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MADA-TARC Cooperative Study

Pilot Project ACRBD 4 Muda Irrigation Scheme

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(1) The pilot project area, selected as the object of the study is situated 12 miles to the north of Alor Setar. The total area covers 760 ha of which 705 ha consist of paddy fields.

The number of farmers cultivating the land within the project area totals 416, but their residences are located mostly outside the area. Farm lots in the project area total 323, and their size is relatively large, being more than 2 ha. The farm lots belonging to single owners account for more than 50% of the total.

The size of a farm in the area is approximately 1.8 ha, being larger than the average farm size of 1.6 ha in the whole Muda area. In the area, 69% of the paddy fields are cultivated by tenants, and the rented land includes 22.5% of semi-owned land in the form of B.S.T.S. and *pesaka*.

(2) The traditional land alienation and the existing land tenure system do not define precisely the relationship between the owner and the operator in the farm lots. On the other hand, the traditional method of registration of land for inheritance clearly defines the right of cultivation from ownership whereas any transaction or sale of land is difficult.

In spite of the difficulties of transaction of land ownership, the land cultivation right is transferred smoothly among farmers. The mobility and flexibility of the cultivation right can be considered as a constraint to the adoption by the farmers of improved cultural methods and to the stimulation of their willingness to carry on farming.

(3) There are two sources of labour supply in the area: family labour and other agricultural labour. The family labour supply is very stable while the seasonal labour supply from outside has dramatically decreased due to the introduction of harvesting machines.

The labour input for farming was 989 man hours per ha per year, 92% of which being spent for paddy production in the area. Farmer's working days in the area numbered 134 days/annum, of which 51% were for harvesting and 25% for transplanting. Both harvesting and transplanting activities are characterized by seasonal and intensive labour inputs.

Therefore, the farmers often face seasonal labour shortage. Recently mechanisation for harvesting has been disseminated rapidly in the area and it has contributed to the elimination of the seasonal labour shortage. Serious labour constraints in the area are now represented by a reluctance to carry on farming, with the development of the rural areas and the spread of education.

Labour utilisation pattern in the area is similar basically too, but slightly differs from that in the whole Muda area, that is transplanting works depend mostly on the *derau* system while in the whole Muda area they depend on the *upah* system.

Labour shortage problem in the area arises from seasonal variation in labour input and to alleviate this problem various measures including staggering of planting, mechanisation, cooperative labour utilisation are being considered. The introduction of harvesting machines has brought about a remarkable change in labour utililsation since 1976.

(4) Farm mechanisation in the Muda area has started before double cropping with the use of the four wheel tractor for land preparation, i.e. there is no causal relationship between

double cropping and farm mechanisation. However, undoubtedly the tractorization of land preparation has helped to accelerate double cropping and to ease the problem of labour peak demand. Since around 1976 combine harvesters began to spread in the area on a commercial basis. They were introduced by private contractors with a motivation of pure profit. They were accepted by the farmers in the area because of their efficiency, economy and convenience rather than as a result of shortage of labour.

Overseas farm machinery agents, harvest contractors and brokers in the area have contributed to the dissemination of mechanisation of harvesting. Achievement ratio of mechanisation in the area was 109% for land preparation works, 35% for harvesting in the off season and 82% in the main season of 1979 respectively. However the ratio for harvesting varies from region to region and depends on the size of the farm.

Although the farming practices and farm management in the area become influenced by tractorization and harvesting mechanisation, the effect of the latter is rather different from that of the former. Tractorization as a substitute for buffaloes, has had little influence on farm income formation and labour input pattern while the mechanisation of harvesting has directly influenced them and, as a result, the redistribution of income among the farmers has changed. Besides, surplus labour problem began to occur in the small size farms.

(5) The calendar for double cropping in the area still remains unstable and variable, nowadays, 10 years after the initiation of double cropping. Although most of the farming practices have been carried out with traditional methods as in the single cropping period, new technology is applied to fit to double cropping; a) all the farmers in the area grow new varieties suitable for double cropping instead of the traditional and local varieties and they prefer to introduce the newest varieties into the area every season. b) the amount of fertiliser (nitrogen) and other chemicals applied by the farmers has increased i.e. 63kg for the off season and 76kg for the main season per ha, respectively. On the other hand farmers have a poor knowledge of the period suitable for application. c) the traditional harvesting has been changed into a mechanised one with the use of the combine harvester. About 70% of the area was harvested by machine in 1979, while the transplanting works in the area are still carried out by hand.

In the estimation of the paddy yield, the amounts of guni reported by the sampled farmers and the deduction rate of the paddy which was obtained from their sales receipts provided from brokers were used.

The deduction rate — (gross weight-net weight)/gross weight—was estimated at 84.6% for the off season and 84.8% for the main season of 1979. Estimated paddy yield in the area accounted for 3.65 tons in the off season and 4.12 tons in the main season.

The factors influencing paddy yield level seem to be land tenure, age and sex of the farmers, paddy variety employed, and timing of transplanting, on the basis of the farm management surveys carried out in the area. Besides, the relative amount of fertiliser applied also influenced the increase of the yield. On the other hand it seems that there is no relationship between the period of application of fertiliser and yield.

It is expected that in the area the yield may increase by about 30% when the Muda II project is achieved, even though the projected figures estimated at 20-24% the rate of increase. However suitable land consolidation, improved water management and new technologies to increase the yield in the area should be promoted because the yield varies from field to field.

(6) Agricultural receipts per farm in the study area were higher than in the whole Muda area due to the larger farm size and higher paddy yields. Among the total agricultural expenditure the study area had 37% of the total agricultural receipts while the whole Muda area had 40% of them, due to the smaller labour charge expenditure caused dy the greater incidence of *derau* labour system in transplanting. The contribution to lease and contractor charges became, however, higher in the study area due to the rapid spread of harvesting machines. The net agricultural income by farm size was the highest in the 5-10 relong* category. The income ratio was 63.4% on the average while in the whole Muda it was 61.0%. The production cost of paddy in the area was higher than in the whole Muda area and returns from paddy production in the study area totalled M$325 per relong while M$265 in the Muda area. However the final rate of returns was almost the same as in the Muda area.

The household expenditure of the family farm in the area which amounted to M$1.5 per capita per day including home consumption was almost the same as in the whole Muda area in 1973. The breakdown of the expenditure was 40% for food, 23% for domestic goods, 8% for education and 18% for eating and drinking out and entertainment. Engel's coefficient was 0.46 on the average and a poor family spent a larger proportion of the income for food in accordance with Engel's law.

The agricultural, household and surplus income of the family farm in the area was controlled by the farm size in accordance with the concept of economies of scale or size. However, as far as the agricultural income per unit area was concerned, the highest income corresponded to the lower medium size farm category (5-10 relongs) followed by the large farm, the upper medium and the small farm. Therefore a plot type of viable farm could be found in the lower medium size category.

With regard to the surplus income per capita, the difference among farm sizes was conspicuous. The highest income was recorded by the large family farm (M$115 per capita per annum) while for the small family farm the income was only M$15. On an average, the household income per capita per annum was M$1,231, equivalent to US$586 in 1979/80.

National average income per capita that was US$1,030 in 1978 is projected to increase to US$1,530 in 1988. Assuming the same rate of growth as national average, the income in the study area should rise to US$867 in 1988. Even if the study area achieves the target of 30% yield increase, the relative income position of the family in the area is likely to deteriorate without price support or subsidy policies for paddy production.

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* 1 relong = 0.287ha

INTRODUCTION

As part of the Malaysian government policy to develop its economy in general and its agricultural sector in particular, the Muda Irrigation Project was initiated with the construction of engineering infrastructure accompanied by its supporting agriculture services to enable double cropping of paddy in the region. This resulted in the ability to convert the 96,000 ha of paddy land from a traditional single cropping area dependent on natural rainfall to a double cropped area with independent supply of irrigation water. Double cropping started in 1970 and by 1975 a cropping intensity of 192% had been achieved.

Although double cropping was introduced to the area, the system as a whole had not been stabilised and constraints to optimal production of paddy still persisted. This was manifested in the unpredictable supply of irrigation water to a significant portion of the project area. The Muda II development plan[9] was subsequently introduced so as to alleviate the unpredictability of supply to these areas, to spread the supply to other areas and to improve the level of water control in the field.

The basis of the Muda II irrigation project is the intensification of irrigation canals, drains and farm roads, from a pre-project density of 11-12 metres/ha to a post-project density of 30-35 metres/ha. While the project is a major step in the right direction towards optimum farming in the area by providing the basic infrastructure by which farmers can rationalise their farming techniques, it is felt that steps need to be undertaken to support this effort with new studies to investigate and formulate the establishment of a new farming system.

It has been observed that the cropping techniques had not changed much from a single cropping agriculture to a double cropping environment. There was merely a transfer of techniques from a single cropping environment to a double cropping one. This, it is felt, is inadequate to transform the paddy farming economy into a stable paddy production system. A new farming system needs to be developed which is suitable for double cropping agriculture and to enable this to be evolved, detailed studies need to be initiated to cover the role of farm mechanisation, to determine the level of water management techniques suitable for the local farm, and to optimise the utilisation of labour. Land consolidation and the improvement of the land condition also need to be seriously considered to improve the physical environment for the farm. It is imperative therefore that such an optimum cropping system be developed if the infrastructure provided under the Muda II project is to be fully utilised and paddy production optimised.

In developing the optimum farming system, the concept of the "viable farm" will be introduced. This concept revolves around the belief that a farm should be self-supporting and also provide a surplus from its production. In connection with this, the economic targets of the farmer need to be redefined into a more specific and attainable goal rather than the vague exhortations of improved standards of living.

As part of the Tropical Agricultural Research Programme of Japan, a cooperative study is being undertaken on a multidisciplinary basis by the Tropical Agricultural Research Centre (TARC) of Japan, and the Muda Agricultural Development Authority (MADA) of Malaysia.

The studies are aimed at establishing rational, integrated methods of paddy double cropping, to construct facilities for improved water management and to raise the level of agricultural productivity. Research relating to improved cultivation technology, mechanisation for paddy production and improved infrastructural system in the project area will be pursued.

To achieve the above objectives, a pilot project area comprising the irrigation block ACRBD 4* was selected from the 110 irrigation blocks which comprise the Muda Scheme area. A Japanese study

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* Located in Distict II, about 5 miles West from Jitra and 12 miles to the North of Alor Setar.

team was organised with the inclusion of agricultural civil engineers, agronomists, agricultural machinery engineers and agricultural economists to implement the study.

The agro-economic studies have been designed to enable the evaluation of land improvement including the new facilities, new production techniques to establish a more suitable farming system, better farm management technology and functional farm organisation in order to set up "viable farms" with double cropping of paddy.

The concept of a "viable farm" can be defined as a farm unit independently supported by its paddy double cropping activities without off-farm income. Its characteristics are as follows:

(1) The farmer has reached a slightly higher level of agricultural technology than the present average farmer in the area.

(2) Income from double cropping of paddy enables the farmer to support his family, and to accumulate some surplus.

(3) Farm units will consist of private farms operated by one farmer with assistance from his family labour.

METHODOLOGY AND PROCEDURE

In undertaking the studies, two approaches are possible. They are the following:

(1) Deductive method:- Under this approach, all the existing theoretical literature on optimal farming systems will be reviewed and a type of farming system recommended for the area to create high productivity farms. This is then applied to the true-life situation and its impact assessed.

(2) Inductive method: - This method revolves around the present system in the field. A study is made of the existing farming system through surveys and analysis is undertaken on farming targets, profitability, productivity and their constraints. Recommendations are then made to overcome existing constraints in order to transform these farms into an optimal farming system.

Under this project, the latter method is adopted for its obvious advantages. It takes into account existing cultural techniques and practices and works round it rather than imposing an alien system to a farming environment in an effort to boost productivity. It reveals to the planners the existing farming system, details on farming and cultural techniques and local sensitivities so that any system that is subsequently introduced will be more acceptable to the farmers.

In implementing the study, a set of surveys will be carried out in the project area to collect

Table 1 Number of farms, household members, and labour force by farm size in study area

	Unit	ISA-A, B, and E*				Pilot Project Area ACRBD4	Whole Muda Area***
		Small Size	Medium Size	Large Size	Total (average)		
No. of farms		62	60	59	181	416	60,000
Paddy field cultivated per farm	relong	3.1	7.5	17.0	9.1	8.7	6.0
Located in study area	relong	3.2	5.7	12.6	7.1	6.4	—
Located outside study area	relong	—	1.8	4.4	2.0	2.3	—
No. of family members per farm	person	4.9	6.1	6.7	5.9	5.7	5.3
No. of labour force per farm**	person	3.0	3.4	3.8	3.6	3.5	2.9
No. of family members engaged in farming per farm	person	2.1	2.4	2.1	2.2	2.3	2.4

* small size : Below 5 relongs (1.4 ha)
medium size: 5 - 10 relongs (2.8 ha)
large size : more than 10 relongs

** Labour force : person from 16 to 60 years old.

*** 1974 Agro - Economic Studies.

comprehensive data necessary to achieve the above objectives. This will cover 40 representative farmers operating in the project area, purposely selected rather than randomly selected. They are representative of the scale of operations in the area, the tenure system and the physical system.

A benchmark survey in the pilot project area was carried out before the sample farm study, by a team of Japanese officers in association with MADA. From this initial survey, three compartments (later to be called ISA-A, ISA-B and ISA-E) were chosen for the trial of tertiary facilities as shown in Appendix 1. The total area of ISA-A and ISA-B combined covers 224 ho (of which 223 ha is planted area) while the area of ISA-E covers 125 ha (of which 98 ha is planted area). These two areas make up the study area.

Table 1 shows the number of farms participating in paddy farming in the study area, the farm size and the number of household members.

The above Table 1 indicates that there is a nearly equal number of farms in each farm size category in the study area, showing that the study area is not typical of the Muda area as far as farm size is concerned. The total area under the large size category is much larger in the study area.

Average farm size operated in the area is 9.1 relongs (of which 2.0 relongs are outside the study area), which is significantly higher than the average Muda size of 5.7 relongs.However the number of family members engaged in farming is smaller although the number of potential labour force is larger. This reflects a non-preference for farming work by the family members in the study area.

The following procedure was adopted in the selection of the sample for the study:

(1) ISA-A and ISA-B were grouped together and partitioned into zones according to the distance from the secondary canal and the condition of the land (that is, deep areas and swampy areas as one zone). ISA-E was considered as a single zone (see Appendix 2).

(2) All farmers cultivating land in each zone were classified by the farm size.

(3) Farms were further categorised according to their size group i.e. large (exceeding 10 relongs or 2.8 ha), medium size (5-10 relongs or 1.4-2.8 ha) and small size (below 5 relongs or 1.4 ha)

(4) One owner's farm, one tenant farm and one owner-tenant farm were selected within each group in each zone at random.*

Table 2 shows the distrifution of the selected sample farms by zone and tenure. The total sampling fraction is 23%.

The survey would begin with an opening inventory, followed by a weekly current farm management survey and end by a closing inventory survey. In all, the survey will be undertaken during three different phases of the project life, namely, before the improved physical infrastructure for the area is constructed, during construction and after construction. This report covers the first phase of the study.

The main survey items include the following:

1 Farmer's Budget (Income and expenditure)

1) Receipt - income

(1) Farm products. (2) Fish and fish products. (3) Sale or exchange of stock-pile. (4) Income, wages and salary. (5) Income from lease and contract. (6) Income from rented out land and buildings. (7) Income from interest. (8) Government subsidy. (9)Income from off farm business. (10) Income from miscellaneous sources.

2) Expenditure - purchase, credit, and input or self-consumption.

(1) Farm inputs. (2) Capital goods. (3) Repair, insurance and service charge. (4)

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* Landlords and landless farmers were excluded from the sampling.

Table 2 Distribution of the selected sample farms *

	Sample Farms							Parameter (all farms)
	ISA- and B					ISA-E	Grand Total	
	Zone 1	Zone 2	Zone 3	Zone 4	Total	Zone 5		
Owner's	3	2	2	2	9	3	12	88
Tenant	2	3	1	3	9	2	11	61
Owner &Tenant	3	4	2	4	13	5	18	32
Total	8	9	5	9	31	10	41	181
Parameter (all farms)	43	35	16	38	132	49	181	
Sampling Fraction (%)	18.6	25.7	31.3	23.7	23.5	20.4	22.7	

* Landlords and landless farmers were excluded from the sampling.

Payment of labour charge and wages. (5) Expenditure for lease and contract. (6) Rent payment. (7) Expenditure for off farm business. (8) Payment of taxes and other public charges including *zakat, fitrah.*

3) Expenditure for household consumption.
4) Miscellaneous expenditure.
5) Savings, deposits and loan deposits.

2 Farm works and labour utilisation.
1) Existing labour input related to paddy production in own farm.
(1) Nursery work. (2) Paddy field work. (3) Labour input for work after harvesting.
2) Labour input for work other than paddy production.
3) Labour input of own and family labour on other farms.
4) Labour input of own and family labour for off farm business and house works.
5) Information relating to labour utilisation.

3 Conditions of nursery bed and paddy field.
1) Nursery bed
(1) Number of nursery beds. (2) Location. (3) Acreage. (4) Date of sowing. (5) Paddy variety. (6) Condition of nursery beds.
2) Main field
(1) Number of parcels.(2) Location. (3) Acreage. (4) Depth of surface of soil. (5) Height of footpath. (6) Depth of water. (7) Eveness of parcel. (8) Date of transplanting. (9) Paddy variety planted. (10) Condition of paddy and paddy field. (11) Date of harvesting. (12) Amount of harvested paddy. (13) Amount of paddy at selling time. (14) Selling price of paddy.

1 Profile of the pilot project area ACRBD 4

1.1 Location

The pilot project area (irrigation block) ACRBD 4 is located in locality D2 in the Muda District II. It is situated 12 miles to the north of Alor Setar and 5 miles to the West of Jitra. A map showing its location is attached in Appendix 2.

1.2 Physical conditions and existing infrastructure

The total area of block ACRBD 4 covers 760 hectares. It is surrounded by 5 km of secondary canals made up of the canal ADRBD 4 to the east and the drain ACRBD 5 to the west. Its northern boundary is the Tunjang drain while its southern flank is the Alor Changileh canal.

The irrigation consists of 705 ha of paddy fields, 26.1 ha of batas, 0.6 ha of farm roads, 1.2 ha of canals, 1.0 ha of drains, and 27.9 ha of houselots and built-up areas.

A study of the locality D2 undertaken by the Centre for Policy Research, Universiti Sains Malaysia in 1976, indicates that the total available cultivated area is 2,548 relongs or 730 ha of which the actual cultivated area is 2,336 relongs or 671 ha. The difference between this figure and the earlier estimated paddy area of 705 ha shows that approximately 34 ha cannot be cultivated because of their location in swampy and low lying areas.

The weather is uniform throughout the irrigation block and all the cultivated area is suitable for double cropping. However, in the centre of the pilot project area there is an area of relatively higher ground which presents some difficulty in achieving double cropping.

The altitude of the area ranges from 2.0m to 3.0 m above mean sea level. Although the area is relatively flat on the micro- level, it has an intricate micro-topography, due to the existence of dried up river beds and swampy areas.

The soil in the area belongs to the Telok soil series which is acid sulphate in nature. Preliminary findings however indicate that the effect of the acid sulphate soils on yields is not as serious as originally feared.

1.3 Residence of farmers

Within the pilot project area are located six villages which lie totally inside or along the edges of the area. Most of them are linear settlements along drains and canals. Because there are only a few villages located in the project area proper, it is not surprising to find that the farmers (totalling 416 in number) who operate farms within the area, do not all live in these villages. Besides, their farms are not always located within the project area only. It is found that these 416 farmers operate a total of 923 ha, of which 70% or 647 ha are within the project area and the balance of 30% or 276 ha lies outside of the project area.

The residences of the farmers are also scattered over a hundred villages, most of which are located outside of the project area. The names of the main villages including the number of paddy cultivators in the area are listed in Table 3. The table shows that only 227 farmers or 55% come from 15 villages, while the other 189 or 45% reside in 95 other villages. Farmers who reside in the six villages located in or at the edges of the area total only 103 or 25% of the total. This shows that the farmers' residences are very scattered and far from the fields.

Table 3 Main residential villages of farmers and number of operators

	Name of Village	No. of Farmers
1.	Gelong Rambai	35
* 2.	Telaga Batu	33
* 3.	Telok Bilik	23
4.	Bagan	19
* 5.	Padang Telok	15
* 6.	Kepala sa-puloh FIDA 2	14
7.	Tunjang	13
8.	Kampung Baru	12
9.	Binjal	11
* 10.	Kolok Telaga Batu	11
11.	Chegar	11
12.	Kampung Raja	10
13.	Pulau Timbul	7
* 14.	Telaga Janggus	7
15.	Pulai	6
Subtotal	15 villages	227 farmers
Others	95 villages	189 farmers
Grand Total	110 villages	416 farmers

* Villages located in or at the edges of the project area.

1.4 Family size and labour force

The average family size of farmers involved in paddy production in the area is 5.7 persons. The male-female ratio is 51:49 and the age-sex distribution is shown below:

Table 4 Family size in the project area

Age	Male	Female	Total
0 — 15	1.1	1.0	2.1
16 — 60	1.8	1.7	3.5
Over 60	0.0	0.1	0.1
Total	2.9	2.8	5.7

The table indicates that the available labour force, i. e. in the age group 16-60 years old, per family is 3.5 persons with 1.8 males and 1.7 females while it was 2.9 per family with 1.3 males and 1.6 females in the whole Muda area. For various reasons, not all of the labour force engages in paddy farming activities. The survey indicates that the average number of persons participating in farming in the area is 2.3 with 1.3 males and 1.0 female per family. This is equivalent to only 66% of the total labour force.

Comparison with the Muda average obtained from the Agro-Economic Studies[5] indicates that the project area has a small ratio of the participants in farming to the labour force. The number of people engaged in farming was 24 persons, equivalent to 83% of the labour force.

Landless farmers have also been found to be residing in the area. However their exact number could not be determined.

1.5 Farm lot and ownership

Farm lots in the pilot project area total 323. The sizes of the farm lots vary from 1 relong (0.29 ha) to 54 relongs (15.5 ha). Figure 1 shows the size distribution of the farm lots in the project area.

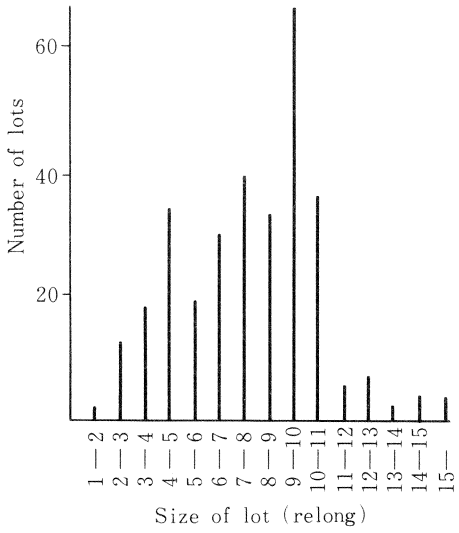

Fig. 1 Number of farm lots classified by size

Seventy-one percent of the farm lots fall in the size category between 4 to 10 relongs (1.2 to 2.9 ha). However the highest frequency is in the category of 9 to 10 relongs (2.6 to 2.9 ha) which alone accounts for 21% of the farm lots.

Each farm lot need not necessarily belong to a single owner, and multiple ownership is also common. Table 5 shows that only half of the farm lots belong to single owners, 24% to two owners and 15% to more than 4 owners.

Table 5 shows that the number of single owners is still significant when compared to the overall Muda figures[3]. Farm lots are still large and fragmentation of land has not become serious. This is perhaps due to the area being newly settled and the recent introduction of land registration (in the 1950s).

Table 5 Distribution of farm lots by number of owners

No. of Owners	No. of Farm Lots	Distribution %
1	100	50.5
2	47	23.7
3	21	10.6
4	12	6.1
5	6	3.0
6	4	2.0
Over 8	8	4.1
Total	198	100.0

1.6 Farm size and tenure status

As mentioned earlier, total operators number 416. The total project area is 762 ha, resulting in an average farm size of 1.83 ha per farmer. This is larger than the average farm size in the Muda area[4] which amounts to 1.64 ha. The distribution of the farmer operators is shown in Figure 2 below:

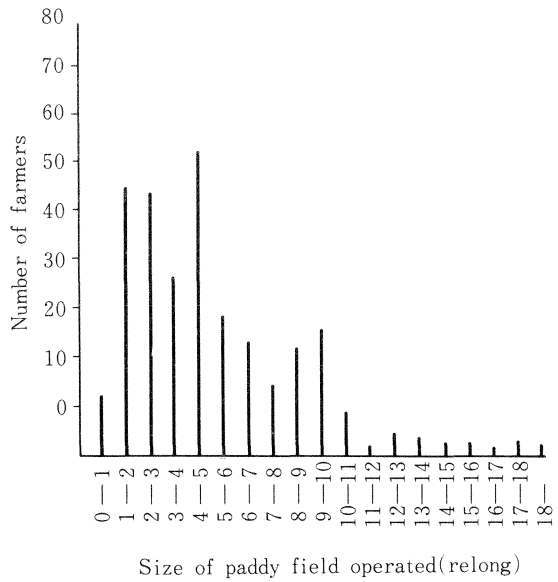

Fig. 2 Distribution of farm size

Table 6 indicates the total number of operators by lot. It shows that 68% of the farm lots are operated by single operators while 19% of the lots are operated by two farmers. The balance of 13% is operated by more than 2 farmers.

Table 6 Distribution of farm lots by operators

No. of Operators	No. of Lots	Percentage (%)
1	219	67.8
2	62	19.2
3	22	6.8
4	8	2.5
5	5	1.5
6	5	1.5
7	1	0.3
•	•	•
•	•	•
•	•	•
11	1	0.3
Total	323	100.0

Table 7 indicates the tenure status of the land in the pilot project area. Approximately 52% of the land in the area is cultivated by tenants who rent in land on a fixed rental basis or who do not pay rent (*B. S. T. S.-Bukan Sendiri Tanpa Sewa*, or no rental payment for cultivating land owned by another person).

About 7.2% of the land is cultivated by *tuntut* which means a right to inheritance without finalising legal procedure or transferring the title deed. This refers to *pesaka* land.

The category of *B. S. T. S.* and *pesaka* can be considered as a form of ownership. The category of paddy rented land thus falls to 41.2% while owned and semi-owned land accounts for 53% of the total. The owner operator category is therefore very significant in the pilot project area.

Table 7 Tenure status of operators

Tenure	Percentage (%)
Owner - operator	30.7
Rented : (*sewa*)	51.7
Cash Rent	(56.7)
Rent paid in paddy	(13.7)
B. S. T. S.	(29.5)
Pawah	1.1
Pesaka	7.2
Pajak	3.7
Miscellaneous	5.6
Total	100.0

2 Status of farm management in the pilot project area

2.1 Landlord-tenant relationship and cultivation right

The nature of land tenure in developing countries with its complex arrangements and the traditional characteristics in the relationship between the land owner and the tenant has generally been a constraint to improvement of infrastructure such as land condition, irrigation and drainage systems, farm access and farm road facilities. The Muda area is no exception. In the following few pages, the existing relationship between landlord and tenant will be described and its effects on land improvement or investment will be examined.

1) Relationship between owner and operator in the farm lot

Appendix 5 shows the relationship between the owner and operator of the farm lots in which the farmers sampled are operating. The data reveal that:

i) Ownership of many lots cannot be ascertained from the land office records.
ii) Many lots belong to owners who cannot be traced or belong to a deceased person whose name still appears in the land title.
iii) Many lots belong to the *tuntut* category, that is, a claimed owner.
iv) Most of the lots belong to more than one owner.

Problems also arise because the relationship between the owner's area and the operator's area is not clearly defined. For example, in farm lot 0629, the lot area of 7.5 relongs is owned by 3 persons, each share being 2.64 relongs. The share of each owner is not delineated in the grant title or physically on the ground. On the other hand, operator SC-27 operates 3 relongs of the lot. The relationship between the physical area operated by SC-27 and each owner's area is not clearly defined. This arises because although each owner's share is definite, its actual share of the lot in the field is not physically marked, whereas the operator's area is definite.

2) Land alienation

The obscurity between the status of the owner and the operator in the farm lot stems from the existing land tenure system and the traditional land alienation, including the method of registration of the land.

According to data obtained from the land office in Jitra, the first land grant (*Surat Kecil*) was given to farmers in the Muda area in 1881 (Muslim Calendar Year 1301). Before this, a feudal land system was practiced there and, although land is being operated by farmers, the ultimate ownership of the land rests with the Sultan. In 1933 a new title deed (*Surat Putus Kecil*) was introduced based on the Land Law of 1929. After the Second World War, a new system of land title was introduced based on a new Federal Land Law passed in 1965. (See Appendix 6). Based on this, all new titles were given under the name of "*Geran Mukim*".

In practice, the old grant and title deeds under the old title types are still legal together with the new title grants.

3) Separation of cultivation right from ownership

Possession of a piece of land is mostly through transmission or transaction, since the land law of 1965 has made mortgage difficult. Transmission of ownership or inheritance can occur when the owner of the land goes to the land office and gives the new owners' names and acreage, bringing with him his title deed.Also he can include this matter in his will before his

death. When the Land Office endorses the new owners' names and their areas, inheritance comes into force.

In this case, a new title deed is not issued and the title deed and the farm lot become the joint ownership of the new owners. The farmer can also request new individual titles which will separate the grant title and the farm lot among the new owners. This will only occur after a detailed survey is undertaken to physically delineate their new boundaries and involves a great deal of time and money. Transaction of land can also be a means of acquiring the land and in this case, the new owner's name is endorsed on the title deed.

Inheritance of land is the most common means of land possession in the project area and in most cases, the new owners are endorsed on the title deed, rather than asking for individual titles with their own physically marked area. This is for the following reasons:

i) The procedure is simple
ii) It fits into the Muslim Law because under the land law, a farm lot cannot be further separated below a minimum acreage.
iii) No trouble between inheritors will arise.
iv) Separation of the farm lot involves the cost for surveying the new boundaries and a delay in the transactions.

The traditional inheritance bowever has the following disadvantages:

i) As time passes, the connection between the owners will become complicated and many claims (*tuntut*) will be generated.
ii) The cultivation right is separated from ownership.
iii) Any transaction or sale of the land will become difficult.
iv) In connection with ii), the cultivation right becomes very flexible.
v) The difficulty in land acquisition creates a constraint to infrastructural improvement of the land.
vi) The weakness of the connection between the owner and the operator makes the operators unwilling to improve the land by themselves.
vii) Finally, the traditional inheritance system enhances fragmentation of the land.

4) Flexibility and mobility of land cultivation right

Despite the difficulties of transaction in land ownership, the land cultivation right seems to be easily transferred among farmers. This is manifested in the two sets of data obtained from the study area. Table 8 shows that from 1978 to the off season of 1979, 35% of the farmers changed the cultivation area; 23% of the sampled farmers also changed their cultivation area from the off season of 1979 to the main season of 1979.

In connection with this, rent in this area has no fixed guidelines and is not always based on economic criteria. As an extreme case no rent or only a nominal rent is paid. This occurs often between close kin and sometimes rent is also negotiable after harvest.

The *pajak* practice, though not common, still exists in the project area. *Pajak* refers to the practice whereby a farmer sells his cultivation right over a piece of land in exchange for a sum of money as rental paid in advance over a number of seasons. This practice implies that the cultivation right over *padi* can be sold and contributes to the mobility and flexibility of cultivation right in the area.

This flexibility in the cultivation area indicates that a cultivation right over a farming area is not permanent and can be considered a constraint by farmers in the adoption of improved cultural techniques and the non-receptivity to extension works.

Table 8 Change in farm area through time

	1978 - Off season 1979		Off season 1979- Main season 1979	
	No.	%	No.	%
Number of farmers observed	37	100	35	100
Number of farmers who extended their operating area	3	8	7	20
Number of farmers who reduced their operating area	10	27	1	3
Total number of farmers who changed their operating area	13	35	8	23

2.2 Pattern of labour utilisation *

1) Labour force and farming participants

The labour force for paddy production is derived from two sources. Firstly, the family labour of the farmer provides the main source while other agricultural labour from the immediate vicinity or immigrant labour from outside the Muda area supplements the family labour in activities where family labour alone is not sufficient.

(1) Family labour

Table 9 below provides information on the family labour supply in the irrigation block ACRBD 4. It shows that although the potential labour force is larger than that in the whole Muda area, the number of actual labour participants is almost the same. The ratio of family participants to the labour force is only 66% while in the Muda area the ratio is 83%. This can

Table 9 Family labour supply

	Total (average)		by farm size (ACRBD4)		
	ACRBD-4	Muda	Small	Medium	Large
1. Number of farmers	416	61,000			
2. Average operating area (relongs)	8.8	5.7	3.1	7.5	17.0
3. No. of family members (persons)	5.7	5.3	4.9	6.1	6.7
4. No. within labour force (persons)	3.5	2.9	3.0	3.4	3.8
5. No. of farming participants (persons)	2.3	2.4	2.1	2.4	2.1
(2) ÷ (4) (relongs)	2.5	1.9	1.0	2.2	5.1
(2) ÷ (5) (relongs)	3.8	2.4	1.5	3.1	8.1
(5) ÷ (4)	66%	83%	70%	70%	55%

* All figures on the whole Muda area in this chapter are quoted from MADA(Agro-Economic Studies in the project area. Part 1, Farm management report. May, 1976.)

perhaps be explained by the larger farm size in the project area (8.8 relongs against 5.7 relongs for Muda) and the reluctance of the family members to enter the farming labour market because of their higher economic status.

In the study area, the situation of family labour supply is shown in Table 10. The average labour force and the participant labour force per farm is 3.5 and 2.3 respectively. There has not been any change in the family labour force situation during the study from 1978 to 1980. This means that the family labour force for paddy production in the study area is very stable.

(2) Other agricultural labour force

The other agricultural labour force category comes from two sources. They are the landless farmers or non-agricultural households in the kampongs or within the vicinity, and seasonal immigrant labour force from Kelantan and Southern Thailand.

Since 1978, the seasonal labour force has dramatically decreased in importance in the project area. This is due to the introduction of harvesting machines in the Muda Scheme which in the off season harvested 35% of the study area while in the main season 82%. This situation tends to discourage seasonal labour from Kelantan from coming during the harvesting period out of fear of inadequate job opportunities. The draw of job opportunities in Singapore which encourages large numbers of the Kelantan youth to leave the State has also reduced the number of immigrant labour.

The number of workers from the fringe areas of Muda who provided a significant source of labour is not significant in the project area.

Although the Muda area registers 7% of landless agricultural workers, the number in the project area is very minimal. Only a small number was recorded including one instance where the farmer *pajak* his farm to another farmer for a number of years and became an agricultral worker.

The labour supply situation from hired sources in the project area can be thus described as acute.

The total potential labour force that can be supplied from the study area accounts for 634 persons, of which 139 persons should be channelled to work on the portion of the farms outside the Study area which is operated by the sampled farmers. The actual farming participants total 416 persons of which 91 persons should be allocated for work outside the ISA. Therefore in the study area, 3,960 man hours of labour should potentially be forthcoming from internal sources of which 2,600 man hours should be actually provided.

2) Labour utilisation

Labour utilisation or labour input in paddy farming is treated under three sections: i) labour input for each farming practice, ii) the input pattern of labour utilisation, and iii) kinds of labour utilised.

(1) Labour input for each farming practice

The farmers in the project area utilised their labour not only for paddy cultivation but also for other activities like livestock care, fruit cultivation and cottage industries. Paddy cultivation activities could again be cassified by group of activities , namely, paddy field husbandry, transplanting and harvesting.

Table 11 shows the labour input for paddy field husbandry for the off season and the main season of 1979 and the equivalent figures obtained from the Agro-Economic Studies for Muda undertaken in 1974/75. The table indicates that the labour input for paddy field husbandry for the off season is higher than that for the main season. It also shows that the amount of labour

Table 10 Labour force and farming participants in study area

Farm Size Group	Average Area (relong)	Opening Inventory Survey 1978			Off Season 1979		Average Area (relong)	Main Season 1979		Closing Inventory Survey 1980		
		No. of Family Members	No. in Labour Force	No. of Farming Participants	No. of Family Members	No. in Labour Force		No. of Family Members	No. in Labour Force	No. of Family Members	No. in Labour Force	No. of Farming Participants
Below 5 relongs	3.0	4.3	2.7	2.3	4.4	2.8	3.3	4.5	2.8	4.8	3.4	2.5
5—10 〃	7.1	6.2	3.3	2.3	6.3	3.3	7.1	6.3	3.3	6.6	3.4	2.3
10—15 〃	11.5	6.6	3.9	2.4	6.3	3.4	11.7	6.3	3.7	7.0	4.2	2.2
Over 15 〃	19.4	6.7	3.6	2.9	6.7	3.6	19.8	6.2	3.4	5.8	3.2	2.4
Total (Average)	9.3	5.8	3.5	2.3	5.8	3.2	8.8	5.6	3.2	5.9	3.5	2.4

Table 11 Labour input for paddy field husbandry (man hours per relong)

Farming practices	Pilot Project Area			Whole Muda Area		
	Off Season	Main Season	Whole Year 1979	Off Season	Main Season	Whole Year 1974/75
Seed Preparation	0.4	0.3	0.7	0.9	0.6	1.5
Nursery Bed Preparation	2.5	2.3	4.8	5.5	4.2	9.7
Care of Nursery	1.7	1.4	3.1	2.1	1.2	3.3
Preparation of Main Field	8.2	6.8	15.0	14.5	13.5	28.0
Re-transplanting	1.6	2.8	4.4	—	—	—
Application of Fertiliser	2.7	2.5	5.2	3.1	2.2	5.3
Weeding	2.6	1.0	3.6	14.3	4.5	18.8
Pest and Disease Control	2.2	0.2	2.4	—	—	—
Water Control	0.6	0.8	1.4	0.4	0.2	0.6
Other Care	7.1	7.1	14.2	—	—	—
Total	29.6	25.2	54.8	40.8	26.4	67.2

input for the project area is less than the Muda average in spite of the inclusion of re-transplanting works and other care of field in the study area. This is caused mainly by the smaller amount of labour input devoted to preparation of main field, nursery bed and weeding. Land preparation in the project area is also more mechanised than that in the 1974/75 study. In addition, the labour input for water control and control of pests and diseases is larger in the project area than that indicated for the Muda average. This suggests that the water control and pest problem in the project area are more acute than in the average Muda area.

The labour input for transplanting is shown in Table 12, which indicates the labour input per relong in each sequence of transplanting activity by season. It shows that the amount of labour input for transplanting is 28 man hours in the off season and 38 man hours in the main season. The reason for the larger labour input during the main season is believed to be due to the younger age of the seedlings in the main season (30-35 days old) which are more difficult to transplant and their shorter size which makes them more susceptible to flooding, as compared with older seedlings used in the off season (40-45 days old). Inadequate water conditions in the main season also contribute to the higher labour input for transplanting.

When comparing these data with the Muda average, the labour input is found to be significantly smaller. However, the reason for this could not be identified.

The labour input for transplanting depends also on various conditions, including the type of labour used, the field conditions, and the water conditions. The labour input used in actual transplanting in the project area is 19.5 man hours in the off season and 26.1 man hours in the main season. Variability within the sample farmers is not large, the standard deviation being only 5.1 in the main season of 1979.

Since the introduction of combine harvesters in the project area in 1977, labour utilisation for harvesting is categorised into two different patterns, that is, harvesting using the traditional manual method and that for machines. As shown in Table 13 below, 35% of the study area

Table 12 Labour input for transplanting
(man hours per relong)

a) By Farm Size :

Farm Size Group	Pulling Seedlings		Transportation of Seedlings		Transplanting		Total	
	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season
Below 5 relongs	5.2	11.0	2.2	2.1	20.1	26.3	27.5	39.4
5—10 〃	7.9	11.6	1.8	2.0	20.4	30.5	30.1	44.1
10—15 〃	5.1	10.3	1.3	1.7	19.5	25.6	25.9	37.6
Over 15 〃	7.9	8.0	1.7	1.7	19.0	24.2	28.6	33.9
Average	6.9	9.9	1.7	1.8	19.5	26.1	28.1	37.8
b) By Location of Parcel :								
ISA A—1	4.8	12.1	1.8	1.6	16.0	25.2	22.6	38.9
ISA A—2	7.5	10.8	1.1	1.8	25.1	29.4	33.7	42.0
ISA B	8.7	8.4	2.0	1.3	21.1	23.3	31.8	33.0
ISA E	3.4	11.5	3.1	2.7	19.4	26.9	25.9	41.1
Swampy And Deep Areas	6.9	10.0	1.3	2.8	23.9	25.2	22.1	38.0
Out of ISA	7.6	10.8	1.5	2.3	20.9	26.3	30.0	39.4
Out of block	6.9	7.4	2.0	1.4	19.1	28.6	28.0	37.4
Whole Muda Area	8.7	8.7	3.0	3.7	31.6	30.5	43.3	42.9

Table 13 Percentage of area harvested by combine harvesters

Farm Size Group	Off Season 1979	Main Season 1979
Below 5 relongs	14.1	62.7
5 - 10 〃	26.4	86.9
10 - 15 〃	38.1	83.2
Over 15 〃	43.1	85.9
Average	35.2	81.7

was harvested by combine harvesters in the off season of 1979, and 82% a season later in the main season of 1979. On the whole, less than 50% of the study area was harvested by the traditional manual method in 1979.

Table 14 shows the total labour input per relong for each farm size category by the manual method. It shows that the average total labour input for manual harvesting is 66.2 man hours per relong in the off season and 67.6 man hours per relong in the main season. The total labour requirement is almost the same although each sub-activity of cutting, threshing, and

Table 14 Labour input for manual harvesting, 1979

a) By Farm Size

Farm Size Group	Cutting		Threshing		Transportation		Total	
	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season
Below 5 relongs	46.5	39.1	14.9	21.4	3.7	5.5	65.1	66.0
5−10 〃	42.3	50.9	18.5	19.7	6.3	6.5	67.1	77.1
10−15 〃	45.0	34.6	17.9	17.7	6.8	5.1	69.7	57.4
Over 15 〃	44.0	36.8	15.1	34.6	4.6	6.1	63.7	77.5
Average	44.1	38.5	16.6	23.4	5.5	5.7	66.2	67.6

b) By Zone

ISA A−1	37.8	49.2	16.4	26.2	5.5	5.7	59.7	81.1
ISA A−2	47.8	31.1	19.2	18.6	6.7	5.0	73.1	54.7
ISA B	50.8	42.4	18.0	17.1	3.8	5.3	72.6	64.8
ISA E	48.4	35.8	16.2	16.4	5.9	2.6	70.5	54.8
Swampy & Deep Areas	45.4	49.2	17.7	17.5	5.6	5.5	68.7	72.2
Out of ISA	46.5	42.9	16.6	17.5	5.0	6.8	68.1	67.2
Out of Block	42.1	38.8	15.6	31.4	4.7	5.6	62.4	75.8
Whole Muda area (1974/75)	45.8	44.9	27.3	23.3	8.1	7.2	81.2	75.4

transportation shows differences. Labour utilisation by zone is also indicated. Here, variation by zone is more marked. Comparing the labour utilisation for manual harvesting with the Muda average, it is observed that the study area utilised 15% less labour input than the Muda average. Even after adjusting for the lower yield figures in the 1974/75 study (4% lower) the labour utilisation for manual harvesting in the study area is lower as shown in Table 15.

In the case of harvesting by machine, the cutting and the threshing work is done at the same time by the combine harvester. However the task of bagging the paddy and transporting it is still carried out manually. The operating hours for harvesting by machine in the off season are 0.43 hours per relong while in the main season, 0.51 hours per relong. The results indicate that the machine operating hours are longer in the main season, which is contrary to expectations because the off season harvest in associated with more difficult access and field conditions. This difference is explained by the yield difference (the main season yield is higher and therefore bagging time in particular is longer) and the kinds of machine used (it is a known fact that there is a significant difference in work efficiency among different brands of machines).

The total labour input for harvesting by machine in the main season 1979 is reported in Table 16, which shows that harvesting by machine takes only 1/10 of the time required by manual harvesting.

Table 15 Comparative labour utilisation for manual harvesting per relong

	Study Area	Muda
Off Season	66.2 man hours	73.9 man hours
Main Season	74.9 man hours	72.3 man hours

Table 16 Labour input for harvesting by combine harvesters in main season 1979 (man hours per relong)

Farm Size Group	Bagging Paddy	Trans-portation	Operating Machine	Total
Less than 5 relongs	2.2	2.3	1.2	5.7
5 - 10 〃	2.9	4.0	1.0	7.9
10 - 15 〃	2.6	2.8	1.1	6.5
Over 15 〃	3.0	2.6	1.0	6.6
Average	2.7	2.9	1.0	6.6

Table 17 shows the labour input for post-harvest works. These include activities for drying, winnowing, selling and storage of paddy. In total, the amount of labour devoted to these activities is 4.6 man hours in the off season and 0.4 man hours in the main season. The shorter duration of post-harvest works in the main season is due to the fact that the harvesting takes place in a relatively dry period as against the harvest in the off season. It is also partly due to the influence of mechanisation where the paddy harvested does not come into contact with the ground and the drier paddy is more often than not sold directly.

Besides the labour activities for paddy production, the farmer and his family also devote a part of their time for productive purposes other than paddy production. These include activities for livestock husbandry, cottage production, fruit and vegetable production and other similar activities.

The total labour utilisation for these activities was 24 man hours per relong or 211 man hours per farm household for the whole year 1979 (see Appendix 5). The intensity of the labour is however not the same as paddy work as the nature of the work is usually light.

In conclusion, the total labour utilisation for paddy production is summarised in Table 18. It shows that the total labour input for paddy production is almost the same for both the off season and the main season. Total labour requirement for paddy production is 129 man hours in the off season and 132 man hours in the main season. When non-paddy activities are included, the total requirement is 142 man hours is the off season and 143 man hours in the main season. This figure refers to farmers who manually harvest their crop. Manual harvesting accounts for a significant portion (51%) of the total labour input. In the case of farms harvested by machine, the total labour input is half that of manual harvesting. This reduction of the total labour requirements in the case where the crop is mechanically harvested is one of the most significant changes in the labour utilisation patterns to affect the paddy producing economy.

Table 17 Input labour for post-harvesting works
(man hours per relong)

Farm Size Group	Drying of Paddy		Winnowing		Others		Total	
	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season
Below 5 relongs	6.3	—	0.9	0.3	2.3	0.4	9.5	0.7
5 —10 〃	3.5	0.3	0.2	0.1	2.7	0.6	6.4	1.0
10—15 〃	3.5	0.2	0.4	0.2	1.5	0.1	5.4	0.5
Over 15 〃	1.4	0.1	0.2	—	0.5	0.1	2.1	0.2
Average	2.9	0.1	0.3	0.1	1.4	0.2	4.6	0.4

Table 18 Total labour input for paddy production

	Off Season	Main Season	Total	Indices (%)	
Paddy Field Husbandry	30	25	55	19.3	21.1
Transplanting	28	38	66	23.2	25.3
Harvesting	66(6)	68(7)	134(13)	47.0	51.3
Post-Harvest Works	5	1	6	2.1	2.3
Total	129(69)	132(71)	261(140)	91.6	100.0
Non-Paddy Production	13	11	24	8.4	—
Grand Total	142(82)	143(82)	285(164)	100.0	—

Note: The figures in brackets refer to cases where the field is harvested by combine harvesters.

(2) Labour utilisation pattern

The labour utilisation pattern or types of labour found in the study area is the same as in the whole Muda area. The types of labour in the study area, are the farmer and family labour, hired labour,*derau* and *gotong-royong*. However, the relative importance of each type of labour is different in the study area. While the farmer and family labour category is most important in contributing to labour (45% in off season and 46% in the main season) in the study area, the hired labour category (see Table 19) was the most important in the whole Muda area (59%). The Muda averrage figures were taken from the Agro- Economic Studies in 1974 and as such, changes could have set in, particularly with regard to the effect of combine harvesters on the labour pattern.

Table 19 Pattern of labour utilisation (%)

	Study Area (1979)		Whole Muda (1974)	Before 1970
	Off Season	Main Season		
Farmer &Family Labour	45	46	39	34
Hired Labour	44	29	59	32
Derau	11	24	2	} 34
Gotong-Royong	0	0	0	
Total	100	100	100	100

The share of *derau* labour is still high, reflecting a high dependence on *derau* labour for transplanting. In this case 64% of the transplanting activities utilised *derau* labour in the study area (see Table 20). The harvesting utilisation pattern in the study area is similar to that of the whole Muda average. For ploughing however, hired labour is less in the study area, reflecting a greater incidence of farmer-owned power tillers in the study area. *Gotong-royong* on the other hand, is relatively unimportant except for a small percentage of the observed cases in transplanting and harvesting.

Table 20 Pattern of labour utilisation for ploughing, transplanting and harvesting (%)

	Ploughing		Transplanting		Harvesting	
	Study Area	Whole Muda	Study Area	Whole Muda	Study Area	Whole Muda
Farmer &Family Labour	79.7	33.1	12.4	26.0	15.6	16.0
Hired Labour	20.3	66.9	21.7	69.4	83.8	70.0
Derau	—	—	64.3	4.4	—	12.0
Gotong Royong	—	—	1.7	0.0	0.6	2.0
Tatal	100	100	100	100	100	100

The introduction of combine harvesters has also changed the labour pattern for harvesting. Table 21 shows the types of labour used in both manual harvesting and machine harvesting.

Table 21 Types of labour in manual and machine harvesting (%)

	Manual Harvesting	Machine Harvesting
Farmer &Family Labour	15.6	22.5
Hired Labour	83.8	77.5
Derau	—	—
Gotong Royong	0.6	—

Although the types of labour have not changed, the number of hired labour has decreased due to the smaller requirement of hired labour for machine harvesting of paddy.

The labour utilisation pattern is influenced by the farm size. As seen in Table 22 the larger sized farms utilise more hired labour while the smaller sized farms still utilise a great deal of family labour.

Table 22 Pattern of labour utilisation by farm size per relong

Farm Size Group	Off Season				Main Season			
	Family Labour	Hired Labour	*Derau*	Total	Family Labour	Hired Labour	*Derau*	Total
Below 5 relongs	69.5	23.9	6.6	100.0	56.5	25.8	17.7	100.0
5—10 〃	51.2	40.6	8.2	100.0	49.9	16.2	33.8	100.0
10—15 〃	38.4	47.8	13.8	100.0	43.1	27.4	29.5	100.0
Over 15 〃	35.7	50.9	13.4	100.0	41.5	41.7	16.8	100.0
Average	45.1	43.7	11.2	100.0	46.2	29.3	24.4	100.0

(3) Family labour and other labour utilisation

Although the pattern of labour utilisation as explained above is categorised into four types, basically it is composed of family labour and other labour from the view-point of an individual farmer. A few years ago, the other labour category comprised an important element of immigrant labour but in the study area this group has decreased in importance to such an extent that almost all the labour comes from the immediate vicinity.

From a macro-view of the project area, the labour input in derived from the farmers themselves. *Derau* can be considered as transformed family labour because the farmer has to repay an equivalent amount of time in terms of his own family labour. Hired labour on the other hand is to some extent offset by the farmer himself working in other farms for wages. The situation is thus likened to a double labour usage situation. As seen in Appendix 6, a farmer contributes family labour into his own farm as well as in other farms. In exchange, he hires other labour input into his own farm. This double labour usage is a good way to utilise family labour to the maximum based on group work and it fits into the *gotong royong* spirit.

Table 23 shows the relationship between the inflow of other labour and the outflow of own labour by farm size. A figure of less than 100% indicates a net outflow of labour and a figure of more than 100% shows a net inflow of labour. Only in the small farm size category is the outflow of labour higher than the inflow of labour and this applies to the transplanting work only.

Table 23 Relationship between outflow of labour and inflow of labour of sample farmers*

Farm Size Group	Transplanting		Harvesting	
	Off Season	Main Season	Off Season	Main Season
Below 5 relongs	44.2	96.0	177.1	190.2
5 - 10 〃	106.9	89.6	427.3	234.8
10 - 15 〃	349.0	147.7	905.6	628.3
Over 15 〃	442.0	375.5	1180.4	819.6
Average	162.0	143.9	544.8	363.5

* The figures are obtained by dividing the inflow of labour by the outflow of labour.

(4) Seasonal labour input and mobility of labour

The labour input for paddy cultivation has always been seasonal in nature. This arose from the peak seasonal labour demand during transplanting and harvesting. In a single crop situation these peaks occur within the limits of the labour input curve, but four peaks are observed under a double crop paddy regime. Because of the telescoping of the paddy activities into tight schedules, the labour peaks have also become sharper and tighter (see Figures 3 and 4).

The issue of the labour shortage problem in Muda should be viewed in the light of these labour peak demands. This labour shortage problem arises from the seasonal variation of

labour input and to alleviate this problem, various measures were taken to counter or ease the situation. These include staggering of planting, mechanisation, cooperative utilisation of labour etc.

It is fortunate that mechanisation (at least of harvesting) has caught on in the Muda Scheme and has rapidly spread since 1978. This has brought about a marked change in the labour input situation. Figure 5 shows the seasonal variation of labour input of 3 sample farmers chosen from the study area in 1979. The marked four peaks are very distinct in a situation of non-mechanised farming (code 11). Code 16 shows a farmer who harvests his main season crop by machine which eliminates one of the labour peaks. Code 17 shows mechanisation of both crops whereby labour input peaks have been reduced to only two (i.e. for

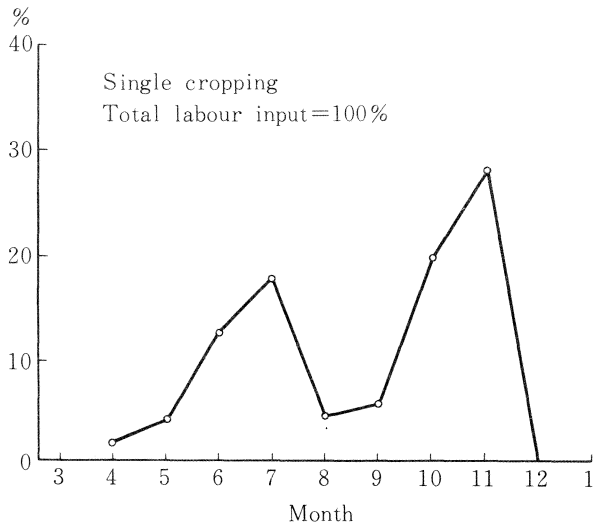

Fig. 3 Seasonal variation of labour input in 1966[1)]

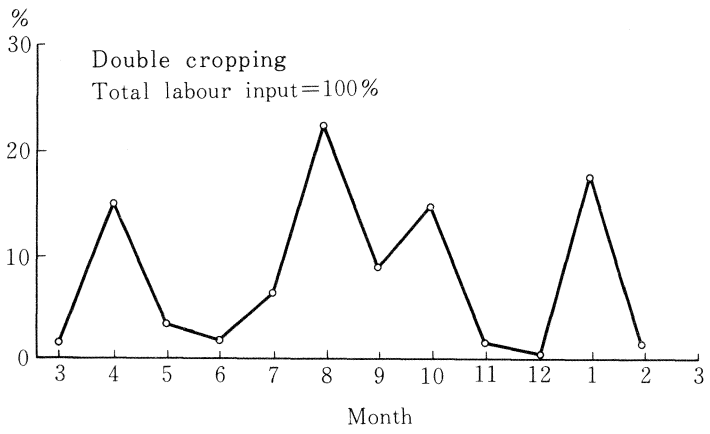

Fig. 4 Seasonal variation of labour input in 1974/75 (whole Muda area)

transplanting only).

As far as mobility of labour is concerned, it seems to be restricted. In the study area most of the labour (both *derau* as well as hired labour) originates from the same or nearby villages. On one or two occasions, organised groups of labour were seen moving up to 7 miles (by lorry) from the village for paddy work. However, due to the progress of the transportation system, organised groups are moving over greater distances to ease the seasonal labour problem.

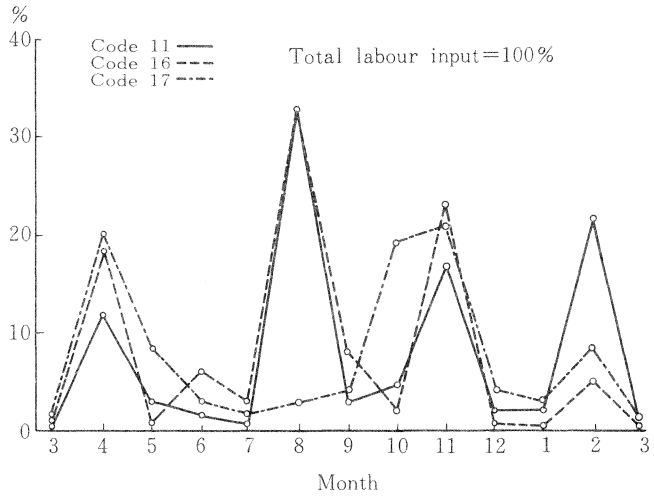

Fig. 5 Seasonal variation of labour input of selected farmers in 1979

2.3 Evolution of mechanisation and its effects

1) Relationship between mechanisation and double cropping in Muda

Mechanisation in Muda started in the late 1950s when tractors for land preparation were introduced. This introduction of the large four wheel tractor by private entrepreneurs was to operate in the inland paddy areas of Muda in 1958. By 1970, when double cropping was introduced in Muda, the number of large four wheel tractors had increased to 253 and power tillers totalled 1,606.[10]

These data show that there is no causal relationship between double cropping and tractorization for land preparation, i.e. mechanisation of land preparation was not a consequence of the introduction of double cropping. It is believed that it is the factor of efficiency, convenience and competitive pricing that led to the acceptance and spread of mechanisation in land preparation, and eventually resulted in the replacement of animal power in land preparation.

On the other hand, it is believed that the ease and speed with which land preparation by tractors was accepted is an important contribution that led to the promotion of double cropping in Muda.

When the Muda scheme was being implemented, in the project management the importance of mechanisation which could help to accelerate double cropping and ease the problem of labour peak demand was realised. Based on this, MADA and the Department of Agriculture embarked on a concerted effort to introduce suitable machinery for harvesting and transplanting in addition to land preparation. The multi-purpose machinery concept[4] was also contem-

plated whereby a basic prime mover is used with suitable attachments for different activities. This however was not successful and attention is now being reverted back to specialised machinery for the various activities.

While the search and testing of various machines was carried out by the government agencies, double cropping had in the meantime spread with mechanisation of land preparation being nearly complete. By 1974, cropping intensity had increased to 192% with planting staggered so as to ease the labour problem (the main reason for crop staggering was however for water distribution purposes).

Since 1976, the use of the combine harvesters began to spread in Muda. This was again mainly a commercial sector initiative without government intervention. The combines were introduced by private contractors solely with profit motivation and were accepted by the farmers because of their efficiency, economy and the shortage of labour experienced. Machines now have begun to replace manpower in the harvesting of paddy, which is an important stimulus for the promotion of double cropping.

2) Evolution of mechanisation in Muda

As stated earlier, mechanisation of paddy cultivation in Muda started with land preparation. Since the introduction of large four wheel tractors in the 1950s, their adoption has spread rapidly in the Muda Scheme area.

The Kedah State Annual Report of 1961 noted that 14,000 acres of paddy or 5.8% of the North Kedah plain was cultivated with four wheel tractors during the year. This increased rapidly and in 1966, in 6% of the total area only tractors were used for land preparation. Those that used tractors in combination with animal and human power amounted to 32% as seen in Table 24.

Table 24 Land preparation in Muda, 1966

Type	%
1. Human power	6.5
2. Buffalo	37.6
3. Tractors	5.9
4. Combination of (1) and (2)	24.3
5. Combination of (1) and (2)	2.1
6. Combination of (2) and (3)	14.1
7. Combination of (3) and (1), (2)	9.5
Total	100.0

The FAO/IBRD Muda River Study in 1972/73 reported that in 1970, 1,606 power tillers and 253 four wheel tractors were operating in the area. The MADA/TARC Agro- Economic Studies in 1974/75 on the other hand, revealed that in 1974, 92% of land preparation was mechanised in the off season and 76% in the main season (see Table 25).

Table 25 Land preparation in Muda, 1974/75 *

	No. Ploughing	Buffalo (1)	Two Wheel Tractor (2)	Four Wheel Tractor (3)	Combination of (1) & (2)	Combination of (1) &(3)	Combination of (2) &(3)	Combination of (1), (2)&(3)	Total %
Off Season	1	7	17	16	29	22	2	6	100
Main Season	14	10	30	14	21	7	1	3	100

* The figures on the Muda area 1974/75 are obtained from the survey of the Agro-Economic Studies.

As far as mechanisation of the harvesting process is concerned, it started in the early 1970s when several units of western-type combines were donated to the implementing agency under the Colombo Plan. These machines were in turn handed over to the Farmers' Associations in the area for operation. However management problems forced these operations to be discontinued a few years later.

Commercialised combine harvesting in Muda started in the mid-1970s when private contractors took the initiative to introduce a few units of western-type combines in response to rising harvesting rates and the labour shortage experienced.

In early 1977, it was noted that 57 units of combine harvesters were in operation of which 52 were of the large western type and 5 were of the small Japanese type (see Table 26). By the end of 1977 there were 118 units of which 88 were of the western and 30 of the Japanese type.

Table 26 Number of combine harvesters, early 1977

Type	No.
Class	25
New Holland	2
Dania	20
Messey Ferguson	5
Total Western Type	52
Iseki 3001	5
Total Japanese Type	5

By 1979, the number of Western type combines had increased to 140 in the off season and 172 in the main season. This was based on personal interviews with the marketing agents of these machines in Alor Setar. Table 27 indicates their breakdown by brands.

According to the World Bank Appraisal Report for Muda II, the total area harvested by combine harvesters in the main season of 1977 was 35% or equivalent to 34,000 ha. This seems to be reasonable in view of the number of harvesting machines and the work rates (88 units at 30 relongs per day for 45 working days).

In the off season of 1979, the area harvested increased to 48,000 ha (50% of the total area) and in the main season of 1979 to 67,000 ha or 70% of the total area.

Table 27 Number of combine harvesters by brand and other particulars, 1979

Name of Brand	No. of Machines		Length of Cutter (ft.)	Horse Power	Weight (tons)	Imported Price (M$1000)	Country of Origin	Agent
	Off Season	Main Season						
New Holland	16	22	13	92	7.5	140	Belgium	K&P TAB
Class	75	85	13	80	8.0	172	Germany	Tractors Malaysia
John Deere	30	30	13	92	7.5	160	Germany	Multico
Laverda	1	19	13	80	7.5	145	Italy	K. A. M.
Messey Ferguson	9	5	13	80	7.5	140	U. K.	I. A. D.
Fahr	9	11	13	80	8.0	140	Germany	KADIM
Total	140	172	—	—	—	—	—	—

3) Status of mechanisation in the study area

In the study area, like in the rest of the Muda area, mechanisation of paddy cultivation started with land preparation. Table 28 shows the number of tractors and buffaloes owned by farmers in 1978 and 1980 in the study area. The numbers have not changed, indicating that tractorization in the study area has been stabilised.

Table 28 Number of tractors and buffaloes owned by sample farmers

Farm Size Group	Number of Farmers	4 Wheel Tractors		2 Wheel Tractors		Buffalo	
		1978	1980	1978	1980	1978	1980
Below 5 relongs	13	—	—	3	3	3	4
5 - 10 〃	7	—	—	2	1	—	—
10 — 15 〃	9	1	1	1	3	1	—
Over 15 〃	5	—	—	8	7	6	5
Total	34	1	1	14	14	10	9

The number of tractors per farmer shows differences according to farm size. The data indicate that the larger the farm size the larger the number of tractors. In 1978 the number per farmer in the farm size category above 15 relongs was 1.6. In 1980 it was 1.4. (One of the farmers had 3 power tillers).

The total number of tractors per farmer on the average is 0.44. This seems to be very high compared to the Muda average of only 0.12, probably due to the large farm size in the study area.

Although the study area has a significant amount of swampy and deep areas, most of these

areas are ploughed by tractors except for very bad areas where the buffalo is resorted to. In any case, the buffaloes belong to the smallest and the largest farm size category and more often than not, they do not do any ploughing work.

The distribution of the tractors by year of purchase is shown in Table 29. Twenty four percent of the tractors were bought before double cropping started, 59% were bought between the introduction of double cropping and 1975 and the remainder have been bought since then. The trend of tractor purchase is almost the same as that for the overall Muda area and seems to be promoted by double cropping.

Table 29 Number of tractors classified by year of purchase

Farm Size Group	No. of Tractors Purchased		
	Before 1970	1971-1975	After 1976
Below 5 relongs	2	1	—
5 - 10 〃	—	2	—
10- 15 〃	—	2	2
Over 15 〃	2	5	1
Total	4	10	3

Tractor utilisation by farmers in the study area is shown in Table 30, which indicates that 47% of the farmers depend on contractor services while 45% depend on owned or shared tractor. The smaller farmers depend more on contractors while the dependence on own tractors is greater in the case of the larger farmers. The acreage ploughed by owned and shared tractors is however larger than that ploughed by contractors. More than half (57%) of the land is ploughed by farmer-owned tractors while 37% is ploughed by contractors',

On an average, 73% of the land is ploughed by power tillers while 27% is ploughed by four wheel tractors. In spite of the relative efficiency of the four wheel tractors, the ploughing charge is the same for both types of tractors. Farmers therefore show a preference for four wheel tractors, indicating a tendency to substitute the power tillers they own for four wheel tractors.

The frequency of ploughing per unit area is indicated in Table 31. It shows that two ploughings per parcel are most common, although the number of farmers who plough once is also very high (48% plough twice and 42% plough once). Ten percent of the area is ploughed three times.

The contractor charges for ploughing are M$25/per relong for one round, M$45/per relong for two rounds and M$60/per relong for three-time ploughing. The rates also increased, compared with M$18/in 1973 and M$22/in 1974/75 for one round of ploughing. On an average, the rate increase is 3.5% annually.

The operating hours of ploughing per relong with a two wheel tractor are 3 hours while with a buffalo, it takes three days.

Mechanisation of harvesting in the project area was introduced in 1976 but until the main season of 1978 it was restricted to only a limited area. It was only in the main season of 1978

Table 30 Tractor usage for land preparation in main season 1979

	Total (average)	Below 5 relongs	5 - 10 relongs	10- 15 relongs	Over 15 relongs
		(a)By Number of Farmers (%)			
Ownership of Tractor					
contract	47.3	61.5	57.1	33.3	20.0
owned	31.6	23.1	14.3	44.5	60.0
shared	13.2	7.7	28.6	11.1	20.0
rented	7.9	7.7	0	11.1	0
Total	100.0	100.0	100.0	100.0	100.0
Kind of Tractor					
2 wheel	76.3	84.6	71.4	55.6	80.0
4 whelel	23.7	15.4	28.6	44.4	20.0
Total	100.0	100.0	100.0	100.0	100.0
No. of Sample Farmers	(34)	(13)	(7)	(9)	(5)
		(b)By Acreage (%)			
Ownership of Tractor					
contract	36.6	55.8	55.8	33.3	18.1
owned	43.4	26.9	18.1	43.5	66.6
shared	14.0	6.9	26.1	13.3	15.3
rented	5.9	10.4	0	9.9	0
Total	100.0	100.0	100.0	100.0	100.0
Kind of Tractor					
2 wheel	72.5	82.7	72.9	53.0	81.8
4 wheel	27.5	17.3	27.1	47.0	18.1
Total	100.0	100.0	100.0	100.0	100.0
Total Area (relongs)	(297.5)	(43.3)	(49.8)	(105.2)	(99.2)

that mechanisation of harvesting increased dramatically. This was due to the favourable dry harvesting conditions during that season which followed a non-planting season (the off season 1978 was cancelled), and also an increase in the number of harvesting machines in Muda. During that season, the area harvested by machines rose to 40% of the total area.

Table 32 shows the area and number of farmers who used machines for harvesting during 1979, indicating that in the off season, 49% of the farmers (or 35% of the area) harvested by machine while in the main season, the percentage reached 82%. The percentage shows variation by farm size. The smaller sized farms show a smaller share of harvesting by machine especially on an area basis.

Table 31 Frequency of ploughing by parcel and area

Sample Parcel	Once		Twice		Three Times		Total	
	No. of Parcels	Area (relong)	No. of Parcels	Area (relong)	No. of Parcels	Area (relong)	No. of Parcels	Area (relong)
ISA A-1	6 4	18.02	1	2.31	3	8.5	10	28.83
ISA A-2	1	3.00	10	47.65	—	—	11	50.65
ISA B	6	27.77	5	20.67	2	5.25	13	53.69
ISA E	6	13.76	4	15.04	—	—	10	28.80
Swampy & Deep Areas	5	23.04	7	26.50	3	11.0	15	60.54
Out of ISA	2	11.50	5	19.50	1	7.5	8	38.50
Out of Block	8	38.00	6	23.00	—	—	14	61.00
Total	34	135.09	38	154.67	9	32.25	81	322.01

Table 32 Number of farmers and area harvested by machine

Farm Size group	Total Number of Sample Farmers		No. of Farmers Who Harvested by Machine		Total Area Cultivated by Sample Farmer (relong)		Harvested Area by Machine (relong)	
	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season
Below 5 relongs	10	13	3	8	30.05	43.31	4.25	27.15
5 - 10 〃	11	7	5	7	78.59	49.79	20.75	43.29
10- 15 〃	7	9	3	8	80.77	105.24	30.77	87.53
Over 15 〃	7	5	6	5	136.07	99.17	58.65	85.17
Total	35	34	17	28	325.48	297.51	114.42	243.14

Eighty six percent of the farmers with farms larger than 15 relongs used machines for harvesting and mechanisation for harvesting is expected to reach 100% in the near future. The small scale farmers are unlikely to be able to achieve 100% mechanisation in harvesting for financial reasons and due to their preference to utilise their own family labour.

Table 33 shows the three main brands of combine harvesters operating in the area, the area harvested and the havvesting charges. It is the village broker who contacts the contractor and sollicits harvesting work from the farmers. In this way, he decides on the brand of harvester to be introduced in the area. The contractor charge during a season fluctuates. In the off season, it starts with M$60.00 per relong, but by the end of the season, the charge can be increased to M$80.00. On the other hand, the charges during the main season are more stable (between M$53.00 to M$55.00).

The harvesting charge by machine was higher in the off season than in the main season. On the other hand, harvesting by manual methods was more costly in the main season (this

Table 33 Harvesting by brand of machine in off season, 1979

Farm Size Group	Number of Farmers Using				Area Harvested (relong)				Payment (M$)		
	Total	John Deare	New Holland	Claas	Total	By John Deare	By New Holland	By Claas	John Deare	New Holland	Claas
Below 5 relongs	10	1	1	1	30.05	1.00	1.25	2.00	70.0	68.4	80.0
5−10 〃	11	4	1	0	78.59	15.5	5.25	—	72.0	70.0	—
10−15 〃	7	2	1	2	80.77	16.0	8.77	6.00	78.0	70.0	80.0
Over 15 〃	7	2	3	3	136.07	25.40	19.75	13.50	62	66	73.0
Total	35	9	6	6	325.48	57.90	35.02	21.50	69.2	67.7	77.0

was due to yields higher by about 13% during that year). Generally, however, the contractor charge for machine harvesting is always competitive with manual harvesting.

4) Effects of mechanisation on farm management and its constraints

In this section, the effects of mechanisation of land preparation (introduced before double cropping) and the effects of mechanisation of harvesting (introduced after double cropping) are analysed. The similarity and differences of these effects are crucial issues which could serve as a guidance for the principles of farm management in the future.

The underlying tone of mechanisation of farming practice is one of the substitution of manpower and animal power. Mechanisation cannot create additional value or land productivity. One could point out that tractorization is related to increases in land productivity due to deeper ploughing but this has not been substantiated. Farm mechanisation is therefore concerned with labour productivity.

In the case of tractorization, the land preparation process had already changed from manpower to animal power. Therefore, there is no direct effect on manpower. The contractor who came from outside the village to help ploughing, drove out the buffalo as a beast of burden in land preparation.

Along with this, the flow of manpower and farmers' income began to change. Figure 6 shows diagramatically the changes that took place in the direction of flow of labour and income in the pre-and post-mechanisation periods. In the 1974/75 Agro-Economic Studies, it was shown that for the overall large farm category, the net balance from the income and

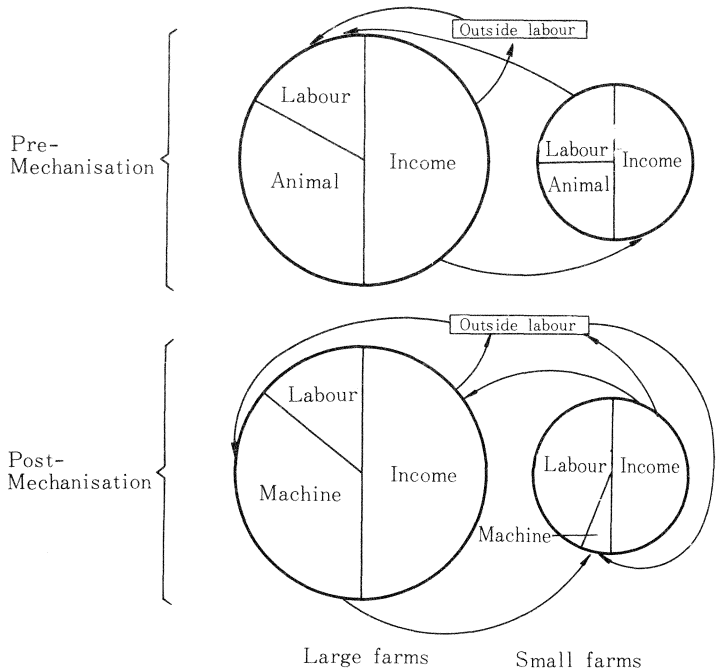

Fig. 6 Tractorization of land preparation

payments for ploughing using tractors is positive to the sum of M$344 per farm household. On the other hand, it revealed a negative balance of M$58 for the small sized farms. This is attributed to the ownership of tractors being concentrated on larger sized farms.

This incremental income from tractor charges in the case of large farmers has therefore resulted in an increase in their income, while the reverse is true for the smaller farmers whose net income from tractor charges has dropped. The decrease in income of the small farmers is however partially offset by increased labour opportunities brought about by double cropping in the unmechanised activities of transplanting (totally unmechanised) and harvesting (partially mechanised) and the reduction of labour immigrant flow into the area.

The total flow of income has therefore not significantly changed and along with the diffusion of tractors into the medium and smaller sized farms, the net balance discrepancies will be further evened out.

As far as harvesting is concerned, the harvesting activity was carried out manually before the introduction of the combine harvester. As such, mechanisation of the harvesting process was undertaken at the expense of human power and not animal power unlike mechanisation of land preparation.

In the case of mechanisation of harvesting, the flow of labour from the small farmer to the larger farmer and the flow of income through this flow from the large farmer to the small farmer was checked (see Figure 7) and this was diverted to other directions. The interchange of labour among small and medium farmers (either through *derau* or hiring each other's labour) was also reduced. Mechanisation of harvesting diverted this flow of income to outside the local village and as a result the total income in the area was reduced.

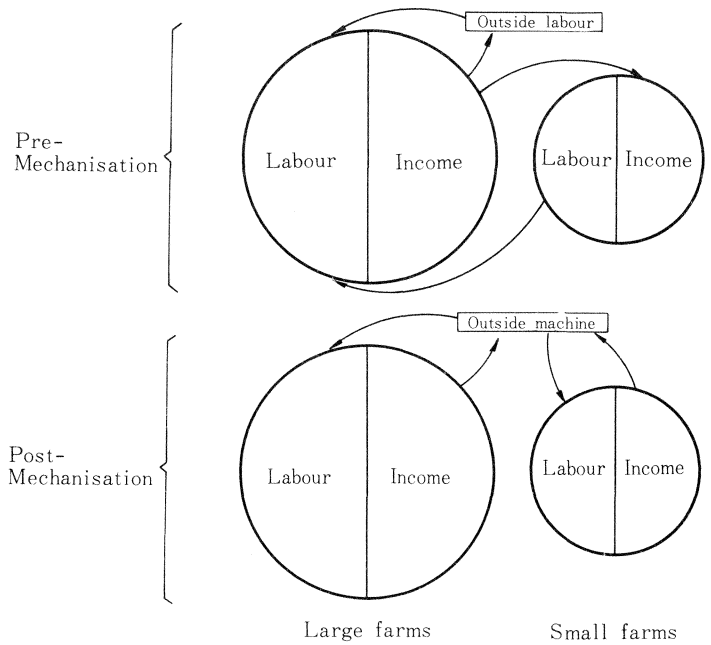

Fig. 7 Mechanisation of harvesting

Appendix 6 shows the influence of mechanisation on harvesting regarding farm labour charges and total labour input. In the off season of 1979 the total labour input for harvesting was 424 man hours; in the main season of 1979, it was drastically reduced to 148 man hours. This reduction was the result of the rapid spread of machine harvesting services in the area. The labour charge income for harvesting in the main season was also reduced as a result (both in terms of receipts and payments).

The Table in Appendix 6 also indicates the diffusion of mechanisation in harvesting. It shows its detrimental effect on the small farmer because the outflow of labour from the small farmers was reduced from 30 hours to 13 hours per farm household. In addition the balance of labour charges from harvesting tends to become worse. As evident in Table 34 below, the net labour charges received from farming show a marked decline in the main season for the small farmers. Table 34 shows that the payment for machine harvesting charges in the main season also increased to twice that of the off season. The table also shows a deterioration in the balance of contractor charges due to rapid mechanisation.

The reduction of labour input in harvesting would alter the farm working system. For instance, the staggering of planting to alleviate peak labour demands might have to be reversed to accommodate machine harvesting, and the varieties planted could also be changed from the easy-threshing varieties to the hard-threshing ones to accommodate machine harvesting.

It is estimated that if the whole study area mechanised the harvesting process, about 10,800 man days of labour input would be lost. This could be translated into 514 persons if the harvesting time were limited to 3 weeks.

The effect would be felt mainly by the small farmers because they have a larger labour force generally. In addition, the aggregate farmers' agricultural income would drop. The small farmer would not be able to contribute to the outflow of labour to the farms in return for income received. But the trend of mechanisation can not be stopped, due to its convenience, efficiency and economy for the individual farmers. The only constraint would be the physical field conditions.

Under the existing conditions, already 82% of the study area is mechanised, and for the whole Muda area, it is estimated that the ceiling for mechanisation would be about 80%. In such a case, about 210-250 harvesting machines would be necessary in the area. The machine agents in Alor Setar have reported that by the end of 1980, another 45 units would be brought into the Scheme area. This would bring the total number of harvesting machines to 220 units.

2.4 Paddy production and the farm working system *

This chapter attemps to identify and analyse the factors which create constraints to the improvement of paddy production. These include technical, social and economic factors which influence the existing cropping pattern in the study area.

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* All figures on the whole Muda area in this chapter are quoted from MADA (Agro-Economic Studies in the Muda Project Area Part 1. Farm management report May, 1976.)

Table 34 Balance of labour charge by farm size

Farm Size Group	Labour charge						Contractor charge					
	Receipts		Payments		Net Balance		Receipts		Payments		Net Balance	
	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season
Below 5 relongs	173	89	115	144	58	- 55	—	-	107	203	-107	-203
5—10 〃	62	135	289	262	-227	-127	32	-	313	633	-281	-633
10—15 〃	53	105	745	530	-692	-425	56	129	555	837	-499	-708
Over 15 〃	58	44	1002	1020	-944	-976	48	150	655	1328	-607	-1178
Average	89	96	504	386	-415	-290	28	56	365	625	-337	-569

1) Cropping calendar in the study area

The starting date of the first crop (off season) in the study area is not definite. It depends on the supply of water from the canal, the weather conditions, the labour supply and other related factors which cause the starting date to shift from year to year.

In the off season of 1979, the preparation of the nursery beds and seed preparation began on the first ten days of March. This seems to be rather late because the date of water release was 7th February in the secondary canal ACRBD 5 and 21st February in the secondary canal ACRBD 4.

The delay was caused by a shortage of water supply due to the lack of rain and lack of water in the canals. In the off season of 1980, the cropping calendar began in early April although water was released on 15th March from ACRBD 5 and 29th March from ACRBD 4.

The sowing date in the off season of 1979 started on 1st March and 40% of the nursery beds

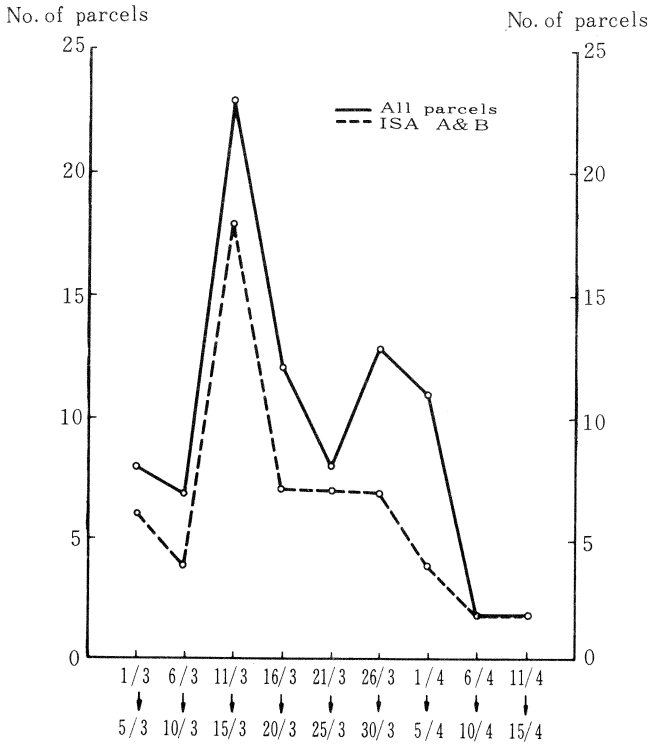

Fig. 8 Sowing date of nursery beds in off season 1979

were sowed on the second 10 days of March while 24% were sowed between 20th March and 10th April (see Figure 8). The duration of sowing of the nursery beds for the entire study area was 1½ months or 45 days.

Land preparation should be carried out from the period of sowing to the period of transplanting. Since the seedling age was about 40 days in the area, (see Table 35) the duration of land preparation was also 40 days on the average although in individual cases it varied from 30 to 50 days depending on the farmers and the field conditions. During the period of land preparation, clearing, ploughing, raking, levelling, removing weeds and straw were carried out.

Transplanting work began on 10th April and it continued until the end of May. During this period, there were transplanting activities in the field every day.

Table 35 Average seedling age in each zone

Zone	Off Season (A)	Main Season (B)	Difference (A)-(B)
	days	days	
ISA A-1	38.5	35.9	2.6
ISA A-2	40.3	36.7	3.6
ISA B	41.6	39.3	2.3
ISA E	39.3	41.3	-2.0
Swampy and Deep Areas	41.2	36.5	4.7
Out of ISA	39.5	38.6	0.9
Out of Block	39.5	37.6	1.9
All area	40.1	37.8	2.3

During the paddy growing stage, paddy husbandry works were carried out. The period of paddy vegetative growth varied, as shown in Appendix 7, with factors such as variety, weather conditions, field conditions, water conditions, and paddy husbandry. The paddy husbandry works carried out during this period consisted of re-transplanting, weeding, fertiliser application, crop protection, water control etc. of which re-transplanting should be carried out within one or two weeks after transplanting.

The harvesting work in the off season in 1979 started at the end of July and was completed 2 months later by 20th September.

After the off season harvest, the cropping calendar of the main season should start immediately. But this was not so in the study area. As seen in Appendix 7, only 3 farmers out of 33 farmers (9%) started within 15 days after harvesting of the previous harvest. Another 15 farmers (57%) started 15-25 days after harvest, and 11 farmers (33%) started after 25 days. Generally, the farmers who harvest early try to delay the starting date of the next crop because they prefer that the majority of the farmers start together for the following reasons:

(1) transplanting in the study area is mainly carried out by *derau* labour, and

(2) any isolated nursery will be damaged by pests (rats, birds, ducks).

Sowing of the main season started after 10th September and it took 30 days to complete the works in the whole area, resulting in a reduction of 10 days compared to the off season sowing (see Figure 9). As seen in Figures 7 and 8, the sowing pattern in the main season was different from that in the off season.

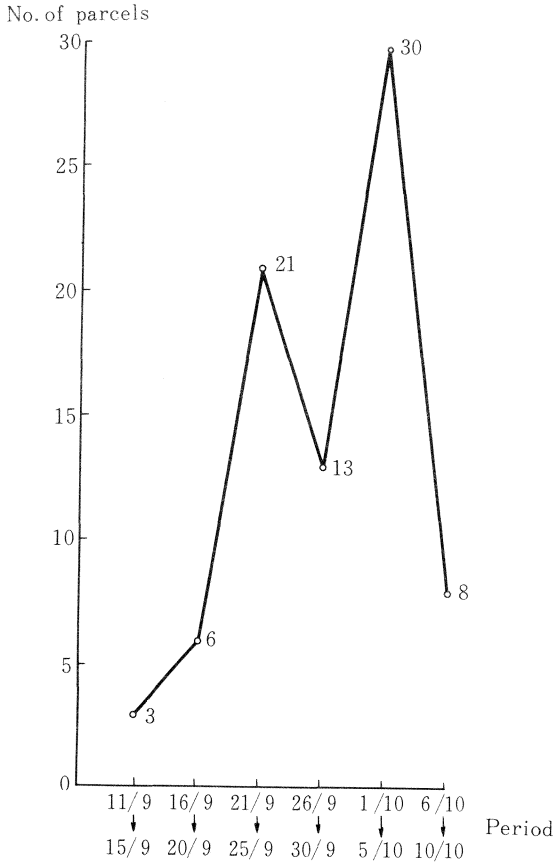

Fig. 9 Sowing date of nursery beds in main season 1979

Transplanting works in the main season began on 16th October and ended on 23rd November. It took a total of 38 days, again 10 days less than in the off season. The seedling age and land preparation period were however very similar to those in the off season.

The farmers in the study area do not carry out transplanting immediately after the first ploughing. They need time to remove weeds and paddy straw. In the main season, most of the parcels were transplanted 25-30 days after the first ploughing.

The harvesting work in the main season began at the end of January 1980 and ended on 9th March, taking 40 days or 10 days less that of the off season harvest. This harvesting work was however speeded up by the larger number of combine harvesters operating in the area during this season.

Between the end of the main season and the beginning of the off season, a period of rest is usually taken. During this time, post harvesting works of drying, winnowing, storing and selling of the paddy take place.

In conclusion, Figure 10 shows the total farming schedule for the entire year. One problem arises when examining the schedule, namely, the overlapping of the harvesting of the off season crop and sowing for the main season crop.

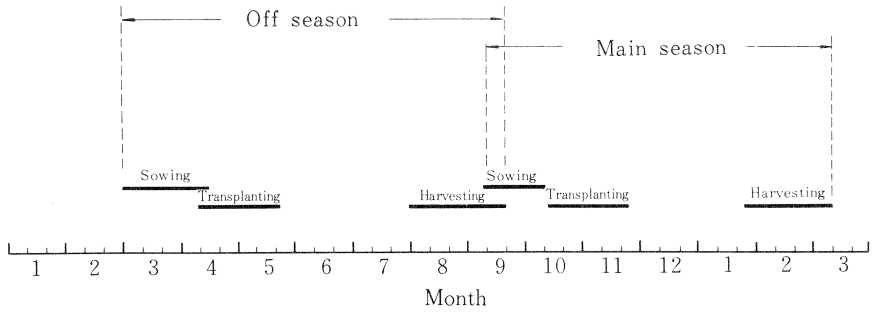

Fig. 10 Cropping calendar in 1979 in study area

The starting dates for key activities as recommended by MADA and actual starting dates in the study area are shown below in Table 36.

Table 36 Recommended and actual starting dates for key activities

	Recommended Dates		Actual Dates - Study Area
	Irrigated by ACRBD 4	Irrigated by ARBD 5	
Sowing date	10. 3. 79	25. 2. 79	1. 3. 79- 10. 4. 79
Transplanting date	1. 4. 79	17. 3. 79	10. 4. 79- 30. 5. 79
Harvesting date	28. 7. 79	14. 7. 79	30. 7. 79- 20. 9. 79

2) Crop husbandry

(1) Nursery bed care

Most of the farmers set up the nurseries within their own operating parcels. Therefore the number of nursery beds in the study area is related to the number of parcels operated by the farmer. The nursery bed area is also related to the operating farm area (see Table 37). However, farmers operating more than one parcel normally amalgamate their nursery plots for ease of management. Of the total farmers, 35% of the farmers cover 2 parcels with one nursery bed and 22% of farmers cover 3 parcels with a single nursery bed.

In locating the nursery beds, the following factors are taken into consideration by farmers:

i) Transportation of seedlings to the main field
ii) Nursery care
iii) Water condition
iv) Fertility of field, and
v) Protection from pests like ducks, rats etc.

The location and size of the nursery beds in the main season was different from that of the

Table 37 Relationship between parcels and nursery beds in off season 1979

Farm Size Group	No. of Sample Farmers	Mean No. of Parcels Operated	Mean No. of Nursery Beds Set Up	Average Operating Area (relongs) (A)	Average Nursery Bed Area (relongs) (B)	(B) ÷(A) (%)
Below 5 relongs	10	1.1	1.0	3.0	0.16	5.3
5 -10 〃	11	2.4	1.5	7.1	0.31	4.4
10-15 〃	7	2.4	1.4	11.6	0.41	3.5
Over 15 〃	7	4.0	3.0	20.3	0.89	4.4
Total (average)	35	2.3	1.7	9.3	0.41	4.4

off season. Table 38 shows that 32% of the nursery beds were set at different locations while 43% of the nursery beds changed their sizes between these two seasons.

Table 38 Location and size of nursery beds between off season and main season 1979

Total No. of Parcels Observed	No. of Nursery Beds located in Same Location with Identical Size	No. of Nursery Beds with Same Location but Different Size	No. of Parcels Where Nursery Beds were located Only in the Off Season	No. of Parcels Where Nursery Beds were located Only in the Main Season
75	19	32	13	11
100%	25.3	42.7	17.3	14.7

The area of the nursery beds was equivalent to 4-5% of the total operating area (see Table 37).

The most important operation for the nursery beds was fertiliser application followed by water control and seedling protection. Fertiliser was applied in all the nursery beds. In 77% of the nursery beds fertiliser was applied only once, in 20% twice and in 3% 3 times. The amount applied on an average was 8 kg. of urea and 3kg. of mixed fertiliser per *penjuru* (1/4 relong) equivalent to 4.4 kg. of N, 1.8 kg. of P_2O and 1.8 kg. of K per *penjuru*. This figure shows that a high amount of fertiliser is being applied. Fifty percent of the farmers apply water control measures in their nursery beds.

Under the Muda II project, centralised and cooperative nursery beds were advocated, to promote optimum double cropping farming and rational water management. However, several difficulties and constraints may arise. These include:

i) The conservative nature of the farmers who prefer to set up their own nursery plots.
ii) Farmers' preference for specific varieties.
iii) Difficulty in agreeing on transplanting date among farmers.
iv) Difficulty in cooperative care of nursery.

From the above, it is felt that cooperative nurseries may be difficult to set up but since there is a preference to purchase seedlings, the idea of a commercial nursery bed is believed to be a good proposition.

(2) Paddy varieties

The farmers in the study area try to change the paddy varieties planted every season and prefer to introduce new varieties into the area. This is brought about by their high sensitivity to paddy varieties. In the main season of 1978, the paddy varieties planted consisted of 6 types of improved non-glutinous varieties and 1 local glutinous variety (see footnote of Table 39). In the off season of 1979 the same farmers planted 11 types of non-glutinous varieties and 1 type of glutinous variety.

An *enquete* survey was carried out among the farmers who introduced minor (area planted is small) varieties. It was found that there are two types of farmers who are sensitive to paddy varieties. The first category introduces the variety for no special reason except that they want to try it out. The second category of farmers know the characteristics of the varieties beforehand and cultivate them for their good quality.

In the main season, the minor varieties are usually smaller in number than in the off season but in the total cultivated area, no difference was observed. The planting of the variety MR 6 had also increased relative to other minor varieties during this season.

In the off season, of the total area planted, 43% was planted with Anak Dara, 29% with Seribu Gantang, 17% with Benua and the remaining 11% with minor varieties (see Table 39). In the main season, the importance of Anak Dara decreased while the percentage of area planted to Benua increased.

The MADA seasonal paddy price survey results show that in the off season of 1979, the total number of farmers who planted Seribu Gantang was 48%, Anak Dara 37% while in the study area, Anak Dara was the most popular during the same season (42% of farmers followed by 27% of farmers who planted Seribu Gantang). But it must be emphasised that the varieties planted by farmers vary frequently. For example, Mat Candu was planted over 15 ha of the area in the main season of 1978, but it virtually disappeared in the following season (off season of 1979).

(3) Transplanting

It was found that most of the farmers have a fairly good idea of the suitable date for transplanting when the nursery bed is being established. This date is influenced by a number of factors but the main considerations are the adequate water supply for the field and the availability of labour for transplanting. Although presaturation of each field is restricted by the location, topographical condition, and the water conditions, farmers' knowledge of their own fields is adequate and they are able to estimate a suitable date for transplanting.

The sources of transplanting labour are the farmers' own family labour, other farmers' family labour and immigrant labour from outside the scheme. In the main season of 1978, seasonal immigrant labour originated from South Thailand and Kelantan. However in the off season of 1979, this trend stopped due to the delay in transplanting dates. Therefore transplanting is now carried out mainly by local labour.

The transplanting activity can be carried out by the *derau* system or *upah* (hired labour) system. The *derau* system is a cooperative exchange labour system whereby groups of farmers exchange equal labour time without payment of cash. It is preferable if the members of the *derau* system operate fairly equal sized farms but this is not always possible. If farm

Table 39 Paddy varieties grown by sample farmers

Farm Size Group	Number of Sample Farmers			Mat Candu			Anak Dara			Seribu Gantang			Benua			Others		
	1978 1/ Main* Season	1979 2/ Off** Season	1979 3/ Main*** Season	1978 Main Season	1979 Off Season	1979 Main Season	1978 Main Season	1979 Off Season	1979 Main Season	1978 Main Season	1979 Off Season	1979 Main Season	1978 Main Season	1979 Off Season	1979 Main Season	1978 Main Season	1979 Off Season	1979 Main Season
Below 5 relongs	10	10	13	1	—	—	8	4	2	2	3	4	1	2	5	1	2	1
5—10 〃	11	11	7	2	1	—	10	8	3	3	2	4	3	6	2	—	2	2
10 —15 〃	7	7	9	—	—	—	5	6	3	4	6	5	2	2	4	—	—	1
Over 15 〃	7	7	5	2	—	1	6	7	4	1	5	2	2	1	3	2	2	2
Total	35	35	34	5	1	1	29	25	12	10	16	15	8	11	14	3	6	6

* 1/ 6 kinds of varieties planted : Anak Dara, Seribu Gantang, Benua, Mat Candu, Spot and Madutiga.

** 2/ 11 kinds of varieties planted : Anak Dara, Seribu Gantang, Benua, MR-6, Mat Candu, Madutiga, Siam Puteh, Padi Pakya Ketek, Padi Merah, Padi Puteh.

*** 3/ 8 kinds of varieties planted : Anak Dara, Benua, Seribu Gantang, Mat Candu, Melaka, MR-6, Cu-pak Ketak, MR-7.

sizes are different, then any differences in labour time that arise after the exchange of labour are settled with an exchange of cash.

The *derau* system is not a definitely organised grouping. It is a very loosely organised unit whose membership changes with time. In the study area, there are 10 *derau* groups. The largest group consists of 42 members while the smallest consists of only 3 members. Another group restricts itself only to relatives. Normally the group starts with one person who organises a group to help in transplanting his farm on a particular day. While working on this farm, they decide on the next area to transplant. There is thus no long term seasonal planning for the group but rather their schedules are carried out on a day to day basis. If two members vie for transplanting by the group on the same day, the age of seedlings will determine the field to be transplanted. If the seedling age is the same, the group may break into two if no voluntary compromise is offered by either of them.

The other form of labour is the *upah* or hired labour. Here there is no exchange of labour but rather each one is employed on a cash basis. The charges for transplanting are always on a per unit basis, (i.e. per relong) and normally include the pulling of seedlings and transportation of seedlings. Sometimes transportation of seedlings is excluded if done by the farmers and his family labour and the labour are adjusted accordingly. *Upah* can sometimes include members of the farmer's family in the group and he will be paid by the group organiser on an equal basis. The farmer does not discount any contribution of labour by his family labour even though he is a member of the group.

The membership of a *upah* group consists of fellow farmers inclusive of landless farmers from the nearby villages. The labour charge for *upah* was M$35.00 per relong in the off season of 1979. Table 40 shows the balance of *upah* charges by season.

There are no significant differences between the *upah* and the *derau* system in transplanting. Both are labour utilisation on a group basis. Preference for *upah* is usually evident in the case of farmers who have a shortage of family labour to exchange or when the farmers' parcel is far from the rest of his neighbours.

The farmer decides for himself the type of labour to utilise and there is no rigid rule. He may use *derau* labour during one season and *upah* labour the next. There cannot however be a mixture of the two, for example pulling of seedlings by *upah* labour and transplanting by *derau* labour. A mixture of family labour and any of the two systems is however permitted.

Table 40 Balance of labour charge for transplanting per farm household

Farm Size Group	Main Season			Off Season		
	Received	Paid	Balance	Received	Paid	Balance
Below 5 relongs	73.7	47.2	26.5	115	—	115
5 - 10 〃	128.6	44.6	84.0	51	11	40
10- 15 〃	75.6	215.9	(−)140.3	33	136	(−) 103
Over 15 〃	44.4	615.0	(−)570.6	—	54	(−) 54
Total (Average)	81.2	174.8	(−) 93.6	55	42	13

Table 41 indicates the pattern of labour utilisation for transplanting by farm size. It reveals that most farmers (65%) utilise the *derau* type of labour in transplanting. Thirty percent of the farmers utilised the *upah* labour and the remaining 5% exclusively family labour, in the main season of 1978. In the off season of 1979 the incidence of family labour increased and in the main season of 1979, many combined types were seen, i.e. in some parcels transplanting was carried out by *derau* and in others by *upah*. However, the *derau* system is still the predominant system in the area.

Table 41 Labour utilisation in transplanting

Farm Size Group	Observed Sample Farmers	Main Season 1978			Off Season 1979			Main Season 1979		
		Family Labour	*Upah*	*Derau*	Family Labour	*Upah*	*Derau*	Family Labour	*Upah*	*Derau*
Below 5 relongs	7	1	1	5	3	0	4	2	4	4
5 - 10 〃	9	0	2	7	2	3	5	4	1	7
10- 15 〃	4	1	2	2	1	1	4	1	3	5
Over 15 〃	6	0	3	3	1	3	3	1	2	4
Total	26	2	8	17	7	7	16	8	10	20

(4) Fertiliser application practices

The names of the fertilisers applied by the farmers in the project area are shown in Table 42 below. Most of the fertilisers in the area are purchased from retail shops located inside or near the project area. Only a few farmers (2 out of a total of 35) purchased the fertilisers from the Farmers' Association, due to its distance from the farm. Under normal conditions most of the fertiliser is purchased on credit to be repaid in cash or paddy after the season's harvest. In all the paddy parcels in the study area fertiliser was applied and all the farmers used fertiliser in the farms.

Table 42 Fertiliser types in Muda

Fertiliser Type	Contents (%)			Weight per Bag	Price in Off Season 1979 (M$)
	N	P	K		
Urea	46	—	—	20kg	10.80
Campuran	22	11	11	20kg	8.70
Compound	15	15	15	20kg	12.90
Nitrophoska	15	15	15	20kg	12.90
Rustica	15	15	15	20kg	12.90
Baja Debu	One type of Campuran			—	—
Baja Tanah Kelawar	Baja Tahi Kelawar mixed with other types of fertiliser.			30kg	4.50
Baja Tahi Kelawar	0.07	8.4	0.1	30kg	4.50

The amount of fertiliser applied, the types of fertiliser and the frequency of application varied greatly from farm to farm and from parcel to parcel in the off season of 1979. However, in the main season, differences were evened out due to the introduction of the fertiliser subsidy (see Tables 43, 44, 45 and Appendix 8).

In the off season of 1979, three types of fertiliser users were identified. They were firstly farmers who apply only urea; secondly, farmers who apply other fertilisers but not urea; and thirdly those who apply both categories of fertiliser. Most of the farmers (69%) belonged to the first category in the off season of 1979. Another 26% applied both urea and other types, while only 5% did use urea. Those that belong to the second category have medium sized farms and they apply Campuran and Nitrophoska.

Table 43 Fertiliser application by farm size in the off season (per relong)

Farm Size Group	No. of Sample Farmers	Urea		Campuran		N. P. K		Others*	
		No. of Farmers	Amount (kg)	No. of Farmers	Amount (kg)	No. of Farmers	Amount (kg)	No. of Farmers	Amount (kg)
Below 5 relongs	10	10	32.2	—	—	1	50	1	225.0
5 - 10 〃	11	9	30.2	4	23	2	24	1	10
10- 15 〃	7	7	36.9	2	27.8	1	33	—	—
Over 15 〃	7	7	53.2	—	—	1	10	—	—
Total (Average)	35	33	42.1	6	25.3	5	23	2	76.2

* Baja Tanah

Table 44 Fertiliser application by farm size in the main season (per relong)

Farm Size Group	No. of Sample Farmers	Urea		Mixed	
		No. of Farmers	Amount (kg)	No. of Farmers	Amount (kg)
Below 5 relongs	13	12	36.2	9	26.1
5 - 10 〃	7	7	35.3	7	31.3
10- 15 〃	9	9	36.5	9	23.1
Over 15 〃	5	5	40.6	5	21.0
Total (Average)	34	33	37.6	30	23.7

During the main season of 1979, the application pattern of the farmers changed dramatically. This was caused by the introduction of the fertiliser subsidy.

The total amount of fertiliser applied was as follows:

18.1 kg N per relong or 63 kg N per hectare
in the off season and
22 kg N per relong or 76 kg N per hectare
in the main season.

Table 45 Fertiliser application by zone (per relong)

Zone	Off Season						Main Season			
	Applied Amount per relong				Converted into		Applied Amount per relong		Converted into	
	Urea	Campuran	NPK	Other	N	P. K.	Urea	Mixed	N	P. K.
	kg	kg	kg	kg	kg	kg	kg	kg	kg	kg
ISA A−1	37	2	—	1	14.1	0.2	24	28	16.9	3.1
ISA A−2	38	3.7	4	—	21.1	1.0	36	31	23.3	3.5
ISA B	33	4	—	—	10.0	0.4	29	21	17.9	2.3
ISA E	29	8	6	30	15.9	1.8	58	22	31.4	2.4
Swampy and Deep Areas	38	7	3	0.5	11.6	1.3	38	23	22.4	2.5
Out of ISA	55	4	—	—	26.2	0.4	56	14	28.6	1.5
Out of Block	40	2	5	—	19.7	0.9	29	27	19.0	2.9
Total (average)	39	4	3	3	18.1	0.9	37	24	22.0	2.6

In the main season there was an increase in usage of 21% over that in the off season, although the amount used was still below the recommended amount of 80 kg N per hectare in the off season and 100 kg N per hectare in the main season.

The application frequency is indicated in Appendix 9. It shows that in 35% of the parcels fertiliser was applied 3 times in the off season. This was due mainly to the attack of hoppers during that season. However during the main season fertiliser was applied 3 times in only 3.7% of the total parcels. In 90% of the parcels fertiliser was applied twice (inclusive of 3-time category) in the off season and in 99% in the main season.

The date of the first application was 19 days after transplanting on an average in the off season and 18 days after transplanting in the main season. They both occurred later than the recommended period of 2 weeks after transplanting. This is because the transplanting works were mainly done by *derau* labour. The farmers who were involved in *derau* works could only apply fertiliser after the *derau* commitments were fulfilled.

The second application date was 20 days after the first application in the off season and 27 days after the first application in the main season. Comparison with the recommended time of application was not possible because the sample farmers could not always determine the date of panicle initiation.

The fertiliser application period varies greatly from parcel to parcel owing to location and water condition problems. The earliest application was 1 week after transplanting while the latest was 2 months after transplanting.

The price of fertilisers purchased by credit was as follows:

Urea (20 kg)	-M$10.40, M$10.80, M$10.90, M$11.00 and M$12.00
Campuran (20 kg)	-M$7.40, M$8.30, M$8.80 and M$9.00
Compound (50 kg)	-M$30.00, M$30.50 and M$31.00
Baja Debu (20 kg)	-M$7.40
Baja Tanah (30 kg)	-M$4.50

The selling price at the Farmers' Association was as follows:-

Urea	-M$10.90
Campuran (20 kg)	-M$8.70
Compound (20kg)	-M$12.90

Table 46 shows the changes in the amount and value of fertiliser by season for the sample farmers. The purchased amount of urea decrased by 76% in the main season (this refers to actual purchases from private sources and not fertiliser given under the fertiliser subsidy programme). Mixed fertilisers were not purchased in the main season. Total value of purchased fertiliser was M$273 in the off season and this was reduced to M$68 per farm household in the main season.

The fertiliser subsidy programme which was introduced in the main season of 1979 provided all farmers who cultivate paddy with 2 bags of urea and 4 bags of Campuran per acre up to a maximum of 6 acres of cultivated area. The price of the subsidy fertiliser was estimated to be M$12.40 per 20 kg bag of urea and M$10.75 per 20 kg bag of Campuran, resulting in a value per acre of M$67.80. Table 47 shows the actual amount of fertiliser received under the subsidy scheme.

(5) Other activities in main paddy field

The farming activities described in this section consist of re-transplanting, weeding, crop protection measures and water control. Re-transplanting in the off season began one week after transplanting and took place chiefly in the month of May 1979. Re-transplanting

Table 46 Amount of fertiliser purchased by season (per farm household)

Farm Size Group	Urea				Mixed*				Total	
	Amount		Value		Amount		Value		Value	
	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season
	(kg)	(kg)	M$	M$	(kg)	(kg)	M$	M$	M$	M$
Below 5 relongs	142	2	77	1	20	—	3	—	80	1
5—10 〃	206	61	118	33	105	—	49	—	167	33
10—15 〃	505	138	277	76	197	—	97	—	374	76
Over 15 〃	1131	410	602	279	21	—	13	—	615	279
Average	433	125	235	68	83	—	38	—	273	68

* Mixed fertilisers include Campuran and compound.

Table 47 Amount of fertiliser received under the subsidy programme per farm household, main season 1979

Farm Size Group	Urea		Mixed		Total Value (M$)
	Amount (kg)	Value (M$)	Amount (kg)	Value (M$)	
Below 5 relongs	132	82	264	142	224
5 - 10 〃	244	152	489	262	414
10- 15 〃	316	196	631	339	535
Over 15 〃	340	211	680	365	576
Average	234	145	409	252	397

involved 53% of the total parcels in which 68% of the farmers were engaged. In 25% of the cases re-transplanting was done once on the parcels and in 22% of the cases, re-transplanting was carried out twice (see Table 48).

In the main season, out of a total of 81 parcels, 52 parcels (64%)were re-transplanted and about 30% of them were re-transplanted once. Another 30% were re-transplanted twice. Re-transplanting was most frequent during the main season due to unfavorable water conditions and damage by rainfall (transplanting during this season took place in the periods of heavy rainfall).

Weeding is one of the most important practices in paddy cultivation, and this fact had been recognised by the farmers in the project area. Weeding was carried out in all parcels in the off season except in only 3 parcels which were located in deep areas. Frequency of weeding varied with the parcel. However, 50% of the parcels were weeded two or more times. Herbicide use was also common. The herbicides commonly used in the study are Rumputox, Gramaxone, U-46 Air and Zelan D.

The labour input for weeding varied with the farm size and the parcel. The medium sized farms had the largest labour input for weeding while the small and large sized farms had only

half of the labour input of the medium sized farms. ISA A-2 and the swampy areas also had larger inputs of labour as seen in Table 49.

Weeding during the main season was less frequent unlike that in the off season. There were only 33% instances of weeding among the 81 parcels and in some zones little or no weeding at all. The average labour input for weeding was only 1 man hour per relong in the main season while in the off season it was 3 man hours per relong. The difference is believed to be caused by the difference in weather conditions between these two seasons.

The spread of double cropping has led to an increased need for crop protection measures, as diseases and pests increased with year-round planting of paddy. In the main season of 1978, the project area experienced pest damage by *pianggang** while in the off season the crop was seriously attacked by the white-backed hopper. Increased insecticide use was reported as a reaction to these pest problems.

The most popular insecticides used in the area were Bassa, Hopcin, BCa-5, Sogatox, Dolmex and Bagus. Of these, the use of Bassa, Bagus and Dolmex was the highest. It was found that 88% of the sample farmers sprayed insecticides for pest control and 89% of the parcels were attacked by the hoppers during the off season of 1979. In 31% of the parcels, spraying was carried out 3 times (see Table 50).The average labour input for this activity was 2.4 man hours per relong.

In the main season of 1979, no serious pest attack occurred and accordingly the incidence of insecticide use dropped to 22% of the parcels.

As regards water control, it is evident that awareness and sensitivity to this factor had greatly increased since the drought of 1977/78 which caused the cancellation of the off season crop of 1978. Water control methods in the field however remain traditional. The main methods of draining out a field are through the cutting of the batas and the use of a large tin to continuously scoop up the water which is discharged in the neighbouring field. To retain water in the field, any holes in the batas are plugged by grass covered by mud. Some farmers resort to pumping from the canal and drain for water management purposes.

Out of the total of 88 parcels water control measures were carried out in 42% in the off season of 1977 among which in 26 parcels (70%) the measures were implemented 3 times during the season. In 6 parcels (16%) the measures were undertaken only once. These results suggest that the farmers are aware of the importance of water control. The middle sized farms seem to indulge more in water control measures but this may depend on the field conditions (see Table 51).

In the main season of 1979, water control measures had been implemented in 59% of the total parcels. The water control measures in the main season consisted mostly of drainage while in the off season, they were aimed at retaining water.

(6) Harvesting

Harvesting activities in the study area are presently being carried out in two ways, namely, machine harvesting and manual harvesting. There is however no distinct separation between the two methods and individual farmers still apply both methods in different parcels of the same farm. As seen in Table 52, 40% of the farmers used both methods in the off season of 1979 while 27% in the main season. The study area can therefore be said to be in a transitional stage from manual to machine harvesting.

The use of machines in the area depends on the supply of combine harvesters in the area.

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* *Leptocorisa* species

Table 48 No. of parcels re-transplanted

Zone	Off Season 1979					Main Season 1979				
	No. of Parcels	Re-Transplanting				No. of Parcels	Re-Transplanting			
		Once	Twice	3 Times and More	Total		Once	Twice	3 Times and More	Total
ISA A－1	14	1	1	2	4	10	3	2	—	5
ISA A－2	11	5	2	2	9	11	6	4	1	11
ISA B	14	2	7	1	10	13	2	7	1	10
ISA E	9	4	2	—	6	10	4	—	1	5
Swampy and Deep Areas	16	3	6	1	10	15	1	6	1	8
Out of ISA	9	5	1	—	6	8	6	1	—	7
Out of Block	16	2	—	—	2	14	2	4	—	6
Total	88	22	19	6	47	81	24	24	4	52
%	100.0	25	21.6	6.8	53.4	100.0	29.6	29.6	4.9	64.1

Table 49 Frequency of weeding by parcel

Zone	Off Season 1979					Main Season 1979				
	No. of Parcels	Frequency of Weeding				No. of Parcels	Frequency of Weeding			
		Once	Twice	3 Times And More	Total		Once	Twice	3 Times And More	Total
ISA A－1	14	11	—	3	14	10	—	5	—	5
ISA A－2	11	2	3	4	9	11	1	4	2	7
ISA B	14	3	10	1	14	13	4	3	—	7
ISA E	9	3	6	—	9	10	—	—	—	—
Swampy And Deep Areas	16	7	4	4	15	15	—	6	—	6
Out of ISA	8	1	6	1	8	8	—	—	1	1
Out of Block	16	9	6	1	16	14	1	—	—	1
Total	88	36	35	14	85	81	6	18	3	27
%	100.0	41	40	16	97	100.0	7.4	22.2	3.7	33.3

Table 50 Insecticide application by parcels

Zone	Off Season 1979					Main Season 1979				
	No. of Parcels	Frequency of Spraying				No. of Parcels	Frequency of Spraying			
		Once	Twice	3 Times and More	Total		Once	Twice	3 Times And More	Total
ISA A－1	14	3	2	8	13	10	4	—	—	4
ISA A－2	11	8	—	1	9	11	4	2	—	6
ISA B	14	5	5	1	11	13	3	2	—	5
ISA E	9	5	1	3	9	10	—	—	—	—
Swampy And Deep Areas	16	11	—	3	14	15	2	—	—	2
Out of ISA	8	5	—	2	7	8	1	—	—	1
Out of Block	16	6	—	9	15	14	—	—	—	—
Total	88	43	8	27	78	81	14	4	—	18
%	100.0	48.9	9.1	30.7	88.6	100.0	17.3	4.9	—	22.2

Table 51 Water control measures by parcel

Zone	Off Season 1979					Main Season 1979				
	No. of Parcels	Frequency of Water Control				No. of Parcels	Frequency of Water Control			
		Once	Twice	3 Times And More	Total		Once	Twice	3 Times And More	Total
ISA A－1	14	1	—	9	10	10	1	2	—	3
ISA A－2	11	—	—	—	—	11	3	3	2	8
ISA B	14	2	2	1	5	13	3	5	3	11
ISA E	9	—	—	3	3	10	2	1	3	6
Swampy and Deep Areas	16	1	—	5	6	15	5	4	1	10
Out of ISA	8	—	1	1	2	8	1	4	1	6
Out of Block	16	2	2	7	11	14	2	2	—	4
Total	88	6	5	26	37	81	17	21	10	48
%	100.0	6.8	5.7	29.5	42.0	100.0	20.0	25.9	12.3	59.3

Table 52 Harvesting methods in the study area

Farm Size Group	Off Season				Main Season			
	No. of Sample Farmers	Harvested by Machine Only	Harvested Manually Only	Harvested by Machine & Manually	No. of Sample Farmers	Harvested by Machine Only	Harvested Manually Only	Harvested by Machine & Manually
Below 5 relongs	10	1	7	2	13	7	5	1
5 −10 〃	11	—	5	6	7	4	—	3
10−15 〃	7	2	4	1	9	5	1	3
Over 15 〃	7	1	1	5	5	3	—	2
Total	35	4	17	14	34	19	6	9
%	100.0	11.4	48.6	40.0	100.0	55.9	17.6	26.5

In this respect the farmer has little choice and the physical presence of the machine depends much on the broker and the contractor. The broker plays an important intermediary role because he negotiates for the dates of arrival, areas to be harvested and price. Because the dates depend on the ripening time in the majority of the farmers' fields, individual farmers who are out of phase in the block will find it difficult to fit in machine harvesting. The broker also decides on the time-table of harvest for each parcel within an area and the farmers have very little choice in this matter, short of reverting back to manual harvesting.

In the project area there are two brokers, each with a definite area of operation. The broker collects money from the farmer for the services of the machine. In return, the contractor pays the broker M$5 for each relong harvested.

During machine harvesting, bagging of the paddy is the farmers' responsibility. The task is still manually done and additional labour needs to be hired by the farmer for this. Since under manual harvesting, bagging is done by the threshers, a new type of labour demand is thus created by mechanisation of harvesting. The wages for this activity are however not definite, sometimes family labour or *gotong royong* or hired labour is used and there are no fixed charges. An additional man to keep a watch over the paddy against theft is also necessary because all the paddy can not be taken out during one day. The other care of the paddy, that is transportation, entails the same activities as in manual harvesting.

For manual harvesting, three separate and intensive sequences of work have been identified, that is, cutting, threshing and transportation. These activities also need to be completed within a short period of about 7 days.

In the past, the cutting was traditionally done by female labour and threshing and transportation by male labour. But now, due to the shortage of female labour, cutting is done by both males and females. For harvesting, unlike transplanting, the labour is mostly hired and no *derau* has been reported for three reasons. Firstly, the harvesting dates of the neighbouring farmers very often overlap and no delay can be tolerated; secondly, the harvesting work in each sequence or activity is hard and separate; and thirdly the family labour is needed for post-harvest works and thus could not be spared for *derau* work.

3) Yield and paddy production

(1) Estimation of harvesting amount

Although paddy output in the Muda area is generally expressed it terms of *pikuls* or *gantangs*, farmers express it in terms of numbers of gunis or bags. The difficulties in assessing yield can be ascribed to the non-uniform sizes of the guni. In the Agro-Economic Studies of 1974/75[6], three different sizes of guni were identified. They are the large gunis whose content of paddy is estimated at 32 gantangs, the medium sized guni of 30 gantangs and the small sized guni which contain 28 gantangs of paddy.

The difficulties in making uniform the output are compounded by the presence in the paddy inside a guni of empty grains, mud, straw and other impurities. The paddy in each guni has also varying amounts of moisture content. Adjustment for all those factors is necessary to assess actual amounts of paddy harvested.

The LPN (National Paddy and Rice Authority) regulations suggest a standardized deduction rate of moisture content as follows:

Table 53 LPN deduction rates for moisture content

Moisture Content	Deduction Rate (Per Pikul)
13−15%	2 katis
15−17%	4 katis
17−18%	7 katis

The paddy buyers however do not follow these guidelines.

To measure the moisture content of paddy harvested by individual farmers proved to be impractical, given the manpower limitation. The data obtained from the paddy sales receipts (see Appendix 11) were thus used. The average deduction rate as extracted from the receipts is provided below:

Table 54 Average deduction rate in study area

	Gross Weight (A) (gtg)	Net Weight (after Deduction) (B) (gtg)	$\frac{B}{A}$	Deduction Rate
Off Season	32.5	27.5	84.6%	15.4%
Main Season	34.2	29.0	84.8%	15.2%

The value of the harvest as received by the farmers is calculated on the basis of the net weight of paddy in the gunis multiplied by the price of paddy per *pikul*.

(2) Yield

In Appendix 10, the total harvest of paddy expressed in number of gunis is listed. It amounted to 5,397 gunis in the off season or 15.4 gunis per relong. In the main season it totalled 5,255 gunis or 16.3 gunis per relong (area harvested was smaller in the main season).

Based on these data, the net weight of paddy or yield was calculated as shown is Table 55, which indicates the yield in both seasons by farm size and by zone.

The average yield in the off season of 1979 was 420 gantangs per relong or 3.65 tons per hectare. In the main season it was 475 gantangs per relong or 4.12 tons per hectare, an increase of 13% over the off season yield. The farm size class of 5-10 relongs showed the highest yield in both the off season and the main season of 1979. The lowest yield reported by the farmers was less than 5 relongs for both seasons. The difference of yield between the highest and the lowest values was 17% in the off season while this range of yield in the main season was 9%. The range of yields by zones was 16% in the off season and 12% in the main season.

Table 55 Yield of paddy in the study area in 1979

	Off Season 1979			Main Season 1979		
	Gtg. per Relong	Gtg. per Hectare	Tons per Hectare	Gtg. per Relong	Gtg. per Hectare	Tons per Hectare
By Farm Size :						
Below 5 relongs	385	1337	3.34	461	1601	4.00
5 - 10 〃	450	1563	3.91	503	1747	4.37
10- 15 〃	413	1434	3.59	466	1618	4.05
Over 15 〃	417	1448	3.62	478	1660	4.15
Average	420	1458	3.65	475	1649	4.12
By Zone :						
ISA A-1	420	1458	3.65	506	1757	4.39
ISA A-2	418	1451	3.63	491	1705	4.26
ISA B	472	1639	4.10	453	1573	3.93
ISA E	405	1406	3.52	459	1594	3.98
Swampy & Deep Areas	437	1517	3.79	472	1639	4.10
Out of ISA	382	1326	3.32	475	1649	4.12
Out of Block	405	1406	3.52	472	1639	4.10
Average	420	1458	3.65	474	1646	4.12

The paddy yield by variety is indicated in Table 56, showing that the highest yielding variety in the off season was Benua and Anak Dara in the main season. The lowest yielding variety, on the other hand, was Seribu Gantang in both the off season and the main season.

The rate of increase of yield from the off season to the main season was 16% for Anak Dara, 13% for Seribu Gantang while Benua showed a yield decrease of 1%. Regarding the minor varieties, Padi Puteh was the highest yielding in the off season while Siam Puteh was the lowest. MR 6 increased its yield by 14%.

Table 57 groups the farmers by yield classes. Twenty three percent of the farmers and parcels belonged to the group with the highest yield (more than 500 gantangs per relong), in the off season of 1979. In the main season, the numbers rose to 38% of the farmers and 36% of the parcels, respectively. On the other hand, 20% of the farmers and 21% of the parcels belonged to the category with the lowest yield (less than 350 gantangs per relong) in the off

Table 56. Yield of paddy varieties in study area (gantang per relong)

ZONE	Anak Dara		Seribu Gantang		Benua	
	Off Season	Main Season	Off Season	Main Season	Off Season	Main Season
ISA A－1	397	533	438	503	591	468
ISA A－2	458	477	320	504	—	528
ISA B	493	480	387	379	542	471
ISA E	—	—	345	411	462	477
Swampy & Deep Areas	419	483	479	467	499	461
Out of ISA	390	496	372	451	321	453
Out of Block	379	489	389	419	393	402
All Area	423	490	397	448	471	465

Name of Other Varieties	Yield	
	Off Season	Main Season
Siam Puteh	308	—
Padi Puteh	489	—
MR 6	438	498
Madu Tiga	403	—
Melor	451	—
Padi Merah	423	—
Padi Pakya	410	—
Melaka	397	397

season, but in the main season, the values became 0% for the farmers and 1% for the parcels in the main season.

Though an increase in yield is evident from the data on these two seasons, it is difficult to determine the yield levels of each farmer and each parcel with only two seasons' data. A time series data covering 5 years for the same parcel and the same farmer would be necessary before any conclusion can be reached.

Table 57 Grouping of farmers and parcels by yield level

Yield Group	No. of Farmers		No. of Parcels	
	Off Season	Main Season	Off Season	Main Season
Over 500 gtg. (4.3 ton)	22.9	38.2	22.7	35.8
500−450 gtg.	11.4	29.4	18.2	29.6
450−400 gtg.	22.9	26.5	22.7	22.2
400−350 gtg.	22.9	5.9	15.9	11.1
Less 350 gtg. (3.0 ton)	20.0	0	20.5	1.2
Total	100.0	100.0	100.0	100.0

(3) Factors affecting yield

Paddy yields in any farming environment are affected by a multitude of factors, among which the following are:

Socio-economic factors -farming scale, tenure status, labour force, operator willingness and knowledge.

Physical factors -water conditions, field facilities, location of field, infrastructure.

Farming practices -varieties, farming techniques, labour utilisation.

Even though it is difficult to identify the factors affecting yield with such short-term data in the study area, an attempt was made to investigate the relationship between the factors and yield performance. To do so, the yield data in each parcel were arranged by decreasing order of the ten highest yielding parcels and the ten lowest yielding parcels in both the off season and the main season and their characteristics were analysed (see Tables 58 and 59).

The Tables reveal the following for the off season 1979:

i) High yielding parcels; in 6 of them the farmers were the owners, in 4 of them farmers were tenants;
Low yielding parcels; in 5 farmers were owners, in 5 tenants.

ii) In the high yielding parcels, the operators were younger; in the low yielding parcels, the operators were older and females,

iii) In the high yielding parcels, the varieties cultivated were mainly Benua and Anak Dara; in the low yielding parcels, Seribu Gantang.

iv) In the high yielding parcels, with 2 exceptions, all the parcels were transplanted in April; in the low yielding parcels, few were transplanted in April and 6 in May.

v) There were no distinct differences between the two groups of parcels regarding the date of fertiliser application, their amounts and the depth of water.

In the main season, the following could be said:

Table 58(a) Ten highest yielding parcels in the off season

Ranking of Yield	Yield (gtg)	Farm Size (relong)	Tenure Status	Age and Sex of Operator	Variety	Date of Transplanting	Fertiliser		Average Water Depth (ins.)
							First Application Date d. a. t.	Total Amount (kg)	
1	608	2.00	Rented	M.45	A.D.	3/5	15	23	2
2	591	2.31	Own	M.49	Benua	23/4	18	12	3
3	576	3.00	Own	M.24	Benua	22/4	31	18	4
4	576	1.00	Own	M.24	Benua	22/4	18	28	4
5	568	3.15	Own	M.49	A.D.	22/4	20	13	4
6	565	5.00	Own	M.48	Benua	15/4	24	18	2
7	564	2.00	Rented	M.29	A.D.	11/5	14	16	4
8	550	1.00	Own	M.36	S.G.	17/4	28	28	3
9	550	4.50	Rented	M.36	A.D.	17/4	17	18	2
10	549	4.00	Rented	M.42	A.D.	23/4	23	28	5

Table 58(b) . Ten lowest yielding parcels in the off season

1	228	0.99	Own	M.49	S.G.	20/4	25	28	3
2	253	2.97	Own	M.49	A.D.	20/4	28	28	3
3	281	5.00	Rented	M.29	A.D.	10/5	10	29	2
4	300	1.00	Rented	M.42	S.G.	28/4	6	14	3
5	305	2.70	Pented	F.42	A.D.	6/5	14	20	5
6	308	4.30	Rented Rented	M,64	Siam Puteh	18/4	25	10	3
7	311	4.50	Rented	M.45	S.G.	4/5	12	29	3
8	320	10.00	Rented	M.70	S.G.	10/5	17	18	5
9	321	3.00	Rented	M.34	Benua	7/5	11	43	3
10	323	4.50	Rented	M.29	S.G.	7/5	17	31	2

Note : F = Female, M = Male
A.D. = Anak Dara, S.G. = Seribu Gantang

d.a.t. = Days after transplanting.
Amount of fertiliser applied is converted into kg. of Nitrogen.

Table 59(a) Ten highest yielding parcels in the main season

Ranking of Yield	Yield (gtg)	Farm Size (relong)	Tenure Status	Age and Sex of Operator	Variety	Date of Transplanting	Fertiliser		Average Water Amount (ins.)
							First Application Date d. a. t.	Total Amount (kg)	
1	614	1.00	Rented	M.36	A.D.	28/10	17	23(28)	3
2	599	2.00	Rented	M.36	S.G.	4/10	31	20(18)	2
3	596	3.00	Own	M.48	C-6	29/10	21	24(10)	2
4	581	4.00	Own	M.29	A.D.	4/11	11	14(10)	5
5	571	2.00	Own	F.47	S.G.	26/10	17	25(13)	3
6	568	3.00	Own	M.29	S.G.	28/10	17	16(11)	5
7	553	4.50	Rented	M.36	A.D.	28/10	18	15(18)	2
8	551	2.00	Rented	M.29	S.G.	28/10	29	18(16)	4
9	551	5.00	Own	M.48	C-6	18/10	33	18(18)	2
10	536	10.00	Pented	M.70	Benua	5/11	20	18(18)	5

Table 59(b) Ten lowest yielding parcels in the main season

1	338	2.25	Rented	M.48	C-6	10/11	15	10(16)	5
2	363	3.00	Rented	M.47	S.G.	18/11	14	31(13)	2
3	366	2.50	Own	M.40	Benua	11/11	17	22(20)	12
4	377	1.75	Rented	M.70	S.G.	11/11	14	24 *	6
5	378	8.00	Rented	M.45	S.G.	13/11	13	16(28)	7
6	379	8.77	Own	M.51	S.G.	11/11	14	13(9)	5
7	382	3.40	Own	M.51	S.G.	14/11	12	15(18)	2
8	386	1.50	Own	M.69	S.G.	6/11	11	21(18)	9
9	388	2.00	Rented	M.40	Benua	8/11	12	22(21)	5
10	397	2.00	Rented	M.51	Melaka	14/11	10	19(14)	6

* Unknown. The figures in brackets show the fertiliser amounts during the last off season.

i) High yielding parcels, in 7 the farmers are owners and in 3 tenants. Low yielding parcels, in 5 the farmers were owners and in 5 tenants.

ii) In the high yielding parcels, the operators were younger as compared to the low yielding parcels, where the farmers were above 40 years old.

iii) In the high yielding parcels, the varieties were Anak Dara (3), Seribu Gantang (5) and MR 6 (2); in the low yielding parcels, the varieties were Seribu Gantang (6), MR 6 (1), Benua (2) and others (1).

iv) The high yielding parcels, except for 3, were all transplanted in October whereas the low yielding parcels were all transplanted in November.

v) Among the high yielding parcels, in only 3 parcels the water depth was more than 5 inches, while among the low yielding parcels, in 8 the water depth was above 5 inches.

vi) There was no relationship between the date of fertiliser application and the fertiliser amounts between the two categories.

In general, therefore, the above can be summarised as follows: There is a relationship between the level of yield and the tenure status, the operators' sex and age, paddy varieties and transplanting date but no relationship can be determined as regards the fertiliser amounts and application dates.

However, the overall yield increments in the main season may be related to the overall amounts of fertiliser applied because 6 parcels to which large amounts of fertiliser had been applied in the main season were in the high yielding category. The overall yield in the main season increased by 13% over the off season yield while the overall fertiliser amounts applied increased from 63kg of N per hectare to 76 kg of N per hectare (an increase of 21% of N). Of course, caution should be exercised here because other factors may also be responsible for the yield increase, for example, there was no serious damage from pests in the main season, and the water conditions were different. Farmers in the study area who had experienced a decrease of yield in the main season attributed it to bad water conditions.

(4) Projected production in the study area

The Muda II project, which will provide tertiary facilities to enhance agricultural development, is currently being implemented. The post-project yields are indicated in Table 60, showing that a yield increase of 20-24% over the pre-project yields can be anticipated.

Table 60 Muda II pre-and post-project yields

		Present Yield (ton/ha)	Post - Project Yield (ton/ha)	Incremental Yield Increase %
Off Season	Acid Areas	2.87	3.6	24%
	Non-Acid Areas	3.77	4.6	21%
Main Season	Acid Areas	2.87	3.5	21%
	Non-Acid Areas	3.47	4.2	20%

The study area lies in a zone with acid sulphate soils, as can be seen from the soil map of the Muda area. The effect of these soils on yield, however, does not seem to be as serious as

initially feared. Since the project area will also be provided with tertiary facilities, post-project yields can be estimated using the Muda II project yield forecast, as shown in Table 61. This target however does not seem to be difficult to achieve as in many parcels in the study area which have no serious water control problems yields had already exceeded those projected after the completion of the project.

Table 61 Pre-and post-project yields in study area

	Present Yields (ton/ha)	Post -Muda II Yields (ton/ha)	Incremental Yield Increase (%)
Off Season	3.6	4.5	24%
		4.4	21%
		4.3	20%
Main Season	4.1	5.1	24%
		5.0	21%
		4.9	20%

The constraints to this yield increase will be the traditional crop husbandry that is still being practiced, for example, amounts of fertiliser being less than those recommended. If an optimal cropping pattern can be established in the future it is felt that yield increases will surpass the Muda II projections. An increase of 30% can easily be achieved which would push yields to 5.4 tons per hectare.

Using this figure, total output in the irrigation block of 700 hectares can be calculated as shown in Table 62.

Table 62 Present and post-Muda II output in project area (yield assumption of 5.4 tons/ha)

	Present Output (ton)	Post -Muda II Output (ton)	Incremental Output (tons)	Incremental Increase %
Off Season	2520	3276	756	30.0
Main Season	2870	3731	861	30.0
Total	5390	7007	1617	30.0

2.5 Agricultural income and farm household economy*

1) Paddy commodity balance

The flow of the paddy commodity produced and kept by each farmer is indicated in Figures

* All figures on the whole Muda area in this chapter are quoted form MADA(Agro- Economic Studies in the Muda project Area Part 1. Farm management report, May, 1976.).

11 and 12 showing that the total demand for paddy was 79% of the total supply. By the end of April 1980, the farmers were still keeping 21% of the total supply of paddy for sale, home consumption and other uses (refer to Table 63). This is a very significant amount, although the start of the next off season had been delayed to April. It is believed that the farmers retain a large portion of the crop until they are able to determine whether they can get a good crop during the coming season, before selling it.

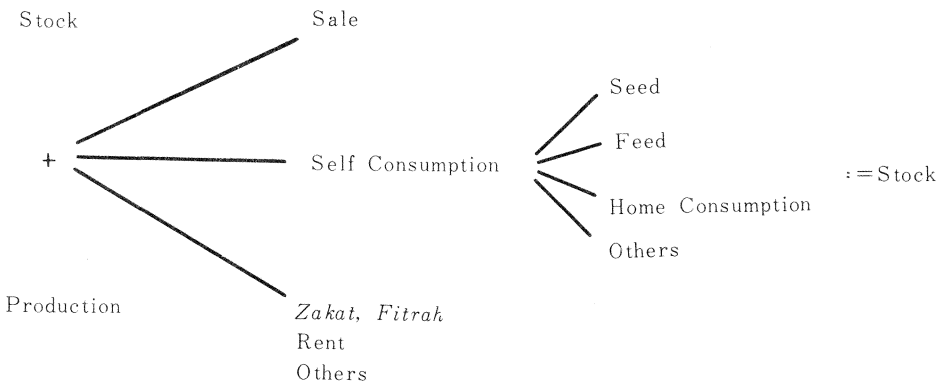

Fig. 11 Flow of paddy commodity

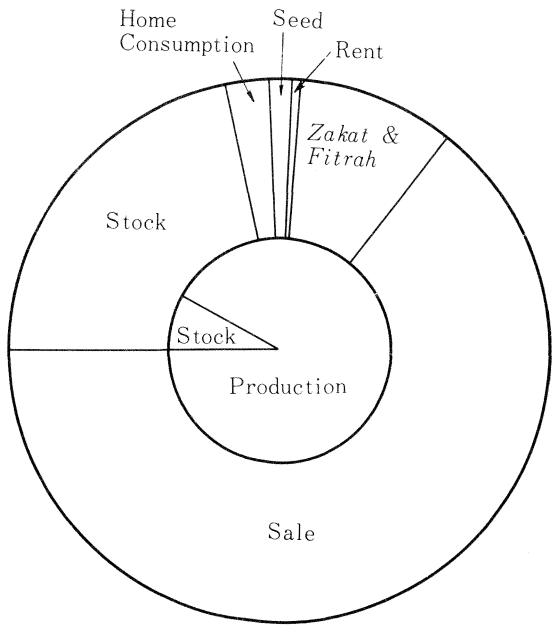

Fig. 12 Demand and supply of paddy, 1979

Table 63 Demand and supply of paddy in 1979/1980

Supply		Demand		
Stock	7.2%	Sale	64.2%	81.0%
Production	92.8%	*Zakat Fitrah*	10.1%	12.8%
Total	100.0%	Rent	0.3%	0.4%
		Seed	0.9%	1.1%
		Home Consumption	3.7%	4.7%
		Sub-total	79.2%	100.0%
		Stock	20.8%	
		Tatal	100.0%	

The Table also shows that 81% of the total supply was delivered to the paddy market, 5% was kept for home consumption, and 14% for other uses including *zakat,* rent, seeds etc. Even though there were a few cases of *pawah* rental system in the study area, the amount of paddy paid as rent is still low. This reflects the preference for payment of rents in cash.

Table 64 shows the monthly sales of paddy for both the off season and main season. For the off season crop, 25% of the paddy was sold in August, 22% in September, 11% in October, 32% in November and 14% in December, making a total sales figure of 76%.

In the main season however, a high proportion of 39% was sold in February while 18% was sold in March, after which sales became insignificant. A change of selling pattern is evident here, as a large proportion of the crop is still kept by the farmers, due to their apprehension over the off season crop, after experiencing the cancellation of the off season crop of 1978 due to a shortage of water. Farmers' expectations over an increase in the price of paddy during that time, also played an important role.

2) Agricultural receipts and expenditure

The total receipts of the overall sampled farmers in the study area for the whole year 1979/80 were M$9,657 on an average basis and of this, 98.9% was contributed by paddy. The overall Muda figure (taken from the 1974 Agro-Economic Studies) was only M$4,961 of which 97.8% consists of paddy (see Table 65). The Table also shows a lower dependency on paddy among the larger farmers in contrast to the Muda average farmer. This is influenced by the significant (2%) contribution made by livestock (including poultry) for the larger farmers in the study area.

The difference in the absolute amount of agricultural receipts between these two studies stems from the difference in farm sizes (8.8 relongs in the study area and 5.7 relongs in the Muda area). When the figures are reduced to a comparable basis, a figure of M$1097 per relong for the study area and M$890 for the Muda area can be obtained. The study area thus shows agricultural receipts to be 23% higher than the Muda average. This difference is explained by yield and paddy price differences. The yield in the study area was 447 gantangs per relong (average of 2 seasons) while the Muda figure was 390 gantangs per relong, a difference of 15%. The paddy price in the study area was also higher, being M$29.50 per pikul against the 1974 Muda figure of M$27.50 per pikul (a difference of 7.3%).

The total agricultural expenditure in the study area was M$3,534 per farm household or 37%

Table 64. Monthly sales of paddy by season(%)

Farm Size Group	Percentage Sales in Off Season							Percentage Sales in Main Season					
	Production	August	September	October	November	December	Total	Production	January	February	March	April	Sub-Total
Below 5 relongs	100.0	33.8	26.7	2.9	—	5.8	69.2	100.0	—	57.6	1.5	—	59.1
5 −10 〃	100.0	20.2	22.2	7.6	—	18.7	68.7	100.0	—	31.0	16.2	0.1	47.3
10−15 〃	100.0	29.1	23.9	17.7	—	17.0	87.7	100.0	—	42.3	13.2	—	55.5
Over 15 〃	100.0	24.6	19.9	13.2	10.8	14.1	82.6	100.0	4.2	31.2	32.1	0.1	67.6
Total (Average)	100.1	25.3	22.1	10.8	3.2	14.1	75.5	100.0	1.4	38.7	18.4	0.1	58.6

Table 65 Agricultural receipts

	Study Area (1979)				Whole Muda Area (1974)			
	Average		Large Farm	Small Farm	Average		Large Farm	Small Farm
	Value	%	%	%	Value	%	%	%
Paddy Production	9548	98.9	98.1	99.5	4961	97.8	99.0	95.1
Livestock	95	1.0	1.8	0.5	35	0.7	0.4	1.6
Miscellaneous	14	0.1	0.1	0.0	78	1.5	0.6	3.3
Total	9657	100.1	100.0	100.0	5074	100.0	100.0	100.0

of agricultural receipts (see Table 66) while that from the Agro-Economic Study was M$1981, or 40% of agricultural receipts. Reduced to a per relong basis, it was M$401 per relong in the study area and M$348 per relong in the Muda area. The contribution of labour charge to this expenditure of 25.6% or M$103 per relong in the study area is lower than that of Muda (35.1% or M$122 per relong), due to the higher incidence of *derau* labour in transplanting in the study area. The contribution to lease and contractor charges is however higher in the study area (24.5% or M$98 per relong against 10% or M$35 in the Muda average) and this can be explained by the rapid spread of mechanisation.

Table 66 Agricultural expenditure

	Study Area				Whole Muda Area			
	Average		Large Farm	Small Farm	Average		Large Farm	Small Farm
	Value M$	%	%	%	Value M$	%	%	%
Total	3534	100.0	100.0	100.0	1981	100.0	100.0	100.0
Labour Charges	905	25.6	28.9	20.6	696	35.1	38.4	26.8
Lease & Contract	867	24.5	22.5	21.7	199	10.0	6.4	10.4
Rent	610	17.3	16.8	16.7	306	15.4	16.0	11.1

The balance of agricultural receipts and income is presented in Table 67, showing that the balance per relong (M$696) is higher in the study area (M$542 per relong for the whole Muda area). The agricutural income ratio is also higher. In the study area it was 63.4% while for the whole Muda area, it was 61.0%, probably due to the higher output in the study area.

Comparing the net agricultural income and the income ratio by farm size in the study area, it was found that the ratio was highest in the 5-10 relong category (Table 68). The net income was M$744 per relong and the income ratio was 65.5%. This is again attributed to the existence of higher yields.

Table 67 Balance of agricultural receipts and expenditure

	Study Area (%)		Whole Muda Area (M$)	
	Total	Per relong	Total	Per relong
Agriculture Receipts (A)	9657	1097	5074	890
Agriculture Expenditure	3534	401	1981	348
Balance (B)	6123	696	3093	542
Income Ratio (B/A)	63.4%	—	61.0%	

Table 68 Agricultural net income and income ratio by farm size in the study area (per relong)

	Below 5 relongs	5—10 relongs	10—15 relongs	Over 15 relongs
Net Income ($)	580	744	616	705
Income Ratio (%)	60.0	65.5	59.3	65.7

3) Production cost

Based on the agricultural receipts and expenditure, the production cost of paddy cultivation in the study area can be calculated. The actual cost of paddy production should include the imputed cost of the farmers' own labour. However, due to data limitations in the survey, this component has been omitted in the production costs presented.

Table 69 indicates that in the study area, the primary cost of paddy production was M$180 per relong in 1979, which was 29% higher than the cost reported in the 1974 Agro-Economic Studies. The secondary cost (which includes land tax, water charges and rent) was also 28% higher in the study area, amounting to M$218 per relong.

Table 69 Production cost per relong (excludes imputed family labour)

	Whole Muda Area 1974 (A)		Study Area 1979 (B)		(B)/(A)
	(M$)	(%)	(M$)	(%)	
1. Materials	43	25.3	62	28.4	1.44
Fertiliser	31	(18.2)	45	(20.6)	1.45
2. Labour Charges	61	35.9	52	23.9	0.85
3. Lease and Contractor Charges	18	10.6	49	22.5	2.72
4. Repair and Depreciation	18	10.6	17	7.8	0.94
Sub-total	140	(82.3)	180	(82.6)	1.29
5. Land tax, water charges	3	1.7	3	1.4	1.00
6. Rent	27	15.9	35	16.0	1.30
Grand Total	170	100.0	218	100.0	1.28

The contribution of materials (including fertiliser) and lease and contractor charges in the production cost was higher in the study area. This is caused by the higher amounts of fertiliser being applied and the larger incidence of machine harvesting. On the other hand, labour charge payments were accordingly lower. The cost of repairs and depreciation, land tax and water charges remained stable while rent payment was higher in the study area.

The cost of producing one gantang of paddy was thus estimated to be M$0.49 in the study area against M$0.43 per gantang for the whole Muda area in 1974. This is 41% of the paddy price in the study area. For the Muda average figures, it was 39% of the paddy price at that time.

The returns to paddy production are shown in Table 70. The paddy income in the study area was M$543 per relong, higher than the Muda figure of M$435 per relong. As to paddy expenditure, the primary cost was M$180 per relong in the study area and M$140 per relong in the 1974 Muda study while the secondary cost was M$218 for the study area and M$170 in Muda. Thus the return to paddy production was M$363 for the study area and M$295 for Muda (based on primary cost only) and M$325 and M$265 respectively, if secondary costs are included.

The final rate of returns was then found to be 67% in the study area and 68% for Muda (when the primary cost was used) and it was 60% for the study area and 61% for Muda (when the secondary cost was included).

Table 70 Returns to paddy production per relong per season

	Study Area (1979) M$	Whole Muda Area (1974) M$
Paddy Income	543	435
Paddy Primary Expenditure (1)	180	140
Paddy Primary and Secondary Expenditure (2)	218	170
Returns (based on (1))	363	295
Returns (based on (2))	325	265
Rate of Returns (based on (1))	66.9%	67.8%
Rate of Returns (based on (2))	59.9%	60.9%

4) Non-agricultural income and expenditure.

The total non-agricultural receipts in the study area were M$822 while these reported by the 1974/75 Agro-Economic Studies amounted to M$787. The absolute difference between them was small (anly 4.4%). But differences appear when the various components are analysed (see Table 71).

The item 'labour charge and salary' accounts for 24% of the total receipts in the study area while the comparative figure for the 1974/75 study was 43% due to the limited off farm work opportunities in the study area. Receipts from lease and contractor charges are also lower in the study area (10% against 17% for Muda) because many of the farmers own their own tractors in the study area. On the other hand, receipts from rents were higher (23% against 8% for Muda) due to the larger number of parcels rented out and also other receipts were higher i.e 18% in the study area against 9% for Muda, which is attributed to the greater amount of river fishing by the sample farmers.

Table 71 Components of non-agricultural receipts

	Study Area			Whole Muda Area		
	Average	Large Farmers	Small Farmers	Average	Large Farmers	Small Farmers
Farm Size (relong)	8.8	19.8	3.3	5.7	17.6	1.9
Farm labour charges	24	6	37	23	4	34
Other labour charges and salary	24	47	18	43	53	45
Lease and contractor charges	10	12	0	17	28	0
Rent	23	0	35	8	14	8
Others	18	34	9	9	0	13
Total	100.0	100.0	100.0	100.0	100.0	100.0

The non-agricultural receipts as a whole are equivalent to only 8.5% of the agricultural income and therefore they do not play a significant role in the aggregate farm income, except for the small farmers whose contribution of non-agricultural receipts accounts for 23% of the agricultural income, and non-agricultural receipts exceed non-agricultural expenditure (see Table 72).

Table 72 Balance of non-agricultural income and expenditure by farm size

Farm Size Group	Total Non-Agricultural Income	Total Non-Agricultural Expenditure	Balance
Below 5 relongs	744	551	+ 193
5−10 〃	426	1055	− 629
10−15 〃	678	2272	−1594
Over 15 〃	1643	2272	− 629
Average	822	1527	− 705

The non-agricultural expenditure is shown in Appendix 12. It totalled M$1527 per household in 1979 and was composed of various expenditure items including labour charge payments, repair charges, *zakat* and *fitrah*, road tax, insurance etc. The expenditure on *zakat* and *fitrah* is found to be significant. The Muslim religious law states that 10% of total production should be contributed by the farmer as *zakat*. In the study area, as shown in Table 73, the *zakat* and *fitrah* payments were higher and averaged 11%. In the Muda sample, they amounted to 6.3% in 1974.

For the balance of non-agricultural receipts and expenditure, one should refer to Table 72. The 1974 Agro-Economic Studies found the balance to be positive as a whole, as it amounted to M$374. However in the study area the net balance of non-agricultural receipts and expenditure was negative on an average, amounting to -M$705 due to the larger amounts of *zakat* and *fitrah* payments and expenditure for repairs, especially house repairs.

Table 73 Zakat and fitrah payments as % of production in 1979 (per farm household)

Farm Size Group	*Zakat Fitrah* (gtg.) (A)	Paddy Production (gtg.) (B)	(A)/(B) %
Below 5 relongs	298	2692	11.1
5—10 〃	773	6787	11.4
10—15 〃	1120	10211	11.0
Over 15 〃	1865	17589	10.6
Average	882	8074	10.9

5) Balance of payments and receipts for farming practices

As mentioned earlier, labour utilisation in the study area is characterised by mutual exchange. On the other hand, some farmers own tractors and set up contracts to plough other farmers' land. Therefore there always exists a two-way account for farm wages and contractors' charges in the aggregated farm budget, that is, receipts from others and payment to others.

To determine the amount of expenditure or receipts for these items of labour and the contractor charges, a balance of accounts has been made, as indicated in the following two Tables (Table 74 and 75) which show those accounts for each season.

Table 74 Balance of farm labour charges and contractor charges by farmer in off season 1979 (per farm household)

Farm Size Group	Receipts			Payments			Balance
	Labour Charges	Contractor Charges	Total	Labour Charges	Contractor Charges	Total	
Below 5 relongs	173	—	173	115	107	222	— 49
5—10 〃	62	32	94	389	313	703	— 608
10—15 〃	53	56	109	745	555	1300	—1191
Over 15 〃	58	48	106	1002	655	1657	—1551
Average	89	28	117	504	365	869	— 752

On an average, farmers have a negative balance of -M$752 in the off season. During the main season, the figure drops further to -M$859, due to the marked increase in contractor charges associated with the increase of mechanisation for harvesting.

The mechanisation process had a particularly unfavourable effect on the small farmer. This is shown in the labour charge balance which became negative in the main season whereas it was positive a season before in the off season.

Payment for contractor charges in the main season became twice as high as in the off season. Although the balance in each farm size group still shows characteristics of mutual

Table 75 Balance of farm labour charges and contractor charges by farmer in main season 1979 (per farm household)

Farm Size Group	Receipts			Payments			Balance
	Labour Charges	Contractor Charges	Total	Labour Charges	Contractor Charges	Total	
Below 5 relongs	89	—	89	144	203	347	− 258
5−10 〃	135	—	135	262	633	895	− 760
10−15 〃	105	129	234	530	837	1367	−1133
Over 15 〃	44	150	194	1020	1328	2348	−2154
Average	96	56	152	386	625	1011	− 859

exchange among farmers in the area, the balance of the average farmer shows the existence of a net transaction between farmers inside the area and outsiders. It therefore indicates an important phenomenon of outflow of value from the farmer to outside the local farming economy.

In the study area, the total outflow of value amounted to M$136,000 (181 farmers x M$859) in the main season of 1979 and this figure is likely to increase further with the increase in the mechanisation of the operations in the area.

6) Farm household expenditure

The farm household expenditure data were obtained from the weekly interview surveys carried out in 1979. As a result of the surveys, the per capita consumption of the sample farmers was calculated and is shown in Table 76.

Table 76 Total expenditure per capita

Farm Size Group	Per Year M$	Per Month M$	Per Day M$	%
Below 5 relongs	523	43.6	1.43	97.3
5−10 〃	483	40.3	1.32	89.8
10−15 〃	527	143.9	1.44	97.9
Over 15 〃	684	57.0	1.87	127.2
Average	537	44.8	1.47	100.0

The total expenditure was M$537 per capita per annum in 1979 or equivalent to M$45 per capita per month or M$1.5. per capita per day. In the Muda river study undertaken by FAO/IBRD in 1973, the per capita expenditure was estimated at M$1.50 per capita per day in that year. As prices increased since the two surveys were carried out the figures for the study area seem to be low.

The largest farmers reported the highest per capita expenditure while the 5-10 relong farm size group registered the lowest per capita expenditure. The overall sample as a whole

however did not show any significant differences among farm size groups except for the larger farmers (over 15 relongs) whose per capita expenditure exceeded the average by 27%.

The components of the household expenditure are shown in Table 77. Expenditure for food accounts for 40% of the total expenditure on the average, ranging from 33% to 43%.

Table 77 Components of household expenditure per capita(%)

Farm Size Group	Food	Domestic Goods	Education	Transportation	Eating, Drinking Out	Entertainment	Others	Total
Below 5 relongs	42.5	17.9	6.7	10.5	8.8	12.4	1.2	100.0
5—10 〃	42.2	25.2	6.2	8.3	4.3	11.6	2.2	100.0
10—15 〃	39.7	22.2	8.9	8.7	6.3	12.5	1.7	100.0
Over 15 〃	33.3	28.4	9.4	10.8	5.4	10.5	2.2	100.0
Average	39.7	22.9	8.0	9.5	6.5	11.7	1.7	100.0

Twenty-three percent of the total expenditure was devoted to the purchase of domestic goods including clothing, furniture, appliances and other goods of daily necessity. Another 8% was spent on education which shows a proportional increase with the increase in farm size. Finally, 18% was spent on entertainment and eating and drinking out.

Engel's coefficient was calculated for the sample farmers and the results are shown in Table 78. The average coefficient was 0.46 which is low when compared with other developing countries which show coefficients of above 0.5. According to Engel's law, a poor family allocates a larger proportion of its expenditure to food items.

Table 78 Engel's coefficient* by farm size

Below 5 relongs	0.51
5—10 〃	0.47
10—15 〃	0.46
Over 15 〃	0.39
Average	0.46

* Includes eating and drinking out.

Therefore it appears that, farmers in the study area show a higher standard of living compared to other developing economies. This is attributed to the large scale of farming operations in the study area.

The Engel's coefficient by farm size indicates a range from 0.39 for farmers who operate farms above 15 relongs to 0.51 for small farmers. The smaller farmers have therefore a much lower standard of living.

The total expenditure for rice is shown in Table 79. Average consumption is 120 kg of rice per capita per annum or equivalent to 0.33 kg of rice per capita per day. The rice consumption is almost the same for most farm size groups. Only the 5-10 relong category reported a smaller consumption amount (109 kg per capita per annum) along with a smaller total

household expenditure.

Table 79 Rice consumption

Farm Size Group	Per Day	Per Year
	kg.	kg.
Below 5 relongs	0.33	120
5—10 〃	0.30	109
10—15 〃	0.32	117
Over 15 〃	0.34	124
Average	0.33	120

7) Farm household economy

The aggregated farm household income can be expressed in terms of indicators such as agricultural income, household income and surplus income. From a management point of view, any enterprise can gain from economies of scale. Farming is no exception. In farm management, economies of scale are mainly obtained from farm size, that is, income is directly correlated with farm size.

As seen in Table 80, the agricultural income, the household income and the surplus income are dictated by the farm size suggesting that the larger farms induce higher incomes and the smaller farms record smaller incomes.

However, when the difference in farm sizes is set aside and income is reduced to a per unit (relong) basis, the situation changes.In the study area, even though the highest household income per unit area is enjoyed by the largest farmers, the 5 - 10 relong farm category occupies the second position and the lowest household income per relong is associated with the upper medium size farm category of 10 - 15 relongs.

Regarding agricultural income per unit area, the highest income is associated with the lower medium size category (5-10 relongs) followed by the large family farm, the upper medium and the small family farm.

For both household income and agricultural income per unit area, there is no significant difference among the different farm size categories. This phenomenon does not apply to the surplus income per unit area.

The difference in the per capita surplus income among farmers is large. The highest per capita surplus income per unit area is enjoyed by the large farmers who report M$115 per capita per annum, followed by M$75 for the lower medium size group while the small farmers have only M$15 per capita per annum of surplus income. The ratio of the highest to lowest is 8:1. The large difference is caused by the difference in household expenditure per capita.

In examining the data in Table 80, it can be concluded that the large farms (above 15 relongs) and the lower medium size farms (5-10 relongs) bring about good income and can fit into the concept of 'viable farms' as expounded earlier on, which is necessary for optimal farming.

On an average, the household income per capita per annum was M$1231. This figure is 34% higher than the income reported by the Agro-Economic Studies in 1974 which totalled M$867 or was equivalent to M$920 in 1979 (adjusted for paddy price increase of 7.2% at that time). Such data of course can be explained by the existence of larger farms in the study area.

Table 80 Aggregated farm household economy(M$)

	Average		Large Farm (Over 15 rel.)		Upper Medium Size Farm (10−15 rel.)		Lower Medium Size Farm (5 −10 rel.)		Small Farm (Below 5 rel.)	
	per Household	per Relong	per Household	per Relong	per Household	per Relong	per Household	per Relong	per Household	per Relong
Average Farm Size (relong)	8.8		19.8		11.7		7.1		3.3	
Agricultural Receipts	9657	1097	21242	1073	12158	1039	8069	1136	3192	967
Agricultural Expenditure	3534	402	7309	369	4951	423	2779	391	1272	385
Agricultural Net Income	6123	695	13933	704	7207	616	5290	745	1920	582
Non-Agricultural Receipts	822	—	1643	—	678	—	426	—	744	—
Non-Agricultural Expenditure	1527	—	2272	—	2270	—	1055	—	551	—
Non-Agricultural Income	(−) 705	—	(−) 629	—	(−)1594	—	(−) 629	—	193	—
Household Income	5418	616	13304	672	5613	480	4661	656	2113	640
Household Income Per Capita	1231	—	2956	—	1123	—	1013	—	571	—
Household Expenditure	2363	—	3078	—	2635	—	2222	—	1935	—
Surplus Income	3055	—	10226	—	2978	—	2439	—	178	—
Per Capita Surplus Income	694	79	2272	115	596	51	530	75	48	15
Family Members*	4.4		4.5		5.0		4.6		3.7	

* Converted to an adult basis

The per capita income of M$1231 is equivalent to US$586. The estimated national average per capita income was US$1030 in 1978, and is expected to increase to US$1530 in 1988[12] (increase of 48%). Assuming a constant rate of growth in per capita household income for the study area, the per capita income should rise to M$1821 or US$867 in 1988.

If the study area achieves the target of 30% yield increase, it will be equivalent to only a 20% increase in per capita household income, or a 28% shortfall compared to national increases. The relative income status of the farmers is therefore expected to deteriorate and if this status is to be maintained, the shortfall of 28% needs to be supplemented, probably by price support policies and subsidies.

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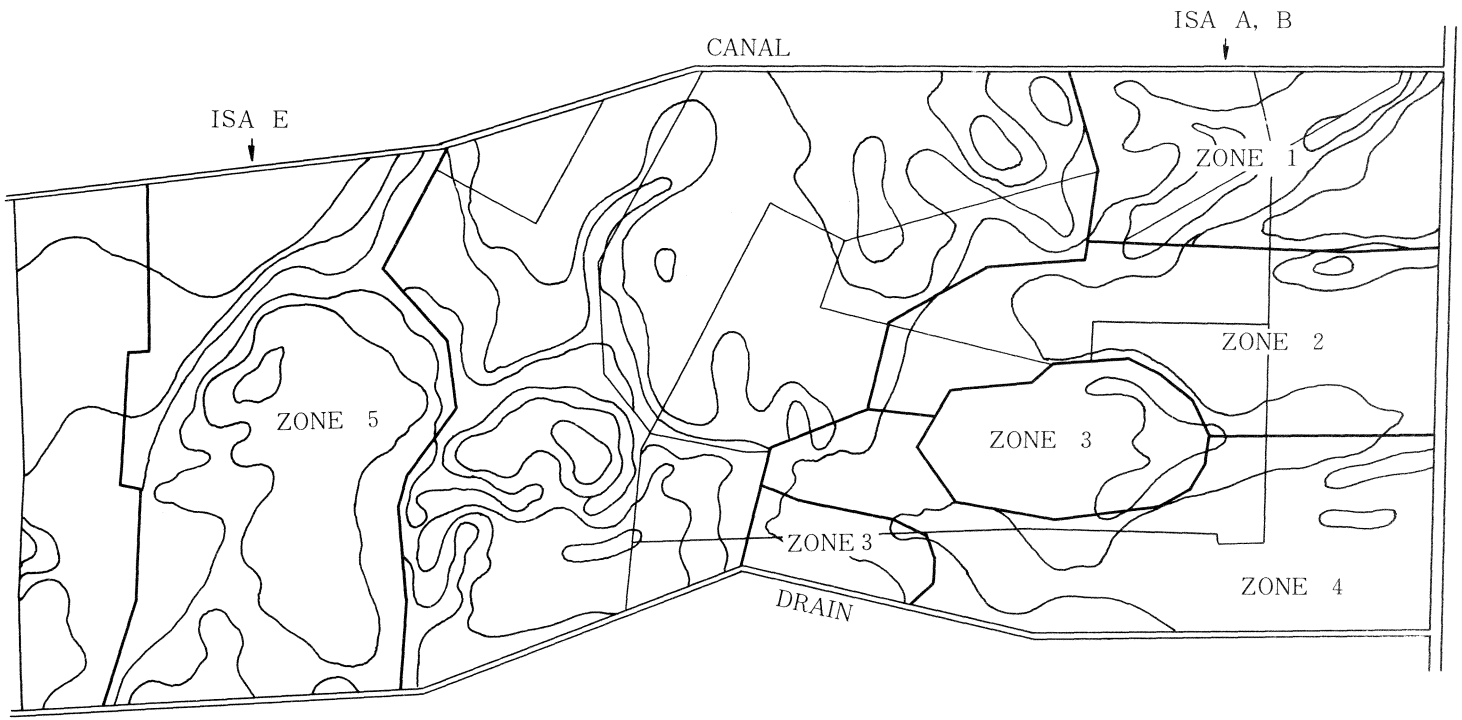
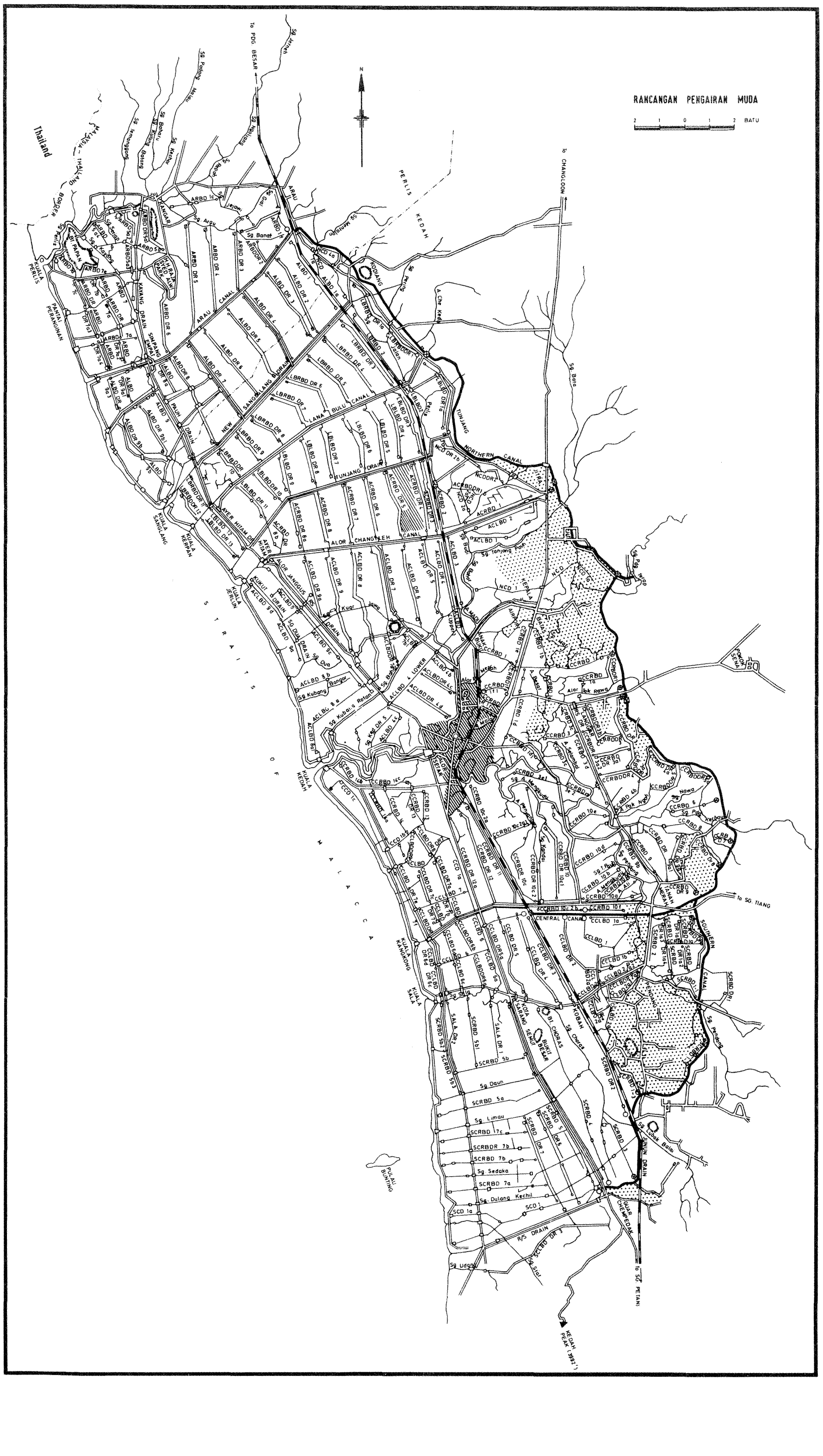
List of Appendices

Appendix 1 ISA A, B and E in the project area



Appendix 2 Location of Pilot Project Area, ACRBD4



Appendix 3
Owner and Operator of The Farm Lots in Pilot Project Area, 1978

unit:relong.

Farm lot			Owner of the lot		Sample farmer Operating the lot	
Lot Number	Total Area	Planted Area	Owner	Area Owned	Operator	Area Operated
0626	6.50	6.50	SC-29 IC-2	3.25 3.25	SC-29	2.50
0627	10.28	10.28	IC-8 IC-27 SC-31 IC-3 N10	3.44 1.71 1.71 1.71 1.71	SC-31	8.04
0629	7.92	6.50	IC-22 IC-23 IC-24	2.64 2.64 2.64	SC-27	3.00
0632	10.85	10.00	SC-17	10.85	SC-17	10.00
0633	8.91	7.50	SC-25	8.91	SC-25	7.50
0635	10.33	9.00	N4	10.33	SC-25	2.40
1421	6.71	6.71	SC-12	6.71	SC-12	6.50
1422	7.68	6.50	IC-17 SC-11	3.84 3.84	SC-9 SC-11	3.00 3.00
1424	9.63	8.75	—	—	SC-6	1.00
1567	12.32	12.32	—	—	SC-3 SC-8	1.50 4.50
1588	9.73	9.73	D1 SC-26	9.73 *Tuntut*	SC-26	9.73
1589	10.02	10.02	—	—	SC-24	4.00
1592	4.86	4.86	—	—	SC-30	5.00
1593	9.89	9.89	—	—	SC-24	10.00
1616	8.96	8.96	—	—	SC-4	8.75
1618	9.05	9.05	—	—	SC-1	4.30
1619	8.91	8.91	—	—	SC-5	2.23
1622	8.90	8.90	D2 SC-2 SC-2 IC-21	0.99 *Tuntut* 2.97 4.94	SC-2	8.90
1655	10.83	10.83	—	—	SC-22 SC-33	3.00 3.00
1658	10.51	10.51	IC-1 IC-29	5.26 5.25	SC-28	2.00
1672	9.92	9.92	D3 IC-30	9.92 *Tuntut*	SC-42	2.00
1681	10.07	9.25	N3	10.07	SC-24	4.50
1684	9.90	7.50	N5	9.90	SC-31	2.25
1717	7.29	5.25	D4 N2	7.29 *Tuntut*	SC-18	4.50
1753	8.90	8.00	—	—	SC-14	4.00

Farm lot			Owner of the lot		Sample farmer Operating the lot	
Lot Number	Total Area	Planted Area	Owner	Area Owned	Operator	Area Operated
			D5	10.23		
1755	10.23	5.00	SC-23	*Tuntut*	SC-23	2.50
			IC-28	*Tuntut*		
1758	9.81	9.81	—	—	SC-21	1.50
			IC-6	1.57		
1759	9.91	9.91	IC-7	1.57	SC-9	2.00
			Another 16 Owners	3.63		
1789	3.15	3.15	SC-12	3.15	SC-12	3.15
1790	2.31	2.31	—	—	SC-12	2.31
1792	5.09	4.50	—	—	SC-7	5.00
1793	11.09	10.00	—	—	SC-6	4.50
1797	4.00	4.00	—	—	SC-17	3.00
1798	9.58	8.00	—	—	SC-12	8.50
1872	9.86	9.86	N3	9.86	SC-21	4.50
1874	9.93	9.93	—	—	SC-15	10.00
1876	9.91	9.91	IC-25	4.46	SC-6	2.00
			IC-25	5.45		
1877	9.78	9.78	—	—	SC-14	1.50
1878	10.09	8.00	D6	10.09	SC-18	2.50
			IC-20	*Tuntut*	SC-32	3.00
					SC-18	4.50
1880	9.54	9.25	—	—	SC-19	2.00
					SC-22	2.50
1882	7.54	7.00	IC-30	7.54	SC-42	4.50
			D7	6.33		
1885	12.66	9.00	D8	6.33	SC-42	4.50
			IC-15	*Tuntut*		
			IC-14	*Tuntut*		
1888	9.99	9.99	—	—	SC-9	4.00
			SC-10	5.06		
1909	10.18	8.00	N1	5.06	SC-10	5.06
			N11	*Tuntut*		
1914	3.48	3.48	—	—	SC-13	3.00
1915	3.50	3.50	—	—	SC-16	3.50
1926	5.47	5.47	IC-13	5.47	SC-10	6.50
1928	9.25	9.25	—	—	SC-7	3.00
1948	9.87	9.87	—	—	SC-39	4.00
			IC-9	0.58		
			IC-20	0.58		
1949	5.19	4.75	SC-39	2.30	SC-35	1.25
			IC-11	1.15	SC-39	2.00
			IC-12	0.58		
1951	4.82	4.50	N2	4.82	SC-42	5.00

Farm lot			Owner of the lot		Sample farmer Operating the lot	
Lot Number	Total Area	Planted Area	Owner	Area Owned	Operator	Area Operated
1986	4.89	4.89	N9	4.89	SC-26	8.77
1990	5.37	5.00	—	—	SC-17	5.00
2096	3.15	3.15	—	—	SC-34	2.72
2120	7.54	7.54	IC-18	7.54	SC-41	8.00
2126	5.04	5.04	—	—	SC-38	5.04
2127	6.29	6.29	—	—	SC-38	2.00
2128	5.03	5.03	IC-4 SC-37 IC-19 D9	1.76 1.76 0.88 0.53	SC-37	4.00
2166	9.23	9.23	T2	9.23	SC-41	8.00
2169	8.14	8.14	T2	8.14	SC-38	8.00
2173	4.06	4.06	—	—	SC-36	4.00
2174	3.96	3.96	—	—	SC-36	4.00
2175	9.19	9.19	—	—	SC-36	4.00
2177	13.59	13.00	N12 IC-20	6.79 6.80	SC-41	4.00
2230	4.46	3.75	—	—	SC-39	3.00
2232	11.28	11.28	—	—	SC-39	6.00
2271	6.09	6.09	T1	6.09	SC-33	3.00
2354	7.50	5.00	D10 IC-5	7.50 *Tuntut*	SC-38	6.50
2360	2.03	2.03	SC-37	2.03	SC-37	2.00
2361	6.52	6.52	N8	6.52	SC-40	6.50
2391	4.93	4.25	—	—	SC-21	5.00
2730	2.45	1.75	SC-34	2.45	SC-34	1.75
2738	6.85	6.85	—	—	SC-35	6.80
2771	6.09	6.09	—	—	SC-14	3.04

Note:

1. IC-1, IC-2—Farmer with known I.C. number.
2. SC-1, SC-2—Farmer already coded as a sample farmer.
3. T1, T2—Institutional land, owned by government etc.
4. N1, N2—Farmer, name and I.C. number unknown.
5. D1, D2—Farmer deceased.
6. *Tuntut*—Claimed owner.

Appendix 4 Land Title Deed

Form 11B
(Section 177)
(Qualified Title corresponding to Land Office Title)
Q7. Register: Mukim of Jeram No.22,
Stae of Kedah.

Document of Qualified Title

Category of Land Use : Agriculture/Bendang
Locality : NANG Dewi
Lot No. : 637
Provisional Area : 60 or 37p

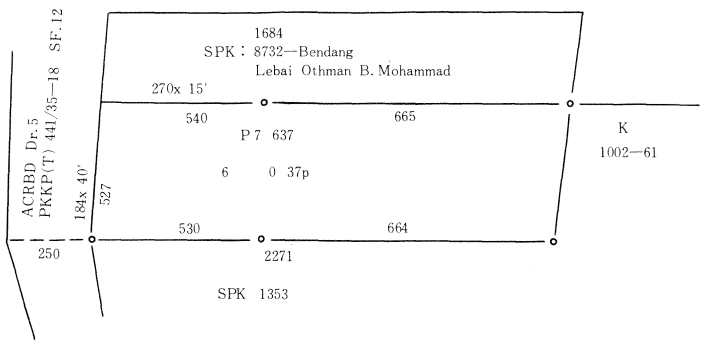
Special condition of QT

1. This title is subject to provisions of the N.L.C. and all these express conditions and restrictions:
   a. Subject to which alienation was approved vide correspondence No. PDKP(T) 55/1968.
   b. Endorsed upon title-to which title is in continuation, vide correspondence No.- (So far as in case of supervision or partition, they are capable of affecting the land comprised have in)
   c. Appended to.
   In the plan of the land below the boundaries shown in red, not having been established by survey, are provisional only.

The land described above is held by proprietor for the time being named in the record of propriestorship below registered this 20 days of 3 1971.

L.S. Collector Sign
District Sign

SKetch plan Mukim Jeram
R/S 134/1971 Daerah: Kubang Pasu
Ukuran: 4 rantai=1"
Shit : 61-a-a/1



Date of first alienation

No. of original title (final or qualified)

No. of immediately preceding title (if different from above Record of proprietorship of dealings and at other matters affecting Title.).

Appendix 5
Total labour input in each farming practice, off season, 1979

per relong man/hours

Farm Size Group	Care of Nursery	Preparation of main field	Transplanting Works				Re-trans-planting	Application fertiliser	Weeding	Crop Protection	Water control	Other care
			own	*derau*	*upah*	total						
Below 5 relongs	1.4	3.6	13.1	14.1	0.4	27.6	2.4	3.2	2.5	2.7	1.1	11.8
5 −10 〃	0.7	2.2	6.6	15.8	7.7	30.1	2.0	2.6	3.1	2.5	0.6	7.8
10−15 〃	—	4.6	1.1	21.0	3.7	25.8	1.5	2.0	3.4	1.5	0.5	5.9
Over 15 〃	0.7	1.2	0.9	18.4	8.9	28.2	1.2	3.0	1.9	2.3	0.7	6.4
Average	0.7	1.8	3.5	18.0	6.5	28.0	1,6	2.7	2.6	2.2	0.6	7.1

per relong

Farm Size Group	Harvesting works				Post harvesting works				Other works Care of livestock	Grand total			
	own	*derau*	*upah*	total	drying	winnowing	sale and storage	total		own	*derau*	*upah*	total
Below 5 relongs	21.7	—	34.6	56.3	6.3	2.3	2.3	9.5	46.7	101.6	9.7	34.9	146.2
5 −10 〃	11.2	—	28.5	49.7	3.5	2.7	2.7	6.4	13.2	53.9	8.6	42.8	105.3
10−15 〃	4.3	—	39.8	44.1	3.5	1.5	1.5	5.4	7.9	33.7	12.1	41.9	87.7
Over 15 〃	3.1	—	38.7	41.8	1.4	0.5	0.5	2.1	9.0	31.1	11.6	44.3	87.1
Average	7.1	—	38.5	45.6	2.9	0.3	1.4	4.6	12.9	43.8	10.8	42.5	97.1

Care of nursery preparation of main field does not include labour input before starting of survey.

(Cont. appendix 5) Total labour input in each farming practice, main season, 1979

Scale of farm	Seed preparation	Nursery bed preparation	Care of nursery	Preparation of main field	Transplanting works				Re-trans-planting	Application fertiliser	Weeding	Crop pro-tection	Water control	Other care
					own	*derau*	*upah*	total						
Below 5 relongs	0.4	3.7	1.8	5.0	4.8	21.3	13.2	37.4	1.4	2.6	0.1	0.1	0.6	7.6
5 −10 〃	0.5	3.5	1.9	10.3	2.9	36.6	4.5	44.0	5.6	2.6	2.1	0.4	0.7	11.6
10−15 〃	0.2	1.9	1.2	8.0	2.5	24.8	10.4	37.7	2.1	2.5	1.3	0.2	1.0	6.7
Over 15 〃	0.3	1.6	1.2	5.1	1.2	13.3	19.4	33.9	2.8	2.5	0.7	0.2	0.9	5.0
Average	0.3	2.3	1.4	6.8	2.5	22.5	12.8	37.8	2.8	1.0	1.0	0.2	0.8	7.1

Scale of farm	Harvesting works				Post harvesting works				Other works care of livestock	Grand total			
	own	*derau*	*upah*	total	drying	winnowing	sale and storage	total		own	*derau*	*upah*	total
Below 5 relongs	10.7	—	16.7	27.4	—	0.3	0.4	0.7	29.3	68,8	21.3	30.0	120.1
5 −10 〃	3.9	—	12.0	15.9	0.3	0.1	0.6	1.0	8.1	55.1	36.6	16.5	108.2
10−15 〃	1.6	—	12.6	14.2	0.2	0.2	0.1	0.5	6.7	36.3	24.8	23.0	84.1
Over 15 〃	1.9	—	13.9	15.8	0.1	—	0.1	0.2	9.5	33.0	13.3	33.2	79.5
Average	3.4	—	13.5	16.9	0.1	0.1	0.2	0.4	11.2	43.1	22.5	26.4	92.0

Appendix 6

Labour utilization for harvesting in off season, 1979

per farm household man hour

Farm Size Group	Own labour input				Other labour input in own farm				Total labor input in own farm	Farm labour charge		
	in own farm	in other farms		total	*derau*	*upah*	others	total		received	paid	balance
		derau	*upah*	total								
Below 5 relongs										M$	M$	M$
5 −10 〃	65.1	6.2	24.2	30.4	95.5	—	104.0	—	104.0	169.1	58.0	114.2	(−) 56.2
10−15 〃	79.8	2.2	1.1	3.3	83.1	—	272.7	2.5	275.2	355.1	11.2	377.1	(−) 365.9
Over 15 〃	49.7	—	6.7	6.7	56.4	—	461.1	—	461.1	510.8	20.3	609.0	(−) 588.7
	59.7	2.3	4.3	6.6	66.3	—	713.4	9.4	722.8	782.6	14.3	885.6	(−) 871.3
Total or average	65.6	2.9	9.5	12.4	78.0	—	350.3	8.5	358.8	424.4	27.0	450.0	(−) 423.0

Labour utilization for harvesting in main season, 1979

per farm household man hour

Farm Size Group	Own labour input				Other labour input in own farm				Total labour input in own farm	Farm labour charge		
	in own farm	in other farms		total	*derau*	*upah*	others	total		received	paid	balance
		derau	*upah*	total								
Below 5 relongs												
5 −10 〃	35.5	—	12.5	12.5	48.0	—	55.8	—	55.8	91.3	15.3	96.7	(−) 81.4
10−15 〃	27.7	—	19.7	19.7	47.4	—	85.6	—	85.6	111.3	35.1	226.9	(−) 196.8
Over 15 〃	18.6	—	7.9	7.9	26.5	—	147.9	—	147.9	166.5	8.1	252.6	(−) 244.5
	38.2	—	—	—	38.2	—	274.9	—	274.9	313.1	—	409.8	(−) 409.8
Total or average	29.8	—	10.9	10.9	40.7	—	118.5	—	118.5	148.3	15.2	210.8	(−) 195.6

Appendix 7 Calendar of farming practices

Code no. of farmer	Off Season, 1979					
	Sowing	Transplanting	Harvesting		Seed preparation	Ploughing
			Beginning	End		
1	10/3	17-19/4	28/7	31/7	21/9	22/9
2	15/3, 20/3, 16/3	20/4	8/8	11/9	23/9	23-25/9
4	20/3	28/4, 1/5, 2/5	7/8	21/9	21/9	23/9
5	1/4	5-8/5	11/8	12/8	30/9	3/10
6	14/3	—	4/8	22/8	22/9, 29/9	19/9, 27/9
8	20/3	1/5	1/9	3/9	no more	
9	14/3	11/5	15/8	2/9	22/9, 25/9	20/9
10	5/3, 6/3, 8/3	12/4, 14/4, 16/4	5/8	19/9	7/9, 29/9	9/9, 4/10
11	15/3	—	4/8	17/8	22/9	22/9
12	15/3	—	6/8	31/8	22/9	20/9
13	25/3	14/5	2/9	14/9	29/9	2/10
14	7/3, 14/3	1/5	8/8	3/9	14/9, 29/9	12-13/9, 15/9
15	30/3	10/5	2/9	2/9	29/9	29/9
16	14/3, 15/3	—	9/8	18/9	30/9	29/9
17	8/3, 30/3	5/5, 14/5	8/8	1/9	16/9, 3/10, 5/10	16/9, 30/9, 3/10
19	25/3	4/5	16/8	30/8	no more	
21	25/3, 12/3	—	20/8	22/8	24/9, 4/10	24/9, 4/10
22	30/3	14/5	16/8	3/9	17/9	17/9
23	3/3	—	12/8	30/8	18/9	18/9
24	2/4, 6/4, 4/4, 10/3	7/5, 10-11/5, 12-13/5	5/8	10/9	22/9, 23/9, 28/9	22/9, 23/9, 28/9
26	25/3, 1/4	5/5, 23/5	15/8	31/8	29/9	1/10, 2/10
27	21/3	4/5	2/8	3/8	22/9	21/9
28	25/3	2-3/5	18/8	18/8	16/9	18/9
29	5/3, 11/3	—	4/8	29/8	11/9, 22/9	10/9, 20/9
30	6/4, 4/4	13/2, 14/5	23/8	9/9	19/9, 29/9	16/9, 27/9
31	4/3, 1/3	—	30/7	16/8	13/9, 21/9, 5/10	10/9, 16/9, 25/9
32	31/3, 1/3	4/5	1/8	18/9	16/9, 29/9	18/9, 1/10
33	19/3	10/5	14/8	27/8	24/9	23/9
34	—	—	not cultivated		29/9	30/9
35	1/4	6/5, 8-10/5, 12-15/5	3/9	13/9	30/9	28/9
37	30/3	—	15/8	30/8	11-13/9	13/9
38	—	20-22/5	27/8	13/9	29/9, 4/10	29/9, 2/10
39	18/3, 11/4	7/5, 22-23/5	13/8	17/9	29/9, 5/10	30/9, 5/10
	20/3, 12/4	1/5, 18/5	18/8	8/9	1/10	29/9, 4/10
40	30/3	4/5, 19/5	27/8	5/9	11/9, 17/9	16/9
41	15/3, 13/3,	30/4, 3-4/5,	16/8	10/9	25/9, 28/9	24/9, 26/9
42	25/3, 20/3	9/5				

Main Season, 1979					
Bed preparation	Sowing	Ploughing paddy field	Transplanting	Harvesting	
				Beginning	End
22/9	27/9	5/10	4/11	16/2	22/2
24-25/9	27-28/9	3/10, 12/10	6-9/11	8/2	22/2
24/9	28/9	8/10, 10/10	6/11, 9/11	10/2	20/2
3/10	5/10	9/10	12/11	26/2	—
23/9, 30/9	24/9, 1/10	24/9, 29/9	28/10, 4/11	7/2	14/2
cultivation		—	—	—	—
23/9, 27/9	24/9, 28/9	30/9, 10/10	28/10, 4/11	4/2	13/2
9/9, 4/10	11/9, 5/10	7/10, 19/10	26/10, 5/11, 9/11	3/2	18/2
24/9	25/9	3/10	4/11	11/2	14/2
23/9	24/9	26/9, 31/9	24/10	3/2	13/2
2/10	3/10	5/10	13/11	19/2	—
16/9	17/9, 1/10	28/9, 24/10	22/10, 27/10, 4/11	8/2	16/2
30/9	1/10	9/10	5/11	18/2	—
30/9, 3/10	4/10, 6/10	10/10, 12/10	9/11, 13/11	20/2	23/2
20/9, 5/10, 7/10	21/9, 5/10, 8/10	27/9, 15/10	26/10, 6/11, 9/11	8/2	25/2
cultivation		—	—	—	—
26/9, 6/10	26/9, 7/10	22/9, 27/9	26/10, 6/11	10/2	14/2
21/9	22/9	1/10, 12/10	2/11, 7/11	10/2	28/2
21/9	24/9	9/10	26/10	3/2	6/2
26/9, 28/9, 2/10	26/9, 28/9, 2/10	8/10, 19/10	29/10, 5/11, 8/11, 14/11, 20/11	15/2	29/2
2/10, 3/10	5/10	9/10	11/11, 14/11	21/2	25/2
23/9	24/9	30/9	7/11	19/2	—
21/9	21/9	9/10	25/10	3/2	—
14/9, 24/9	15/9, 25/9	13/9, 19/10	19-22/10, 1-2/11	3/2	—
24/9, 4/10	24/9, 4/10	10/10, 15/10	4/11, 21/11	15/2	29/2
15/9, 25/9, 6/10	16/9, 25/9, 6/10	16/9, 8/10	18/10, 3/11, 10/11	28/1	21/2
20/9, 5/10	21/9, 5/10	16/10, 19/10	26/10, 18/11	18/2	4/3
26/9	27/9	25/9	4/11	10/2	—
3/10	4/10	8/10, 15/10	11/11, 13/11	18/2	24/2
30/9	4/10	10/10, 15/10	12/11, 14/11	21/2	25/2
14/9	15/9	12/10	19/10	9/2	13/2
3/10, 8/10	3/10, 9/10	15/10, 17/10	16/11, 19/11, 22/11	9/3	—
4/10, 9/10	4/10, 10/10	14/10, 26/10	13/11, 16/11, 18/11, 23/11	27/2	8/3
30/9, 4/10	5/10	7/10, 11/10	8/11, 11/11	23/2	25/2
20/9, 21/9	21/9	2/9, 18/10	23/10, 7/11	26/1	16/2
1/10, 3/10	1/10, 3/10	15/10, 19/10	7/11, 13/11, 18/11	20/2	3/3

Appendix 8 Balance of fertiliser of sample farmers in off season, 1979

per farm household

Farm Size Group	Urea				Campuran				N. P. K.				Other fertiliser				Total			
	Stock	Purchased		Input	Stock	Purchased		Input	Stock	Purchased		Input	Stock	Purchased		Input	Purchased	Input	Balance	
	Q	Q	V	Q	Q	Q	V	Q	Q	Q	V	Q	Q	Q	V	Q	V	V	V	
Below 5 relongs	12	142	77	97	12	—	—	—	—	20	3	15	362	—	—	90	39	80	62	57
5 −10 〃	29	206	118	183	25	78	32	59	—	27	17	27	—	82	12	8	25	179	148	56
10−15 〃	—	505	277	426	—	126	52	101	—	71	45	57	—	—	—	—	—	374	305	69
Over 15 〃	36	1131	602	1035	3	—	—	—	7	21	13	21	214	—	—	—	34	616	571	79
Total or average	20	433	235	377	12	50	20.4	39	1	33	18	29	146	26	4	28	26	277	239	64

N. P. K.·····Nitrophoska

Main Season, 1979

per farm household

Farm Size Group	Urea						Mixed						Total			
	Stock	Purchased		Subsidy		Input	Stock	Purchased		Subsidy		Input	Stock	Purchased	Input	Balance
	Q	Q	V	Q	V	Q	Q	Q	V	Q	V	Q	V	V	V	V
Below 5 relongs	80,0	1.5	0.8	132.2	81.9	112.3	9.2	—	—	264.3	142.0	58.6	47.3	224.6	100.0	172.0
5 −10 〃	15.7	61.4	33.2	244.3	151.5	251.4	68.3	—	—	488.6	262.4	222.8	38.2	447.1	270.0	215.0
10−15 〃	115.9	137.8	76.4	315.6	159.6	426.7	18.9	—	—	631.1	339.1	270.0	70.8	611.1	397.4	284.5
Over 15 〃	120.0	51.0	279.1	340.0	210.8	806.0	4.0	—	—	680.0	365.5	416.0	65.5	855.4	685.2	236.7
Total or average	82.2	124.7	68.4	234.4	145.3	326.2	23.2	—	—	469.5	251.9	198.3	54.5	465.6	299.9	220.2

Q·····amount, kg.
V·····value, M$

Appendix 9 Date and Area of Fertiliser Application

(1) Off Season, 1979

District	Total area	First time		Second time		Third time	
	relong	area	date	area	date	area	date
ISA, A−1	41.76	41.76	23	31.46	19	9.90	4
〃 A−2	50.65	50.65	16	50.65	24	14.50	6
〃 B	55.69	55.69	17	43.92	23	12.92	13
〃 E	29.09	29.09	20	25.69	16	11.04	21
Swampy & deep areas	65.54	65.54	18	62.54	20	28.50	20
Out of ISA	38.50	38.50	18	38.50	22	22.00	9
Out of block	68.75	68.75	20	62.25	18	25.00	21
Total or average	349.98	349.98	19	315.01	20	123.68	15

(2) Main Season, 1979

District	Total area	First time		Second time		Third time	
	relong	area	date	area	date	area	date
ISA, A−1	28.83	28.83	17	28.83	29	0.0	—
〃 A−2	50.65	50.65	20	50.65	30	8.0	10
〃 B	53.69	53.69	18	51.44	33	4.0	14
〃 E	28.80	28.80	15	28.80	23	0.0	—
Swampy & deep areas	60.54	60.54	17	60.54	25	0.0	—
Out of ISA	38.50	38.50	18	38.50	26	0.0	—
Out of block	61.00	61.00	20	61.00	21	0.0	—
Total or average	322.01	322.01	18	319.76	27	12.0	11

Note : Date of first time indicates number of days from transplanting; second time - days from the first time; third time - days from second time.

Appendix 10 Area and amount of harvesting, off season, 1979

District	No. of parcels	Total area (relong)	Total production		First time		Second time		Third time		Yield (gtg)	Net weight of guni (gtg)
			guni	gantang	Harvested area (relong)	Production (guni)	Harvested area (relong)	Production (guni)	Harvested area (relong)	Production (guni)		
ISA, A−1	14	41.76	640	17535	39.26	595	1.50	27	1.00	18	420	27.4
ISA, A−2	11	50.65	771	21151	40.85	600	9.65	169	0.15	2	418	27.4
ISA, B	14	55.69	897	26271	44.54	709	11.15	188	—	—	472 (40.5)	29.3
ISA, E	9	29.09	421	10955	24.90	387	4.19	34	—	—	377	26.0
Swampy & deep areas	16	65.54	1051	28631	53.04	874	12.50	177	—	—	437	27.2
Out of ISA	8	38.50	568	14724	25.50	383	8.75	121	4.25	64	382	25.9
Out of block	16	68.75	1049	27837	60.30	905	3.70	58	4.75	86	405	26.5
Total or average	88	349.98	5397	147104	288.39	4453	51.44	774	10.15	170	420	27.3

Note : 1. The figure in brackets indicates the amount of the area excluding non harvesting. 2. Yield is per relong.

main season, 1979

District	No. of parcels	Total area (relong)	Total production		First time		Second time		Yield (gtg)	Net weight of guni (gtg)
			guni	gantang	Harvested area (relong)	production (guni)	Harvested area (relong)	production (guni)		
ISA, A−1	10	28.83	511	14603	28.83	511	—	—	506	28.6
ISA, A−2	11	50.65	835	24881	47.65	792	3.00	43	491	29.8
ISA, B	13	53.69	839	24320	46.77	743	6.92	96	453	29.0
ISA, E	10	28.80	450	13224	28.80	450	—	—	459	29.4
Swampy & deep areas	15	60.54	980	28577	54.29	880	6.25	100	472	29.2
Out of ISA	8	38.50	628	18119	34.00	553	4.50	75	471	28.9
Out of block	14	61.00	1012	28807	55.00	917	6.00	95	472	28.5
Total or average	81	322.01	5255	152531	295.34	4846	26.67	409	474	29.0

Note : Yield is per relong.

Appendix 11

RESIT BELIAN PADI
(Paddy Sales Receipt)

Nama Pelesen :

PBP

Chuan Yuae D No. 79130

Kelang Tober A/Star.

Nama Penjual :

Lesen No : 46839

Tarikh : 22.9.79

JENIS PADI	Bil Guni	Berat Kasar		Potongan				Berat Bersih		Harga Sepikul		Jumlah Bayaran	
				Guni	Basah		Kotor						
		pk	kt	kt	%	kt	kt	pk	kt	$	S	$	S
2	60	78	89	120	11	20	—	66	49	29	80	1981	40

No. Pikul 267

Wang diterima oleh
Penjual

Potongan 2 kati sahaja dibenarkan untuk satu guni. Pembelian padi adalah tertakluk kepada Harga Minima Terjamin Kerajaan mengikut cara-cara and peraturan LPN.

MPCAS

Appendix 12 Non-agricultural income and expenditure in whole year 1979/80

per farm household

Farm Size Group	Non-agricultural income									Non-agricultural expenditure					
	Labour charge & salary			Contractor charge lease received	Rental charge received	Income from off farm business	Other income including fishing	Grand Total	Subsidy (income)	Non-agri labour charge payment	Repair payment	Payment for capital goods	*Zakat* & *fitrah*	Road tax & insurance	Grand Total
	Farm labour charge received	Other labour charges & salary	Total												
Below 5 relongs	278	131	409	—	265	13	58	745	224	8	68	80	352	43	551
5 −10 〃	246	32	278	32	82	5	29	426	414	4	84	2	913	52	1055
10−15 〃	137	37	174	185	306	—	13	678	535	84	713	105	1321	49	2272
Over 15 〃	102	777	879	198	—	2	563	1642	576	33	350	337	1504	48	2272
Average	196.5	201.3	397.8	83.7	191.7	6.9	142.1	822.2	397	31.6	290	112	1042	51	1526.6

Note : From May to April

Technical Bulletin of the Tropical Agriculture Research Center, Japan

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No. 2. Maize in India (a review of literature), 1971
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