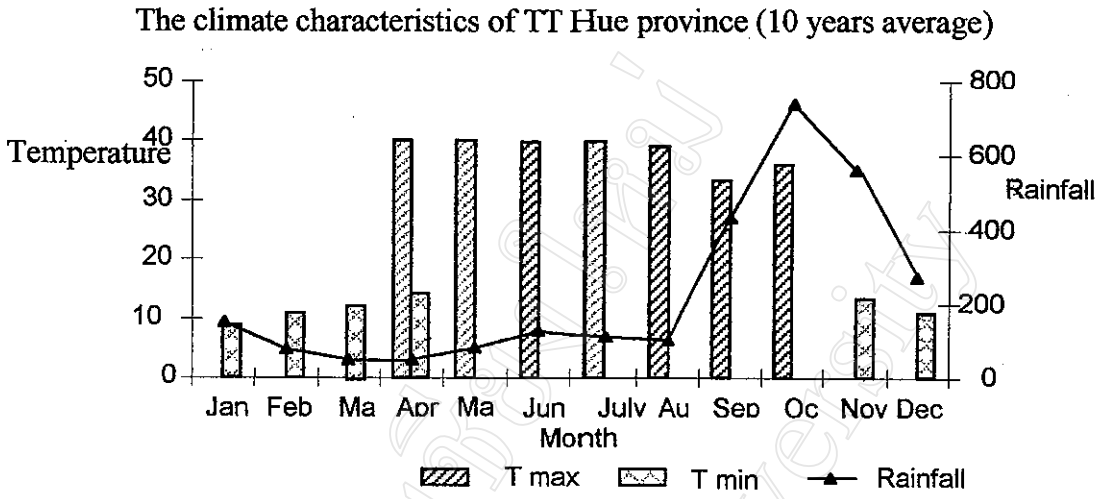

Figure 2: Climatic characteristics of Thua Thien Hue province from 1987- 1997

4.1.2. Soil characteristics.

The major soil types in the delta plain zone are alluvial soils, sandy loam soils, sandy clay loam soil and sandy soil. Duc (1993) revealed that the composition of delta plain soil is basically loam. The content of physical clay is about 15%-20% bulk density varies from 2.81 to 2.95 gm cm^{-3} and its density ranges from 1.58 to 1.72. Porosity varies from 32% to 37%. In general, the delta plain soil in Thua Thien Hue province is poor in terms of water holding capacity and fertility for cultivation. The results of survey data of the Soil Department of Agriculture and Forestry of Hue College showed that soil in the delta plain of Thua Thien Hue province is poor in fertility and is slightly acid (pH< 6.0). There are differences in chemical characteristics between the soils depending cropping patterns. Normally, the soils is flooded annually from the end of September to November resulting in high humus content and complementary accumulation of organic matter during the flooding period. The lowest humus content is observed in the one rice system. The soil chemical characteristics in different cropping system are shown in Table 2.

Table 2: Soil chemical characteristics in different cropping systems

Soil / Cropping pattern	pH		Humus (%)		N (%)	
	Mean	SE	Mean	SE	Mean	SE
Rice- Rice	5.85	0.12	1.005	0.05	0.086	0.01
Rice- food crops	5.2	0.10	1.256	0.07	0.128	0.04
Food crops	5.75	0.11	1.542	0.06	0.235	0.03
One rice crop	5.62	0.13	1.682	0.09	0.102	0.02
Rice- Rice- food crops	5.9	0.15	1.125	0.03	0.098	0.01
Soil	P_2O_5 (%)		K_2O %		Available P (ppm)	
cropping pattern	Mean	SE	Mean	SE	Mean	SE
Rice- Rice	0.320	0.03	0.42	0.03	18.5	0.15
Rice- food crops	0.425	0.05	0.35	0.02	21.2	0.21
Food crops	0.521	0.06	0.40	0.04	28.5	0.32
One rice crop	0.301	0.02	0.30	0.01	16.2	0.19
Rice- Rice- food crops	0.356	0.04	0.56	0.02	20.1	0.20

Source: Soil Department of Hue university

Duc (1993) reported that the composition of coastal sandy soil is basically composed of fine sand (71-74%), whereas the content of physical clay is very low (<10-15%). The bulk density of coastal sandy soil varies from 2.65 to 2.72 gm cm^{-3} and its density ranges from 1.45 - 1.60. porosity varies from 40 - 60 %. The coastal

sandy soil area is poor in terms of water holding capacity and fertility for cultivation. The chemical characteristics of the coastal sandy soils are generally, poor in humus (<1) and low in the nutrient N, P and K. (Table 3)

Table 3: Chemical characteristics of coastal sandy soil in Thua Thien Hue province

Type of soil	Depth (cm)	pH_{KCl}	Humus (%)	N (%)	P_2O_5 (%)	K_2O (%)	Available P (ppm)
Sandy dune	0-20	5.2	0.025	0	0.046	0.25	12.5
	21-60	5.4	0	0	0.040	0.35	22.5
	61-120	5.4	0	0	0.040	0.35	12.5
Planted soil	0 -17	4.4	0.325	0.010	0.035	0.45	15.0
	18-53	4.2	0.300	0.015	0.032	0.40	17.5
	54-85	4.0	0.250	0.005	0.037	0.35	10.0
Rice soil	0-18	4.5	0.750	0.050	0.040	0.40	25.0
	19-40	4.3	0.450	0.085	0.045	0.25	25.5
	41-90	4.6	0.205	0.015	0.064	0.35	17.5
Flooded soil	0-18	4.2	2.750	0.105	0.012	0.27	22.5
	19-45	4.2	1.625	0.081	0.012	0.19	20.0
	46-90	4.5	0.375	0.040	0.011	0.15	15.0

Source: Duc et al., 1993.

The nitrogen content of the sandy soil also depends on the humus content, which commonly is very low (<0.1%). The coastal sandy soil in Thua Thien Hue province is acid (pH<5.5) and poor in both total phosphorus and available phosphorus (available P ranged from 12.5-25 ppm).

4.2. Land use and cropping pattern.

4.2.1 Cropping pattern

4.2.1.1 Cropping pattern in the rainfed lowlands

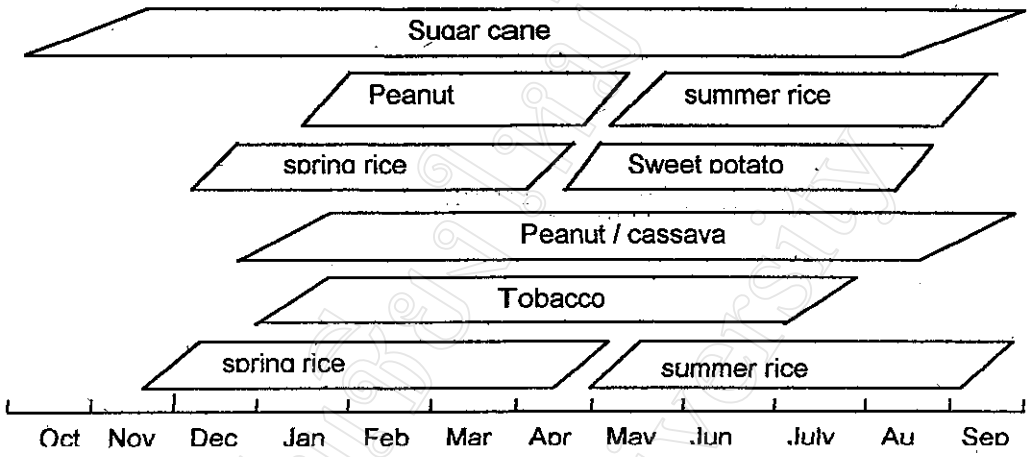

Figure 3: Cropping patterns in coast sandy soil area.

The climatic conditions in the lowlands of Thua Thien Hue province different from to other regions; the rainfall season usually begins in early September and extents to January. Therefore, two growing seasons are possible (spring season and summer season). Local rice varieties are popular in this area, Heo, Chum, Nuoc man rice varieties are planted annually at the middle of November and harvested at the end of April. In the summer season in the formal time farmer uses local rice varieties, but now they use traditional rice and modern rice varieties, both of which are short duration varieties (90 to 110 days). The common rice varieties, which are planted in this area are MTL 61, CR203, and Chien. In addition to rice production, farmers plant chili, sweet potato, cassava and tobacco, which are traditional crops. At present time farmers have also introduced some new crops such as peanuts, and mungbeans into the area.

4.2.1 .2 Cropping pattern in the irrigated lowlands.

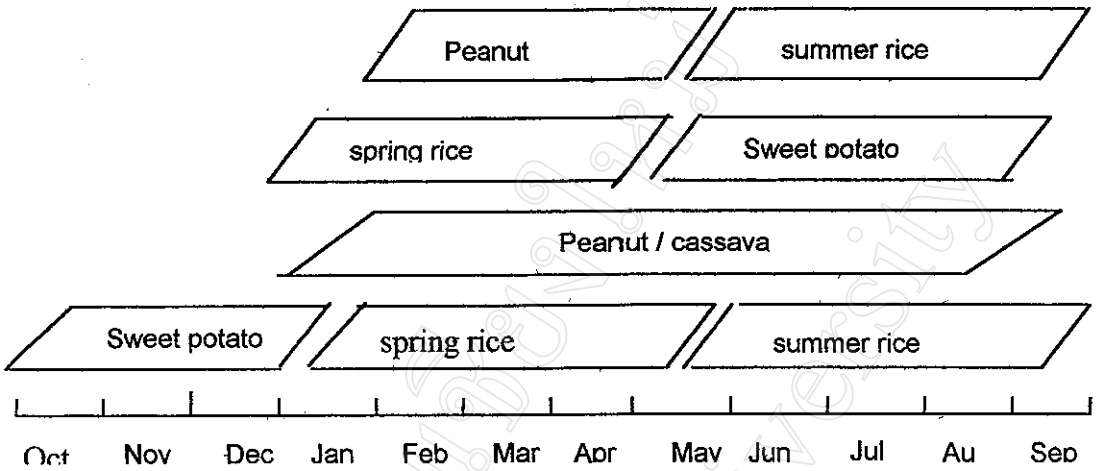

Figure 4: Cropping patterns in the irrigated area

During the rainy season, from the middle of September to December, most lowland areas are fallow land because it rains hard and there is usually flooding time. There is only a small area where the land is higher than the around it. In the garden farmers normally plant vegetables and sweet potatos for home consumption and livestock feed. Spring rice and summer rice occupy largest area in the irrigated zone. During the spring season, (December to May) modern rice varieties are planted, popular glutinous rice varieties are commonly observed including IR17494, IR38, IR 352, DT10. These varieties are medium or long duration rice varieties (120 to 150 days). Beside these varieties, farmer grow some short duration rice varieties in a small area with transplanting method . By using the transplanting method, farmers have time for growing summer rice crop in the subsequent growing season. The study showed that about half of area in the irrigated region, farmers use broadcasting technique which is a new planting method for growing rice. This method was developed 5 or 6 years ago, so far this planting method farmers have followed researchers in Hue university

or extension officers. The main reasons for adopting are to save hired labour and because they can get the same rice yield as well as suitable for family labour. After harvesting spring rice, farmers grow summer rice in the same area and use both planting methods (broadcasting and transplanting). Normally, farmers change a small area of planting methods because they have to follow the plan of the Cooperative and of the irrigation office. The time for land preparation is very short (7 to 10 days). Because the rainy season begin early September and usually flooding occurs, therefore, farmers in the irrigated area of Thua Thien Hue province must use short duration rice varieties (90- 110 days). Common rice varieties in the summer season are CR203, MTL61, CN2. After harvesting the summer rice it is the rainy season, when it rains hard so crops harvested during time of year are very poor.

4.3. Cultural practices in rice production.

4.3.1. Area of rice planted by variety and planting season.

In the spring season:

In the irrigated areas: Over 60% of the irrigated area are planted the IR17494 rice variety. This variety is of medium duration (145- 150 days), although, IR17494 is susceptible to Pyricularia oryzea disease, and is low quality farmers adopted it and grow it in an extensive area because it has a stable and highest yield when compared to other varieties. Other rice varieties such as IR38, IR42, IR352 are higher quality than IR17494 but the planted area is less than for IR17494 because of low yield. In irrigated area the farmers continually grow some short duration varieties such as

CR203, CN2, MTL61 (90- 110 days). The area of these varieties is small but the varieties aresuitable for harvesting and growing period in the rice area.

In the rainfed area: In contrast to the irrigated areas, farmers in rainfed area use local rice varieties such as Nuocman, Heo, Chum. Heo and Chum contribute the largest cropping area because they are resistantt to both drought and flooding. In addition, these varieties require low fertilizer inputs and are highly resistantt to insects and disease. Most of the varieties that the farmers are using have long growing duration (>155 days).

In the summer season

- In the irrigated areas all farmers select short duration varieties for summer rice, in which CR203, N13, IR352 are popularly grown. The main reason for farmers' adoption of these varieties are suitability to the soil and climate conditions as well as high yielding, there are some other varieties recently introduced but they contribute only a small area such as U91, 25cuba, and Chiem hoa .

In the rainfed areas farmers plant both modern and local rice varieties, and they also use short duration varieties (90-120 days). MTL61 and CN2 are commonly preferred varieties by farmers in the rainfed region. Broadcasting method where the water is used sufficient.

Table 4: Rice planted area by variety and water regime(% of total rice area)

Varieties	Irrigated region		Rainfed region	
	Spring season	Summer season	Spring season	Summer season
		Modern varieties		
IR17494	62.0	-	3.0	-
IR 38	11.0	-	-	-
DT14	3.0	-	-	-
IR42	6.6	-	-	-
CN2	0.3	15.0	-	10.0
IR352	11.7	21.0	-	-
Chiem hoa	3.4	5.0	-	-
N13	1.6	22.0	-	-
CR203	0.1	26.0	-	6.9
MTL61	0.3	4.0	-	37.4
U91	-	3.0	-	-
25Cuba	-	4.0	-	-
		Local varieties		
Nuoc man	-	-	12.0	-
Chum	-	-	52.0	-
Heo	-	-	37.0	-
Chien	-	-	-	45.6

Source: survey 1998

Farmers continue to use local rice varieties. For instance, Chien that has a short duration and drought tolerance is a traditional variety in rainfed lowland situation.

4.3.2. Planting date.

The planting date of the spring season depends upon the rice variety; the varieties with a long duration will be planted first, followed by varieties with short

duration. The limitation of spring season rice in the lowlands is at the flowering stage. If rice flowers before 15th of March it usually meets the cold North-East monsoon and the flowers will abort resulting in poor seed set. The limitation of summer season rice is the harvest stage. Farmers must harvest before the 15th of September,before the flooding occurs. The planting date of spring and summer rice in the lowlands will also be determined the Cooperative plan and the plan of Public Irrigation System.

In the rainfed area, farmers planted local rice with medium duration varieties (over 155 days). These are sown in early November and can be transplanted at the end of December (about 60 days old) and thus harvested at the end of April. In the irrigated area , the sowing date also folllows the duration of rice varieties. With IR17494, IR38, IR42 and varieties which have a duration over 145 days, farmers begin sowing on the 25th of November to 5th of December and harvest from the 5th to 15th of May. With short maturity varieties such as CR 203, CN2, and MTL61 farmers sow the crop in early January and harvest it from 25th of April to 5th of May.

In the summer season, at the present time all farmers use short duration varieties. Therefore, the planting date begins from the 5th to the 15th of May for broadcasting rice and from the end of April to the 5th of May for transplanting rice, when harvesting begins 15th of September.

4.3.3. Land preparation.

In the spring season most of the farmers in the irrigated area use tractor for land preparation. After tilling and pudding by tractor they can transplant directly

Table 5: Land preparation by planting method and location

Methods	Irrigated area		Rainfed area	
	Tr (n=60)	Br (n=60)	Tr (n=60)	
Spring season (%)				
Tilling & harrowing by buffalo	0.0	0.0	51.6	-
Tilling & harrowing by tractor	41.7	25.1	8.4	-
Tilling by tractor, leveling by buffalo	31.6	49.2	0.0	-
Tilling by buffalo pudding by tractor	26.7	25.7	40.0	-
Summer season (%)				
	Tr (n=60)	Br (n=60)	Tr (n=30)	Br (n=30)
Tilling & harrowing by buffalo	0.0	0.0	23.0	0.0
Tilling & harrowing by tractor	33.3	16.9	77.0	40.0
Tilling by tractor leveling by buffalo	65.0	83.1	0.0	43.0
Tilling by buffalo pudding by tractor	1.7	0.0	0.0	17.0

Source: survey 1998 . Note: Tr = Transplanting ; Br = Broadcasting

without levelling operations; but, for the broadcasting method, after tractor tilling, the farmer have to use buffalo for levelling. Tilling and harrowing by buffalo is a popular method in the rainfed area. The main reason for this is that farmers in these regions raise more buffaloes and have less drudgery of work in the rainy season (Table 5).

4.3.4. Planting method and planting density.

Because some part of the rainfed area have high water levels in the spring season, some other parts which are higher than the land around usually have water shortages in March and April. Therefore, farmers are not using modern rice varieties for the spring season in rainfed region. But in the summer season in the area along

Tamgiang lagoon where the water level is lower farmers have adopted broadcasting method.

In the spring season farmers in the irrigated area have use both transplanting and broadcasting methods. The survey (Table 6) revealed almost equal proportions of land area under two different planting methods. Farmers in the rainfed area use only the transplanting method.

In the summer season, both methods of rice planting are equally prevalent in the irrigated areas, but in the rainfed area, 55% of farmers use transplanting method, and adopt modern rice variety for broadcasting method.

Planting density: The seeding rate used in the spring season and in irrigated area are higher than in the summer and in the rainfed area. When compared numbers of hill per square meter for transplanting method the plant density in the irrigated area are higher in the rainfed area.

Table 6: Percent of rice area and plant density by planting method and planting season

	Irrigated area				Rainfed area			
	Spring (n=60)		Summer(n=60)		Spring (n=60		Summer (n=30)	
	Planting method (% of rice area)							
Transplanting	51.0		51.0		100.0		55.0	
Broadcasting	49.0		49.0		0.0		45.0	
	Planting density							
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Transplanting (hill/m^2)	46.3	4.0	44.5	3.1	28.3	6.2	25.6	1.6
Broadcasting(kg/sao)	6.0	0.2	5.6	0.5	-		5.7	0.5

Source: survey 1998

Farmers in the irrigated region have more experience than farmers in the rainfed region in using the broadcasting method. In addition, in the spring season the temperature at the sowing time is usually low (< 20°), therefore, the germination rate of the rice is lower and some young rice plant may die, so farmers must increase the sowing rate of seed per unit area. When number of hill per unit area for transplanted rice is considered the plant population in irrigated area is higher than in the rainfed area. This is to be expected because farmers in the irrigated area use modern rice varieties while farmers in the rainfed area use local rice varieties. The rice production systems in the lowlands of Thua Thien Hue province are presented in Figure 5.

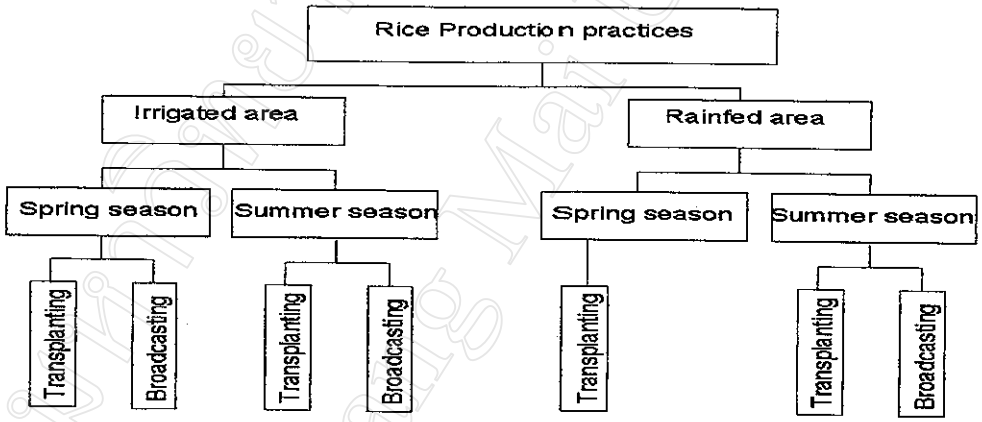

Figure 5: Rice production practices in the lowland of Thua Thien Hue province.

4.3.5. Weed management.

Weeds will compete with rice for sun light, nutrients and water and will thus influence rice yield. To reduce the weeds in the rice fields, farmers in Thua Thien Hue province have used several weeding methods including manual and chemicals.

Results in Table 7 show that 95 % and 13% of farmers in the rainfed area use manual weeding method in spring and summer seasons for transplanted rice respectively. All farmers in the irrigated area used both methods. For broadcasted rice most farmers have used herbicides three days after broadcasting, and then use labour to take up some weeds.

Table 7: Weed management for rice production.

	Irrigated area		Rainfed area	
Spring season (% responses)				
	Tr(n=60)	Br(n=60)	Tr(n=60)	
Manual &Chemical	43	98	0	-
Chemical	17	2	0	-
Manual	40	0	92	-
No weeding	0	0	8	-
Summer season (% responses)				
	Tr (n=60)	Br (n=60)	Tr (n=30)	Br (n=30)
Manual &Chemical	57	98	0	90
Chemical	2	2	0	10
Manual	41	0	13	0
No weeding	0	0	87	0

Source: survey 1998 Note: Tr = Transplanting; Br = Broadcasting

4.3.6 Pest management.

As shown by the cropping pattern, most of the irrigated lowland areas are mono rice cultivation with two rice crops per year. On the other hand, Thua thien Hue province is located in tropical monsoon region, therefore, there is high incidence

of insect and disease. This phenomenan usually reduces rice yield in Thua Thien Hue province, particularly Pyricularia and brown leaf disease and hoppers. The degree of damage caused by pests is determined by how many spraying applications are made by the farmer per rice crop. Results from Table 8 revealed that the proportion of

Table 8: Frequency of pesticide application in rice pest management

	Irrigated area		Rainfed area	
	Transplanting	Broadcasting	Transplanting	Broadcasting
	Spring season (% response)			
No Time	0	0	67	-
<2 Time	6	3	30	-
3-4 Time	72	61	3	-
>4 Time	22	36	0	-
	Summer season (% response)			
No Time	0	0	53	0
<2 Time	10	5	40	3
3-4 Time	75	75	7	87
>4 Time	15	20	0	10

Source: survey 1998

farmers who spray more than three times for one rice crop is higher for broadcasted rice in both the spring and summer seasons. Most of the farmers in the rainfed area do not spray pesticides for transplanted rice in the spring and summer rice season.

This result could be explained by the fact that broadcasted rice normally has higher density than transplanted rice, so the micro climate in the field is suitable for the development of insects and fungal organisms. Local rice is found to be resistant

to insects and diseases. So that few farmers in the rainfed area invest in pesticides for transplanted rice.

4.3.7. Nutrient management.

Two types of fertilizers, organic and chemical fertilizers are investigated in this survey. Most of the organic fertilizer is manure, while chemical fertilizers such as Urea (46% N), super phosphate (19% P_2O_5) and potassium (KCl 60% K_2O) fertilizers are used for all of the production environment and planting methods.

Table 9: Fertilizes used for rice production by location and planting method

Fertilizes	Irrigated area				Rainfed area			
	Spring season (kg/sao)							
	Tr (n=60)		Br(n=60)		Tr(n=60)			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Manure	168.4	86.3	194	75.4	40.0	50.1	-	
Urea	11.9	2.1	12.4	1.4	5.9	1.2	-	
Super phosphate	14.3	4.1	14.2	3.9	11.7	3.5	-	
Potassium KCl)	4.8	1.4	4.5	1.3	0.8	1.2	-	
	Summer season (kg/sao)							
	Tr (n=60)		Br(n=60)		Tr(n=30)		Br (n=30)	
Manure	127.0	36.0	134.0	52.3	31.0	41.8	134.0	39.1
Urea	11.0	1.3	11.8	1.5	5.2	0.6	10.2	1.7
Super phosphate	13.0	3.5	12.0	2.9	11.0	2.0	14.0	2.7
Potassium (KCl)	4.0	1.5	3.3	1.6	0.4	0.9	4.1	1.0

Source: survey 1998

Note: Tr = transplanting; Br = Broadcasting

The average quantity of manure and nitrogen that farmers used are higher for broadcasted rice in both planting seasons in the irrigated area. While in the rainfed area, farmers use amount of manure and potassium for transplanting rice in both planting season. The survey results reveal that farmers in the irrigated area are applying more fertilizer (including non-chemical and chemical fertilizes) for rice production in both seasons. The farmers in the irrigated areas use about 4 times more of manure than the rainfed farmers.

4.3.8. Rice yield of main varieties

Table 10: Average yield of main rice varieties by water regime and planting seasons

Varieties	Irrigated region				Rainfed region			
	Spring 1998		Summer 1997		Spring 1998		Summer 1997	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Modern varieties (ton/ha)								
IR17494	5.11	0.90	-		4.87	1.52	-	
IR 38	4.29	0.50	-		-			
CN2	4.28	0.28	4.13	0.42	-		3.57	0.54
IR352	4.11	0.53	3.98	0.53	-		-	
CR203	4.04	0.25	4.11	0.42	-		3.90	0.74
MTL61	3.29	0.77	4.03	0.07	-		3.68	0.26
Local varieties (ton/ha)								
Nuoc man			-		1.44	0.57	-	
Chum			-		1.50	0.67	-	
Heo			-		2.40	0.35	-	
Chien			-		-		2.33	0.44

Source: survey 1998

In the spring season yields of IR17494 variety is highest in the irrigated area and Heo (traditional variety) is highest in the rainfed areas. This result explains why planted areas values of these two varieties are largest in Table 4.

In the summer season: CR203 and MTL61 are the two high yields. Both varieties provide better yield in the irrigated area than in the rainfed area. (Table10)

4.3.9. Source of seed.

The rice seed from commercial company usually has better quality than seed from neighbours or which the farmers store by themselves. Rice farmers in Thua Thien Hue province used rice seed from many sources, farmers in the rainfed area who planted traditional rice varieties kept their own seed or exchange with another farmers.

Table 11: Sources of seed by planting season and location (% responses)

	Irrigated area		Rainfed area	
Sources	Spring (n=60)	Summer(n=60)	Spring(n=60)	Summer(n=30)
Neighbor	19	14	4	10
Owner	41	72	93	49
Commercial company	40	14	3	41

Source: survey 1998

Farmers would still use their own seed in both irrigated and rainfed areas. The commercial companies only provide seeds of modern varieties, and would contribue about 40%in the irrigated spring rice and rainfed summer rice production.

4.3.10. Methods of selecting and keeping rice seed.

All of the farmer want to keep rice seed for the next growing season but, the methods vary among farmers as shown in Table 12.

Table 12: The method of selecting and storing rice (% of response)

	Irrigated area		Rainfed area	
	Spring (n=60)	Summer (n=60)	Spring (n=60)	Summer (n=30)
Spike selection & harvest separately from main rice harvest	45	23	15	17
Spike selection & harvest at same time but storage separately	15	8	17	0
No selection	40	68	68	83

Source: survey 1998

The majority of farmers does not separate the rice seed and grain at harvest. They still use the rice grain for planting, resulting in poor seedling establishment.

However, farmers would pay more attention to the irrigated spring rice production when they select spikes and keep separately from the grain.