CHAPTER 4

RESULTS AND DISCUSSION OF FIELD SURVEY

Results of survey which are landscape, agricultural climatic conditions, land use, mungbean role in cropping systems, mungbean practices by farmers as well as some chemical properties of mungbean growing soil in the study site will be presented and discussed in this chapter.

4.1 Study site

With 80% of total provincial area of about 394,000 ha (Department of Provincial Land Management, 1991), hilly zone is considered as an important zone for agricultural production. Accordingly, agricultural production in hilly zone has been paid attention for its productivity improvement by the government in recent years. However, its potential has not exploited properly till now. In the area, two villages Huong Ho and Binh Dien in the west of Hue city were selected as study site in this research. Binh Dien is 25 km and Huong Ho is 17 km from Hue (Figure 1). Huong Ho locates at the lower altitude than Binh Dien. It also has longer agricultural history than Binh Dien, in which government has just established through "new economics" policy since 1976.

4.2 Soil type and soil characteristics

Six of eleven main soil types which was defined by Chieu *et al.*, 1996 in Thua Thien Hue locate in hilly zone namely Grey soil, soil in Valleys, Yellow-Red

Ferralitic soil, Humid Yellow-Red soil on mountains, eroded soil with rocks, and Near Springs and Rivers soil. Of which Yellow-Red Ferralitic is a major soil type for agricultural production in the zone (Department of Provincial Land Management, 1991).

Mungbean growing areas often locate in foothill of hilly zone where its elevation ranged from 10 to 150 meters from sea level, and where Yellow-Red Ferralitic Soil on Clay Shale (Acrisols) is mainly. It is low fertility and easily eroded when there is extreme rainfall. This soil type popularly occupies about 60% of total area of the province (Table 1).

Table 1. Some main soil types in Thua Thien Hue province

Soil type	Area (ha)
Sandy dune soils	8,390
Sandy flat soils	40,010
Salty soils	8,910
Acid soils	4,310
Alluvial soils	42,610
Grey soils	1,340
Accumulated soil in valleys	1,150
Yellow-Red ferralitic soils	331,710
Humid Yellow-Red soils on mountains	20,500
Eroded soil	13,330
Near Springs and Rivers	28,615
Total area	500,875

Source: Department of provincial land management, 1991.

Generally, the soil is fairly high in acidity, but low in nitrogen, calcium, magnesium, cation exchangeable capacity, and basis saturation, especially very low in available phosphorous reported by Dinh, (1996) (Table 2).

Table 2. Some main characteristics on Yellow-Red Ferralitic Soils

Soil type	pH	P_2O_5 %	AvaiP Ppm	Ca^{2+} meq/100g	Mg^{2+} meq/100g	CEC meq/100g	BS %
Ferralitic	4-4.5	0.03-0.05	1-1.5	1.2-1.5	1-1.5	10-12	10-12

Source: Vy *et al.*, 1995 cited by Dinh, 1996.CEC = Cation Exchangeable Capacity; BS = Basic Saturation; AvaiP = Available Phosphorous.

Results of soil analysis from mungbean growing fields in the two villages through soil sampling in the survey also shown similar observations. Available phosphorus was really low for mungbean in which they were 3.51 ppm in Huong Ho and 3.77 ppm in Binh Dien. $pH_{(KCl)}$ were low of 4.5, and 4.4 in Huong Ho and Binh Dien, respectively, while exchangeable Al^{3+} were quite high of 0.62-0.76 meq/100g with large variation among samples in both villages. On average, exchangeable Al^{3+} in Binh Dien was higher than in Huong Ho and pH in Binh Dien was lower relevantly (Table 3).

Table 3. Some chemical characteristics of mungbean soil

Indicators	Binh Dien			Huong Ho		
	AvaiP ppm	Ex. Al^{3+} meq/100g	pH	AvaiP ppm	Ex. Al^{3+} meq/100g	pH
Mean	3.77	0.36	4.36	3.51	0.27	4.5
Min.	2.36	0.12	3.91	2.34	0.08	3.91
Max.	5.21	0.76	5.38	4.01	0.62	5.38
SE	0.2627	0.0689	0.1427	0.1497	0.0606	0.1309
CV (%)	22.06	61.33	10.36	13.47	71.81	9.2

AvaiP= Available phosphorous, Ex.Al^{3+}= exchangeable aluminum

4.3 Climatic conditions

Generally, two indistinct seasons characterize much of north region of Central Vietnam. In the hilly area the rainy season, also known as the monsoon, usually begins in September and extends into late February in the following year, six months altogether. More than 80% of total rainfall in a year, 2,301 mm average annual rainfall, falls in those months, during which only crops suffering high rainfall and cold are raised in late rainy season such as winter vegetables. Typhoons and floods often happen in the early rainy season, whilst it is cold and short days in late rainy season. Therefore, every agricultural activity in the fields is often ended before mid October to avoid floods and typhoons. Drier season (March through August), also known as the major growing season, is cool and days are short in early period. Practically, farmers often begin their farming early January for land preparation or sowing to make sure that their seedlings grow up with enough water in the soil. During this period crops in hilly zone can be grown on rainfed land on stored soil moisture or thanks to small rains. Hot, dry weather lasts from early April until rains begin again in May or June, and any crop grown in that period requires irrigation, and this is a sensitive period for crop growth. Mungbean is sometimes considered as occasional crop when failure of peanut or others due to water stress happen during the period (Figure 4.1).

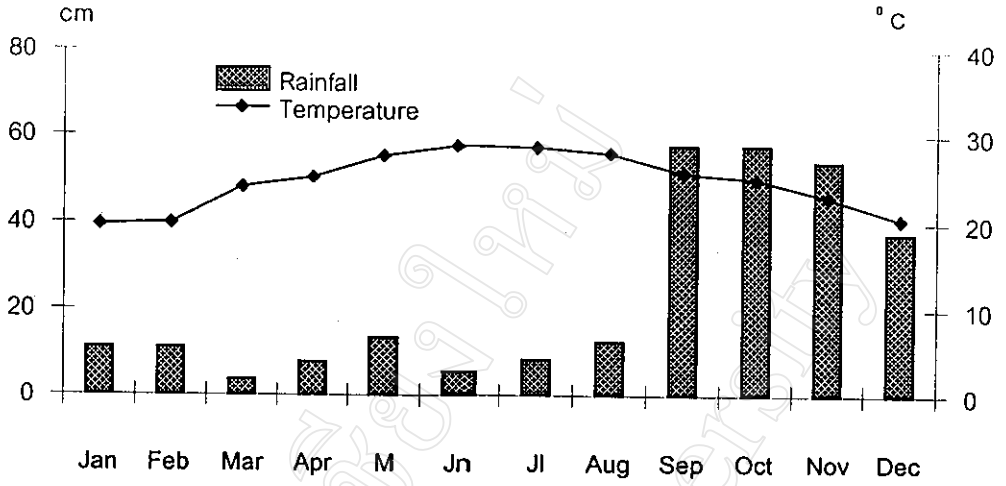

Figure 4.1 Rainfall and temperature of Thua Thien Hue for 14 years (1984-1997)

Source: Hue Meteorological station, 1998.

Rainfall of early six month in 1998 (January through June) was 530 mm, 5% less than fourteen years average of 556 mm. Especially trends of high temperature, of decreasing air humidity, of increasing sunshine hour by months and negative balance between rainfall and evaporation during February through early May, known as El Nino phenomenon damaged growth and development of many different crops in the rainfed areas (Figure 4.2 and 4.3). The droughts affected all the rainfed crops this year, thereby, the negative balance between rainfall and evaporation reduced yields in both medium duration and rainfed short-duration crops. Therefore, mungbean, groundnut yields were low in drier season in the zone. However, mungbean sown in late March with irrigation in experimental site grown and developed normally.

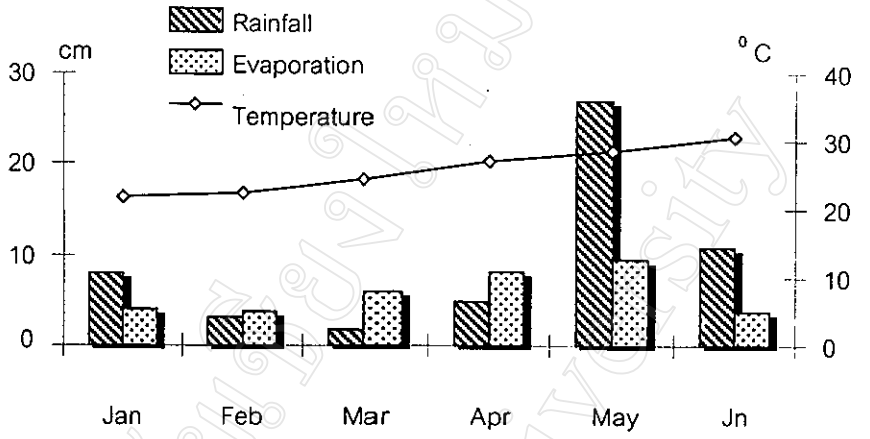

Figure 4.2 Temperature, rainfall, and evaporation of Thua Thien Hue, 1998

Source: Hue Meteorological Station, 1998.

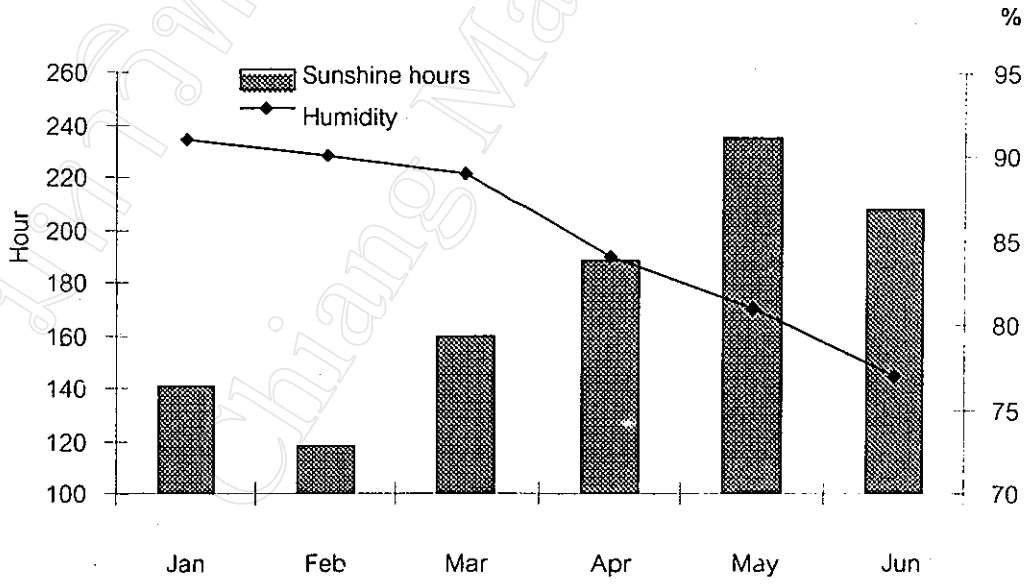

Figure 4.3 Sunshine hour and air humidity of Thua Thien Hue, 1998

Source: Hue Meteorological Station, 1998.

4.4 Land use

Most of the area is also under steep slopes. The majority of the population is Kinh people. Crop production is the major source of food, employment and incomes for most of hilly people. Wetland rice, cassava, sweet potato, peanut, mungbean, and sesame are the six major crops, accounting for more than 80% of all planted area of annual crops in each year (Table 4). Wetland rice is grown in lowland areas near springs or rivers and valleys while cassava and sweet potato are mainly grown in rainfed areas. The four remaining crops are considered as rotation crops, inter-crops with perennial crops or other annual crops in both low and upland. Besides, they are also grown as sole crops in marginal land.

Mungbean has long been the traditional cash, food crop, and employment-generating crop for hilly people. Its area in Huong Tra District has been steadily increasing, from 167 hectares in 1991 up to 340 hectares in 1997, when area of other rainfed crops excepting sesame, and peanut, have been remarkably declining due to poor market and poor processing from post-harvesting. Besides, wetland rice area has been stable for many years in which this indicated that the new suitable area for rice become scarce. The different trends of area growth of rainfed crop, especially mungbean's trend shown new and positive preferences of farmers to improve their incomes and their soil fertility. Accordingly, peanut and mungbean areas are being increasingly grown (Table 4, Figure 4.4).

Table 4. Sown area of some main crops in Huong Tra district

Irrigation	Crop	1991 (ha)	1995 (ha)	1996 (ha)	1997 (ha)
WITH	Winter-Spring rice	3024	3023	3051	3073
	Summer-Autumn rice	3299	2890	2900	2912
	Vegetable	352	297	286	312
WITHOUT	Maize	48	53	56	63
	Sweet potato	1055	723	598	640
	Cassava	467	421	461	474
	Peanut	810	1106	1068	1085
	Mungbean	167	303	315	340
	Sesame	167	163	240	246
	Sugar	254	64	75	80
	Total	9643	9043	9050	9225

Source: Hue Statistical Office, 1997.

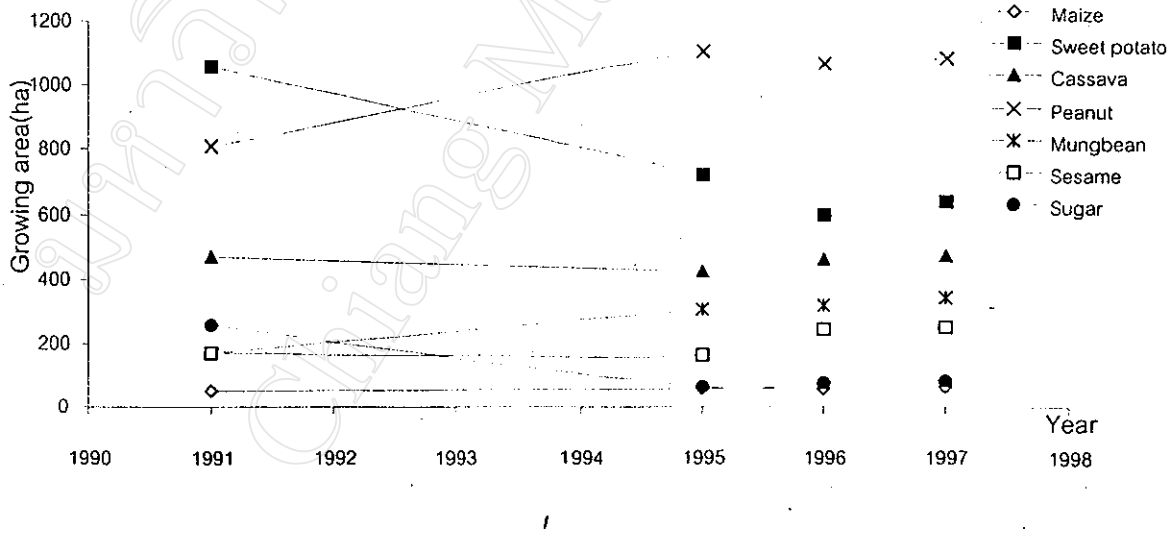

Figure 4.4 Grown area of some main rainfed crops over years in Huong Tra District.

Source: Hue Statistical Office, 1997.

Productivity of all hilly land cropping systems with exception of wetland rice in the past had actually depended on clearing new land to provide good fertility soil. Controlling weeds and pests as well as growing sole crops i.e. cassava and sweet potato that may have been caused erosion and degraded soil during the cropping season. In recent years, it has become less and less practicable to grow cassava and sweet potato for several continuous years because degradation of soil (Vinh and Phien, 1997). Population pressure has been increase in the hilly lands by high growth of the population, through high birth rate and encroachment by people from the lowlands, where land is becoming increasingly scarce (Cuc *et al.*, 1990). Furthermore, national policy on forests and watershed conservation is also forcing hilly people to become sedentary causing them to crop the available land more intensively. On the other hand, there is an increasing need for new cash crops, to replace the cassava and sweet potato as well as to make up for the loss in productivity resulted by the intensification of land use.

4.5 Mungbean in cropping systems

Sweet potato-sweet potato-sweet potato and mungbean-cassava pattern, these two traditional patterns were mainly grown in the past. However, they become less feasible in economic efficiency than the remaining patterns, especially in the opened market context in recent years (Figure 4.4). Moreover, soils under thus patterns were regularly degraded in which soil fertility will be seriously reduced as mentioned above. On the other hand, these traditional patterns still remain their fairly large areas (Table 4), known as "food security" and "low input", in which they are practiced by small farmers in the zone.

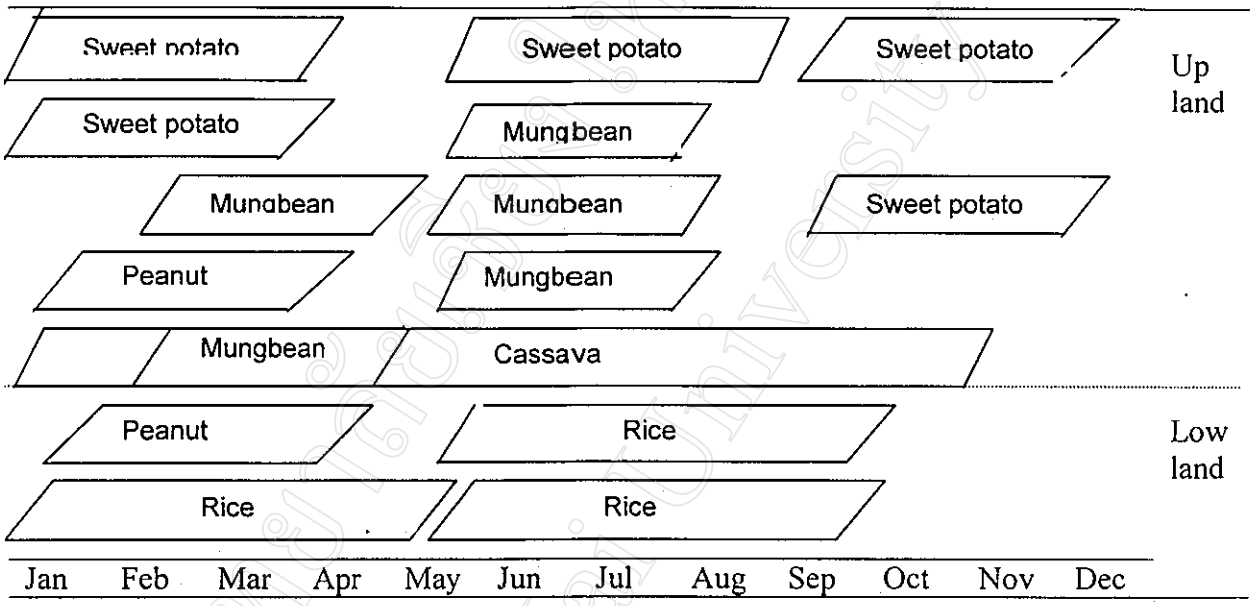

Figure 4.5 Some main cropping patterns in the two villages surveyed.

Mungbean- mungbean-sweet potato and mungbean- cassava pattern are often applied much more in Binh Dien than Huong Ho where peanut-mungbean, peanut-rice and rice-rice patterns are preferred, due to land with irrigation (Table 5 and Figure 4.5).

The results revealed that it was about 27% and 37% of total arable land of household where summer mungbean were grown in Binh Dien and Huong Ho, respectively. However, spring mungbean is often sown much more in Binh Dien than in Huong Ho where farmers often grow peanut instead of mungbean during the time. It was 6% of total arable land of household in Huong Ho was grown spring mungbean, in which it against 26% in Binh Dien (Table 5). The better Huong Ho's

irrigation conditions enable farmers grow other crops instead of mungbean because those crops bring to farmers more cash such as groundnut. This mean that either farmer is used growing mungbean in marginal land or farmer often grow mungbean when other crops can not suffer with natural hazard conditions. However, summer mungbean are popular for both communes because it is often too short in time for other crops grown from May to August. During droughts and floods happen annually, mungbean, therefore become popular in this season (Table 5, Figure 4.5).

Table 5. Average yield, mungbean area and total annual crop area of household in Huong Ho and Binh Dien

Indicator	Binh Dien				Huong Ho			
	Total[(1)] m^2	M1 m^2	M2 M^2	Yield kg/ha	Total[(1)] m^2	M1 m^2	M2 m^2	Yield kg/ha
Mean	5412	1412	1512	520	4465	250	1667	520
Min.	3500	0	500	200	2000	0	1000	100
Max.	8500	2250	2250	1100	11500	1500	2250	1200
CV	26.27	47.1	35.36	57.39	50	210	19	64.72
N	20	20	20	20	20	20	20	20

N: Number household interviewed, M1: The spring sown mungbean area, M2: The summer sown mungbean area; [(1)]: Total area per household; N: Number of household interviewed.

Average mungbean yield in both villages is 520 kg per hectare in which it is fairly low. On the other hand, coefficient of variation from 57% to 64% prove that mungbean yield in the area is very different from a field to others (Table 5). Yield range from 100 to 300 kg/ha is about 40% of total households interviewed in both villages (Table 6). However, maximum yield was 1200 kg ha^{-1}. This indicated that there is high potential to improve mungbean yield in the areas (Table 5).

Soil fertility improvement based on planting mungbean is important in which it was concerned by 40 % of total farmers interviewed in both villages, while there was 47.5% of them assumed nothing changed. Additionally, it was 72.5 % of them agreed that mungbean stover is necessary for green manure (Table 7). Unlike other legume stovers, mungbean stovers are regularly left in the fields after picking pods. Thereby, it is possible to improve soil fertility where mungbean is grown.

Table 6. Yield ranges of mungbean in Huong Ho and Binh Dien

Huong Ho			Binh Dien		
Value(kg/ha)	Farmer (%)	Cum. (%)	Value (kg/ha)	Farmer(%)	Cum. (%)
100	5	5	200	15	15
200	20	25	300	15	40
300	15	40	400	5	45
400	15	50	500	30	75
500	15	70	800	5	80
800	5	75	900	5	85
900	5	80	1000	5	90
1000	15	95	1100	10	100
1200	5	100			

Cum. = cumulative percentage

In pest and disease in the fields with growing mungbean, in which they occurred less often than in the fields without growing mungbean, 65% farmers agreed against 2.5% farmers who disagree that idea (Table 7). Besides, 35% farmers interviewed agreed that nothing changed in their fields where mungbean grown (c.f. other fields) (Table 7).

More than 82% of total farmers who assumed that growing mungbean is better in net return (c.f. growing cassava and sweet potato). Similarly, 90% of them agreed

that growing mungbean enable them use more efficient family labor meanwhile it was only 10% of them who assumed hard time for labor (Table 7). In addition, mungbean is grown in both upland and lowland as sole crop or intercrop with cereal (usually with maize), and perennial tree such as rubber during the time when the foliage canopy of trees is not totally covered. With thus feasibility of mungbean, it is considered as economical effective crop for increasing income of farmers and improving soil conservation in the uplands.

Table 7. Role of mungbean in farming systems in the two communes interviewed

Issue	Level	Percent accepted
Soil fertility improvement	Increase	40
	Decrease	12.5
	No changing	47.5
Pest and disease situation*	Increase	2.5
	Decrease	65
	No changing	32.5
Green manure	Very necessary	30
	Necessary	42.5
	No	27.5
Net return compared with Cassava and sweet potato	Better	82.5
	Similar	17.5
	Worse	0
Family's labor use	More efficient	90
	Hard time for labor	10
	No changing	0

* Compared to other fields (no mungbean)

4.6 Mungbean practices

Most of farmers still use the local varieties of mungbean, so-called "Lang" and "Moc". In the recent few years, some farmers switched to new high yielding varieties of mungbean. However, it was found that the yields were still low. There were about 50-55% total households answering that they are used to using one mungbean variety

only, popularly "Lang". Accordingly, Lang was used as control variety in the experiment (Table 8). Although pest (insects and diseases) often happens on the mungbean fields, 50-70 % farmers ignored controlling pest. Similarly, weeding, hand-weeding, were weakly paid attention by farmers in which 65-70 % farmers weed one time for mungbean (Table 8).

Many farmers applied fertilizers to mungbean, especially N (urea) and manure. However, no relationship between amount of nitrogen fertilizer applied with mungbean yield was found in this study. Result of correlation (Pearson) between them was – 0.1174 (Appendix Figure13). Total 100 % of farmers applied N at different rates, from 51 to 58 kg Urea ha^{-1} (Table 9) whilst there were only 5% of farmers applied phosphorous fertilizer at 60, 100 kg Ninh Binh Phosphate (12% P_2O_5) ha^{-1} in Huong Ho and Binh Dien, respectively. Despite of acid soils, some farmers assumed that applying of phosphorous fertilizer gave higher yield than liming and farmers often use either phosphorous fertilizer or lime for their mungbean fields. There was not farmer who applied phosphorous fertilizer and lime in their mungbean fields.

Obviously, effectiveness of incorporating lime application with phosphorous fertilization for mungbean fields was not recognized in the zone. Similarly, potassium fertilizer was usually not applied in upland fields for mungbean. However, farmers often applied potassium fertilizer together with nitrogen and phosphorous fertilizer for paddy rice in the lowlands. Some farmers in both villages used plant ash as source of substitute potassium. Only 15% farmers in Huong Ho and 25% in Binh Dien did not use manure for mungbean production. Almost farmers use manure with average amount of 3,400 , 4,400 kg ha^{-1} in Binh Dien, and Huong Ho, respectively (Table 9).

Table 8. Mungbean practices from farmers in Huong Ho and Binh Dien

Issue	Value	% in BD	% in HH
1. Tillage	With	85	100
	Without	15	0
2. Manure application	0	25	15
	2 t/ha	20	25
	4 t/ha	35	25
	8 t/ha	20	30
	10 t/ha	0	5
3. Urea (46%N) application	20 kg/ha	5	10
	40 kg/ha	25	50
	60 kg/ha	45	20
	80 kg/ha	25	15
	100 kg/ha	5	5
4.Phosphorous application	0	95	95
	60 kg/ha(12% P_2O_5)	5	5
5. Potassium	Without	100	100
6. Pest control	With	30	50
	Without	70	50
7. No. variety used/farm	1	55	50
	2	45	50
8. No. weeding/ crop	1 time	70	65
	2 times	30	35

% in BD = Content of farmer in Binh Dien; % in HH = Content of farmer in Huong Ho

Table 9. Average fertilizers applied in mungbean fields in both villages

Indicator	Binh Dien			Huong Ho		
	Manure (kg/ha)	Urea (kg/ha)	P_2O_5 (kg/ha)	Manure (kg/ha)	Urea (kg/ha)	P_2O_5 (kg/ha)
Mean	3400	58	5	4400	51	3
Min.	0	20	0	0	20	0
Max.	8000	80	100	10000	100	60
N	20	20	20	20	20	20
CV (%)	83.4	29.4	447.2	73.1	41.2	447.2