The Governments of Malaysia & the State of Johor

Johor tenggara

6 agriculture

part three

dairy cattle multiplication scheme

Husting Technical Services Ltd.
Binnie and Partners
Overseas Development Group
University of East Anglia
Shankland Cox Overseas

1971

THE GOVERNMENT OF MALAYSIA AND THE STATE OF JOHOR

JOHOR TENGAH AND TANJONG PENGGERANG
REGIONAL MASTER PLAN

FEASIBILITY STUDIES

SUPPORTING VOLUME 6

PART III

DIARY CATTLE MULTIPLICATION SCHEME

AUGUST 1971

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Hunting Technical Services Ltd.
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CHAPTER 1

SUMMARY

1.1 Purpose and cost of project

Finance and technical assistance is requested to implement and operate a dairy cattle development, multiplication and training scheme of about 2700 acres in the northern part of the South East Johor Project Area.

Financing of about $5.7 million is required over the period 1972-1976. Of this sum, which excludes interest, $2.2 million is the foreign exchange component. The cost of the technical assistance posts requested is $2.2 million over the period 1972-1980.

1.2 Summary Background to the Project

1.2.1 The Dairy Industry in West Malaysia.

Local dairy cows are of Indian Zebu origin and are characterised by poor milk yields and milking characteristics but good tolerance to the climate and in particular to ticks and tickborne diseases. Exotic dairy stock from the temperate regions have good milking abilities but need a very high level of management to enable them to survive the climate and many local diseases.

Work in Malaysia at the Central Animal Husbandary Station at Ayer Hitam has demonstrated that the cross between a Friesian bull and a Local Indian Dairy (LID) cow has acceptable milk yields and good tolerance to the environment and is considered to be the right type of stock on which to base a dairy industry. Another line of approach is to identify the management conditions under which exotic temperate stock can produce economic milk yields at acceptable levels of management, cost and risks. The solution of such problems could open up the way to a more rapid increase in milk and beef production by the import of the necessary stock.

There are few of these crossbred animals in Malaysia at present. Furthermore, the population of female LID stock appears to be declining. There is thus an urgent need for multiplication of crossbred dairy stock. However, the requirements for successful development also include:

Establishment of management methods and techniques

Establishment of a skilled labour force

Establishment of markets and marketing processes

Coordination of services to the industry

Expansion policies and extension work to support these.

A series of three multiplication schemes are proposed by the Veterinary Division, in Perak, Negri Sembilan and Trengganu respectively. These are to be supported by a rural artificial insemination programme. The programmes are designed to make exclusive use of Malaysian resources of manpower and skills and as such they only have the capacity to contribute towards the multiplication of crossbred stock.

1.2.2 Potential for dairy farming in SE Johor.

The potential for dairy farming has been investigated and shows that this activity could play an important role in the diversification of the agricultural economy of the country which is traditionally reliant on rubber, rice, oil palms and coconuts. All except rice are long term tree crops with little flexibility in production possible to meet changing economic circumstances.

The environment of the South East Johor Project Area is well suited to high production levels of vegetative material, having a high rainfall, usually more than 100 inches, spread fairly evenly over the year. Soils and terrain over most of the project area are suitable for grass production and its exploitation by cattle.

The project region is situated in an ideal position vis-a-vis the large high income market potentials in Singapore and the developing urban areas of Johor Baharu. Price forecasts have been made on the assumption that, with a) increasing incomes and b) decreasing retail price of liquid milk, fresh liquid milk can capture up to half the total market for powdered full cream and imported liquid milks. This assumes, therefore, a total potential market for up to 20 million gallons of milk in Singapore and Johor by 1990 at a price of 40 cents per pint retail, which is equivalent to a farm gate price of $1.28 per gallon.

The income potential of a dairy farm is good, better than rubber and oil palms on an equivalent acreage, and employment possibilities are also good at about 10 acres per worker.

Secondary employment in milk processing and distribution and in the service industries would also occur and there are linkages with the possible development of a Malaysian based cattle feed industry.

CHAPTER 2

BACKGROUND AND JUSTIFICATION OF PROJECT

2.1 The Agricultural Economy

The agricultural economy of West Malaysia is dominated by rubber, rice, coconuts and oil palms which together occupied 95 percent of the total cultivated land area in 1968. Of the total cultivated area of 6.8 million acres in that year, rubber accounted for 4.2 million or 63 percent. Rubber and oil palm exports in 1968 accounted for 36 percent of total exports.

The heavy reliance on a few crops, especially rubber, has led to intense government interest in diversification. Oil palm plantings are increasing, some at the expense of rubber and there is much interest in cocoa, sugar cane and tapioca production and some interest in beef production using imported stock.

Within the smallholder section of the rural sector, the livestock industry is quite important. Pigs and poultry tend to be in the hands of specialist producers and current internal demand for the products is generally fully satisfied at present.

Cattle and buffalo numbers have been declining, particularly since the mid 1970's. There was a 10 percent fall in cattle numbers between 1965 and 1968 from 312,000 to 286,000 and an 18 percent drop in buffalo numbers from 275,000 to 227,000 in the same period. This is thought to be due to three main reasons;

i) the replacement of draught animals by machines in padi areas,

ii) the impact of Urban Cleansing programmes, with no alternative sites offered to dairy producers, and

iii) increased illegal slaughterings in kampongs, especially during periods of low rubber prices.

2.2 The Dairy Industry

2.2.1 The present situation.

Cattle in West Malaysia consist of both draught and milk types, the latter forming about 25 percent of the total cattle population.

These are known as Local Indian Dairy cattle (LID) and are normally run in small units of 5 to 20 cows on roadside, rubber estate and padi stubble grazing. Estimated net milk production from them is 4 million gallons per year and this is usually retailed by the farmer or through small retail businesses.

In addition to the dairy producers described above, there are a few established dairy farms, notably two operated by the Veterinary Division, together with a dairy colony where milk producers from Kuala Lumpur were given land about 20 miles from the city after a town cleansing programme. At the Central Animal Husbandry Station (CAHS) at Ayer Hitam in Johor, the Veterinary Division have carried out the basic work of crossbreeding LID stock Friesians to produce an animal with an acceptable milk yield, heat tolerance and resistance to ticks and tickborne diseases. There are two further commercial units in Johor; one is stocked entirely with Friesians and the other grading up LID stock by using a Friesian bull.

2.2.2 Constraints to Development.

The major constraints to rapid development of a Malaysian dairy industry, described in detail in Appendix C are:-

i) The limited availability of suitable dairy cattle

ii) The lack of knowledge of the management techniques necessary to exploit the potential in the environment. This applies both to pasture management and cattle management.

iii) The lack of trained and experienced personnel within Malaysia, both dairy farm managers and stockmen.

iv) Lack of accurate and comprehensive data on which to plan expansion from any introductory schemes including the most appropriate degree of cross breeding.

v) Lack of a body to plan and control the wide range of essential services required for a dairy industry.

2.2.3 Current proposals for public sector dairy development.

The major initiative and effort in dairy development has been provided by the Veterinary Division who initiated and carried out the work of crossing LIDs with Friesians at the Central Animal Husbandry Station. The basic worth of the resultant crossbred has been proved to the satisfaction of the Division, which is now planning an expansion programme to be operated under a nucleus dairy development planning unit. This would be set up within the Veterinary Division and later incorporated in a national Livestock Development Authority. This programme would have two main features:-

i) Multiplication units will be established similar to the operation of the CAHS. This has recently changed its role from that of a research station and is now concentrating almost entirely on multi-

FIGURE 2.1

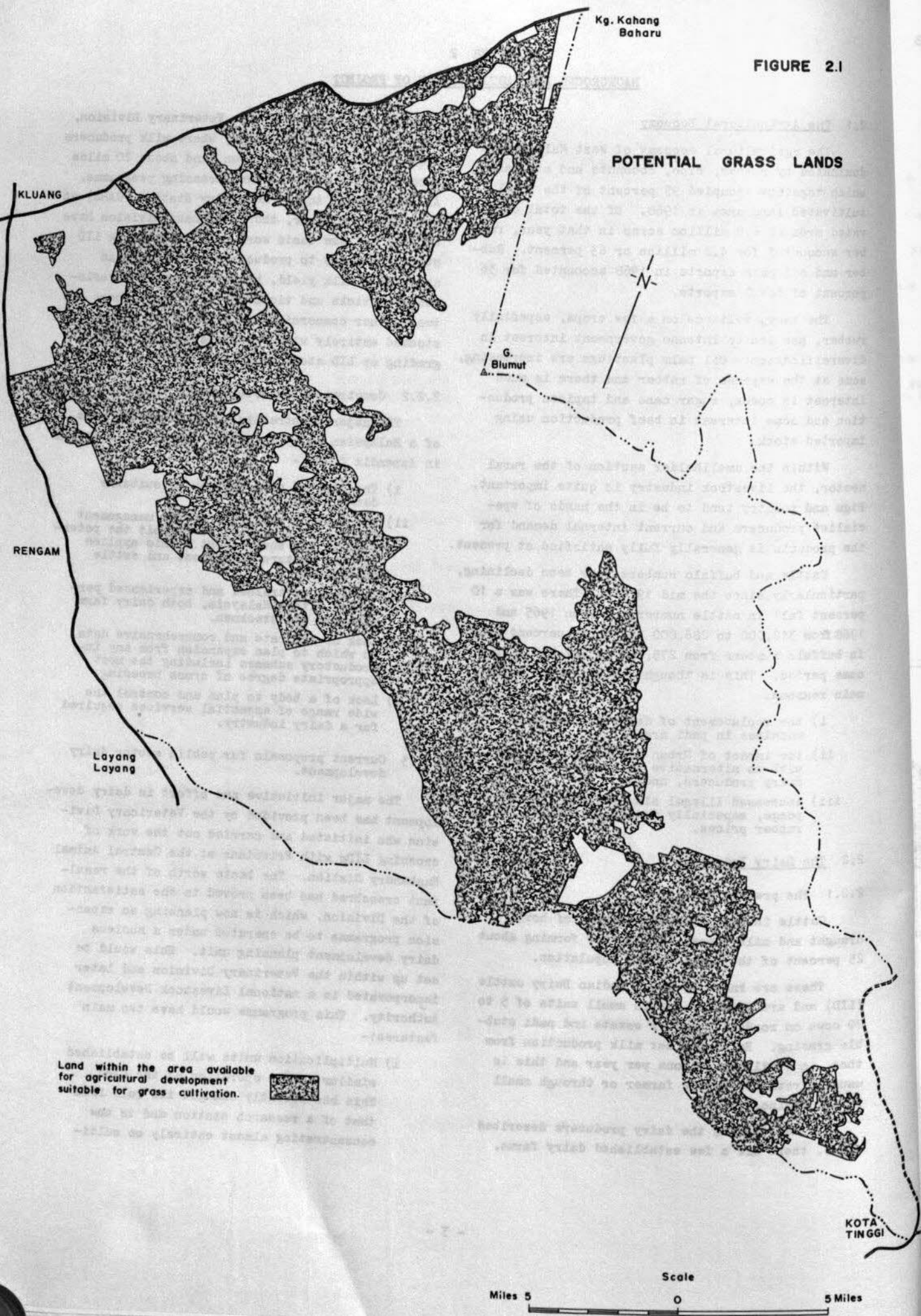
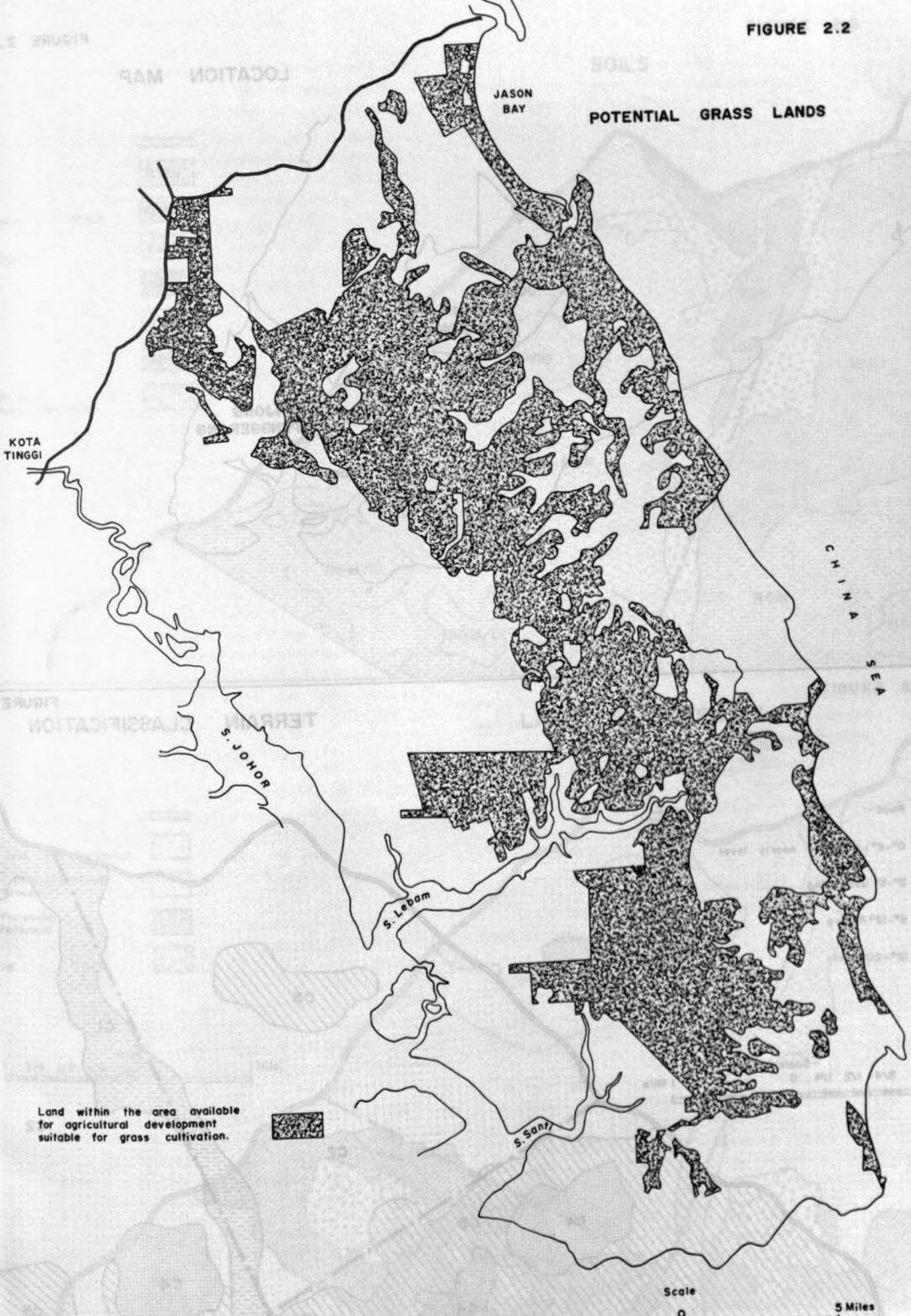

POTENTIAL GRASS LANDS
Kg. Kahang Baharu
KLUANG
G. Blumut
N
RENGAM
Layang Layang
KOTA TINGGI
Land within the area available for agricultural development suitable for grass cultivation.
Scale
Miles 5
0
5 Miles

FIGURE 2.2


JASON BAY
POTENTIAL GRASS LANDS
KOTA TINGGI
CHINA SEA
S. JOHOR
S. Ledam
S. Sanf
Land within the area available for agricultural development suitable for grass cultivation.
Scale
Miles 5
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5 Miles

FIGURE 2.1

POTENTIAL GRASS LANDS

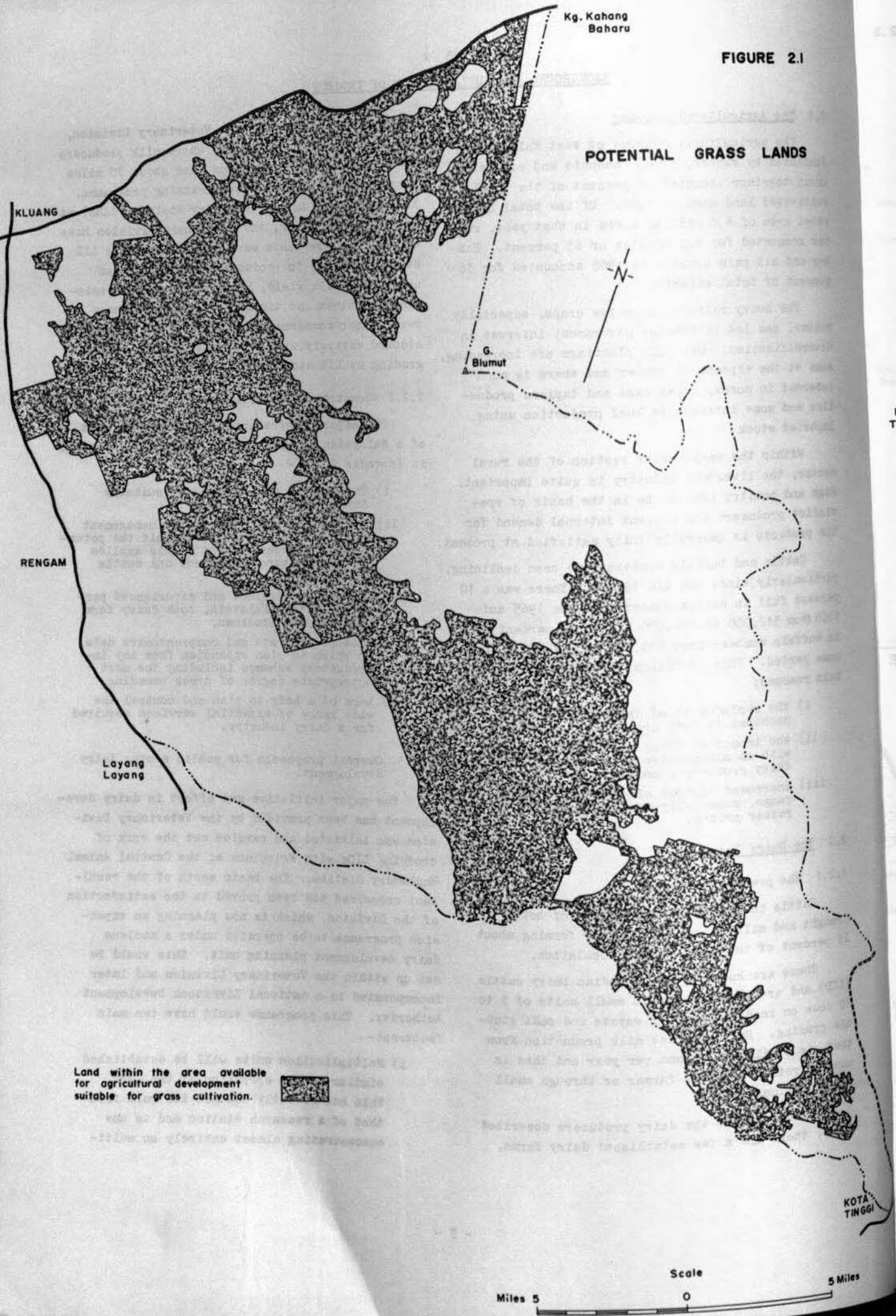
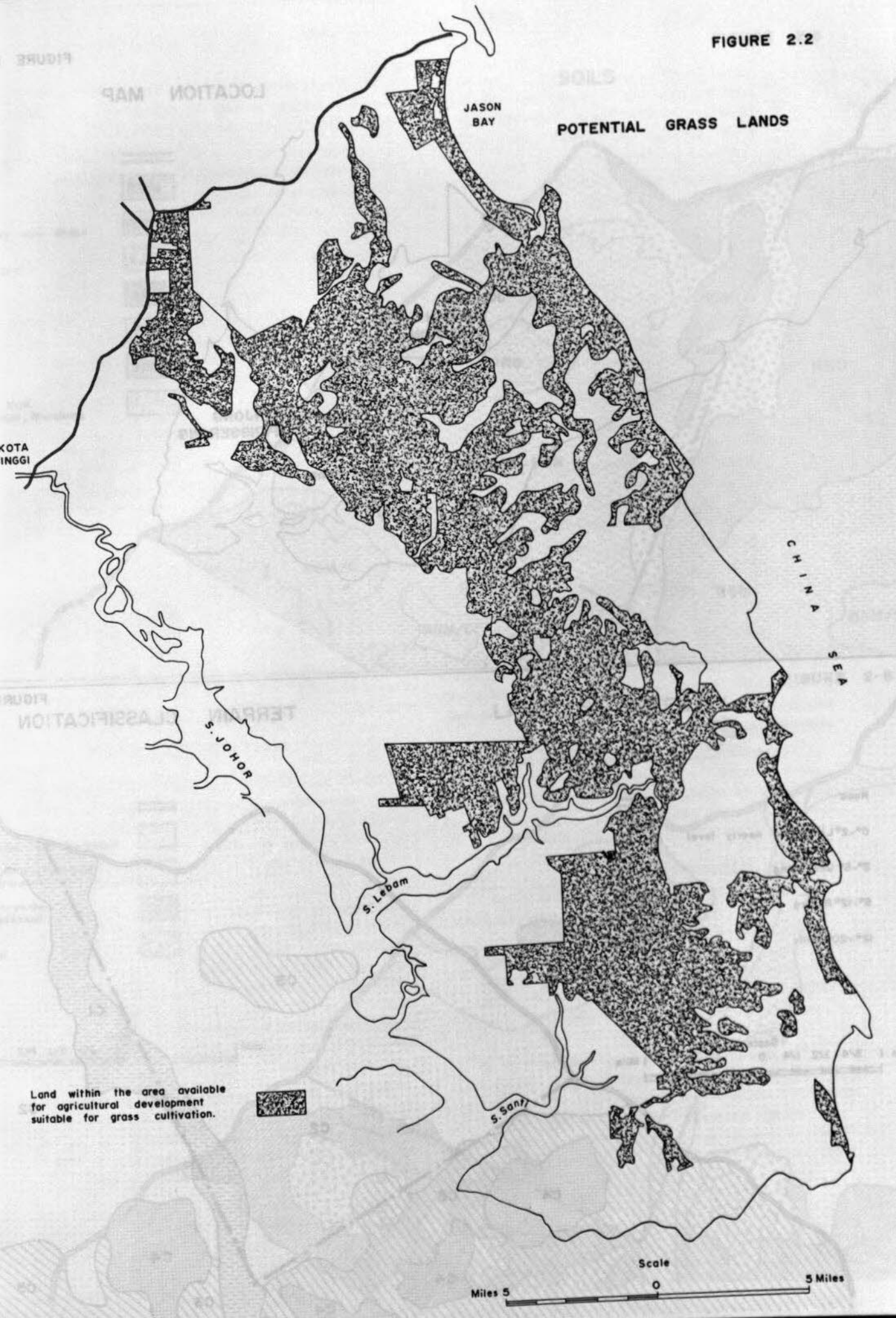


FIGURE 2.2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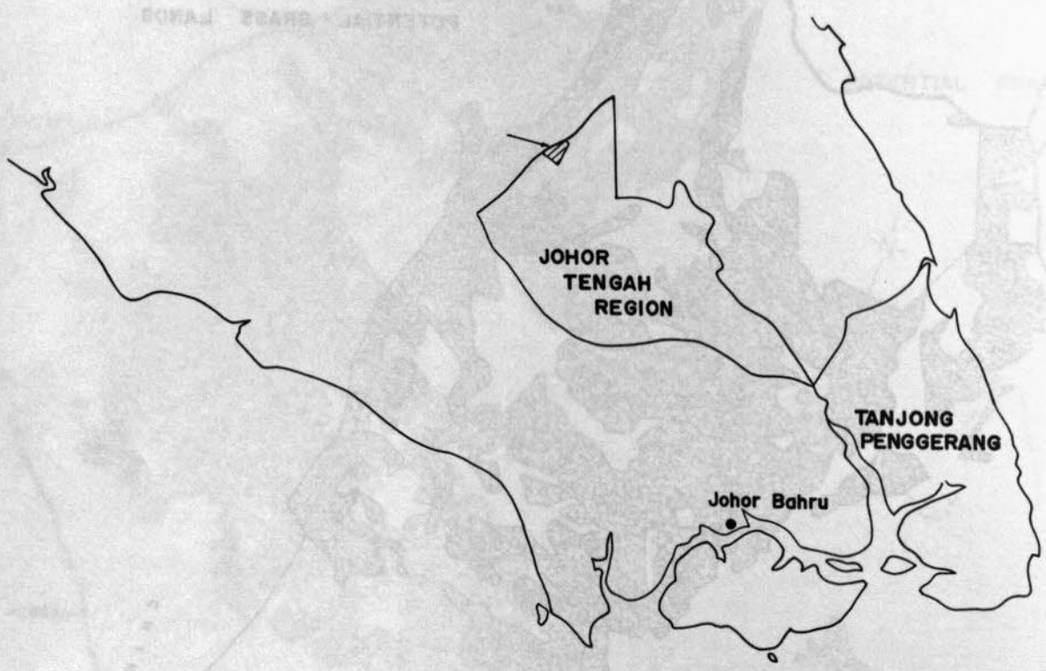
POTENTIAL GRASS LANDS
KOTA INGGI
S. JOHOR
S. Lebam
S. Sanfi
CHINA SEA
Land within the area available for agricultural development suitable for grass cultivation.
Scale
Miles 5
0
5 Miles

FIGURE 2.3

LOCATION MAP



FIGURE

TERRAIN CLASSIFICATION

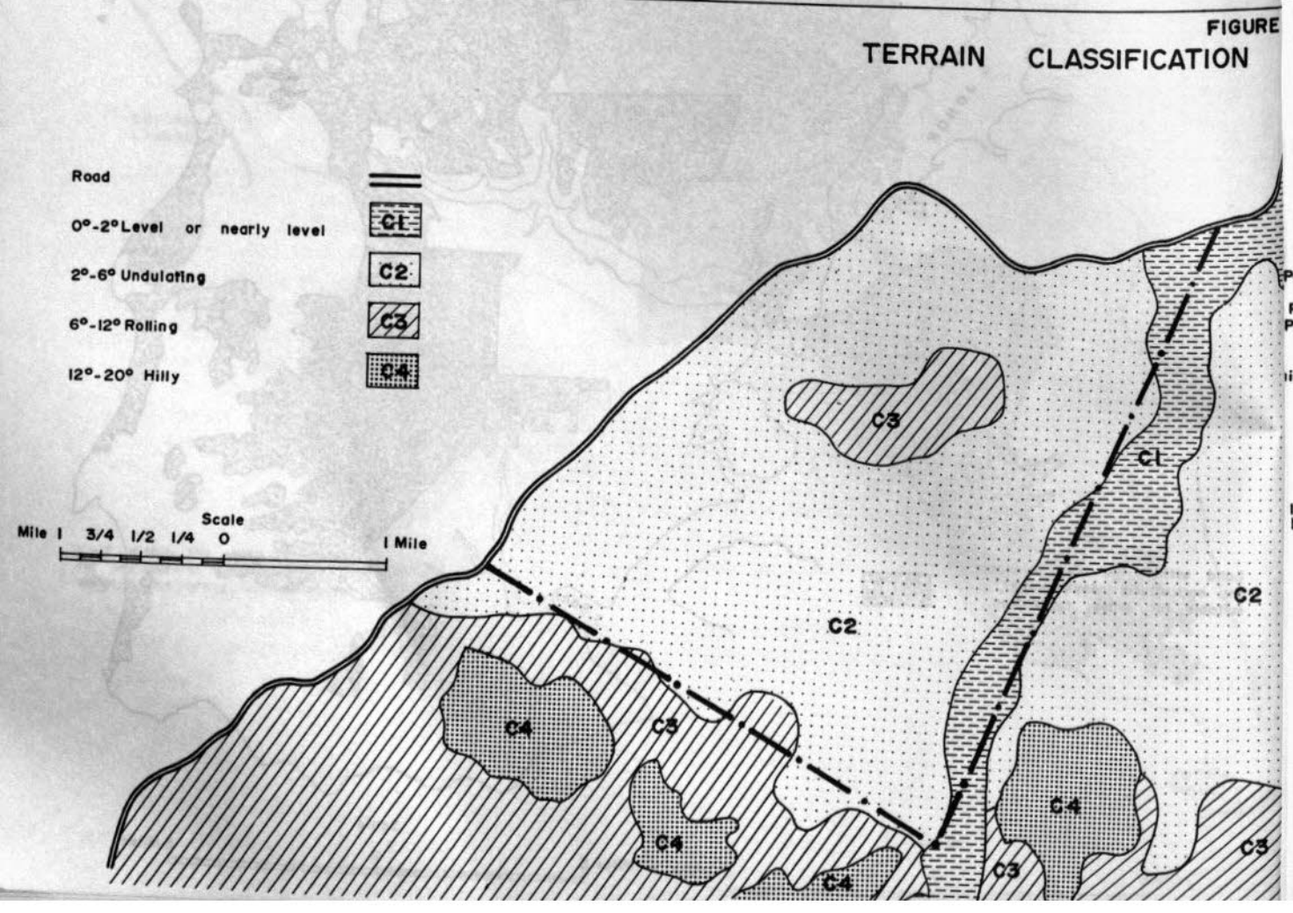


FIGURE 2·5

SOILS

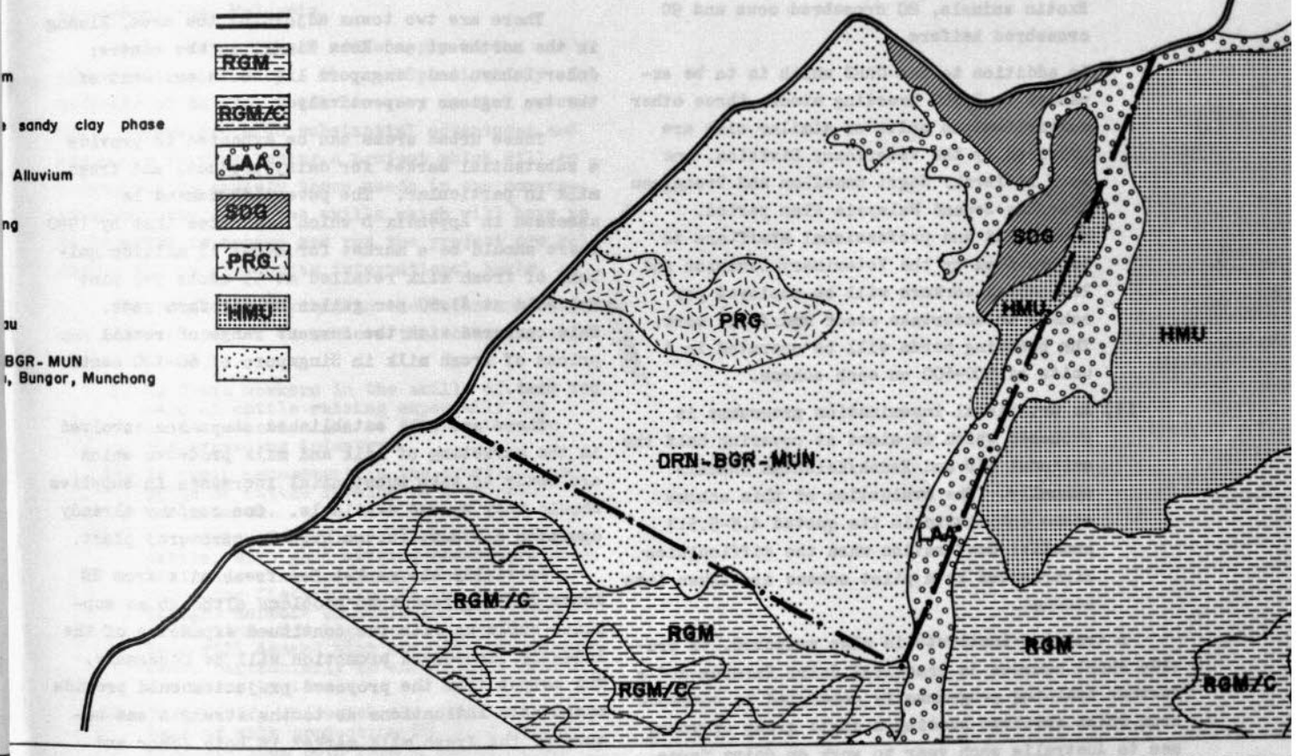
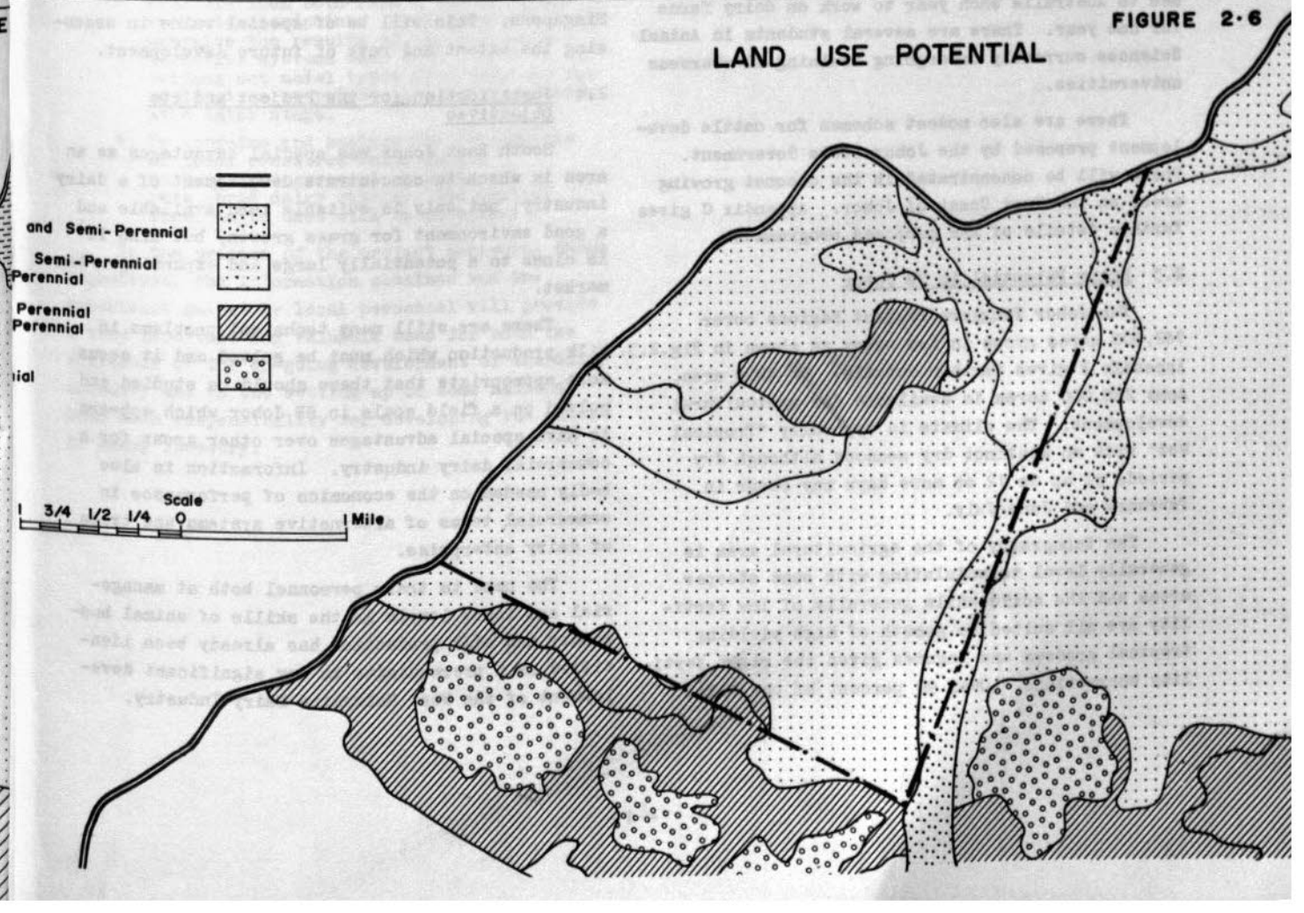


FIGURE 2·6

LAND USE POTENTIAL



plication of crossbred cattle. The total breeding herd was 2050 in March 1971 and consisted of 1770 Zebus, 110 Temperate Exotic animals, 80 crossbred cows and 90 crossbred heifers.

In addition to the CAHS which is to be expanded to 2,500 breeding stock, three other multiplication units of similar size are proposed by the Veterinary Division, one each in Perak, Negri Sembilan and Trengganu over the Second Malaysia Plan period. Management and professional staff are to be provided by the Veterinary Division and 200 casual workers will be employed per scheme to undertake stock and field work. The breeding herds will be operated in 4 units of 500-600 on each scheme.

ii) An artificial insemination programme is proposed which is aimed at covering half the national LID and Kedah/Kelantan animals annually. The evaluation of this scheme seems optimistic in its quoted 4.5-5.5:1 benefit: cost ratios when the difficulties experienced by a pilot scheme are taken into account.

A training institute is also proposed, to provide short courses in practical dairy farming and a further training programme is scheduled to commence soon which involves sending a small group of young men to Australia each year to work on dairy farms for one year. There are several students in Animal Sciences currently undergoing training at overseas universities.

There are also modest schemes for cattle development proposed by the Johor State Government. These will be concentrated in the coconut growing areas on the West Coast of Johor. Appendix C gives further details of the proposed programmes.

2.3 Dairy Potential in SE Johor

The Johor Tenggara Project Regions cover 742,000 acres gross in two areas as shown in Fig.2.3. Appendix B gives further details. Of this area, some 280,000 acres is available for agricultural development. The climate is typically "Tropical Wet" with no distinct dry seasons although dry periods of up to 12 or more days may occur in February and June/July.

The topography of the agricultural area is generally level to undulating with some steeper areas and the soils while generally of low fertility are all suited to growth of high yielding tropical grasses and legumes given the right fertility corrections. Over 90 percent of the total agricultural development area is identified as suitable for the growth and exploitation of grass by cattle. This is shown in Figs. 2.1 and 2.2.

There are two towns adjoining the area, Kluang in the northwest and Kota Tinggi in the centre; Johor Baharu and Singapore lie south and west of the two regions respectively.

These urban areas can be expected to provide a substantial market for dairy products and fresh milk in particular. The potential demand is assessed in Appendix D which indicates that by 1990 there should be a market for about 12 million gallons of fresh milk retailed at 55 cents per pint and sold at $1.80 per gallon at the farm gate. This compares with the current range of retail prices of fresh milk in Singapore of 60-100 cents per pint.

There are well established companies involved in the marketing of milk and milk products which are ready to take substantial increases in supplies should they become available. One company already operates a U.H.T. (Ultra High Temperature) plant.

Initially the market for fresh milk from SE Johor should present no problems although as supplies build up with the continued expansion of the industry, increased promotion will be necessary. The output from the proposed project should provide reasonable indications as to the strength and nature of the fresh milk market in both Johor and Singapore. This will be of special value in assessing the extent and rate of future development.

2.4 Justification for the Project and its Objectives

South East Johor has special advantages as an area in which to concentrate development of a dairy industry; not only is suitable land available and a good environment for grass growth, but also it is close to a potentially large and expanding urban market.

There are still many technical problems in milk production which must be solved and it seems more appropriate that these should be studied and solved on a field scale in SE Johor which appears to have special advantages over other areas for a commercial dairy industry. Information is also badly needed on the economics of performance in commercial terms of alternative systems and types of dairy enterprise.

The need to train personnel both at managerial and lower levels in the skills of animal husbandry and milk production has already been identified as a prerequisite to any significant development of the West Malaysian Dairy Industry.

The shortage of suitable dairy stock for development of the dairy industry acts as a severe constraint on development, both in SE Johor and throughout West Malaysia.

While many of these needs apply to the national dairy industry - they are particularly significant to an area which has very special potential. There are also substantial advantages and economies in formulating a project which will go a long way to satisfy these needs in one comprehensive unit, since the skills which will have to be imported to manage and run the project are relatively scarce even on an international basis.

The project described in the following chapter has been formulated to achieve the following objectives:-

i) to train workers in the skills of commercial cattle raising especially for milk production and to release them to the expanding industry.

ii) to train management in the practical aspects of cattle farming in a tropical environment.

iii) to provide a surplus of crossbred dairy cattle, with good milking characteristics and possessing local environmental tolerance, for distribution to new farmers thought capable of achieving efficient production of a high quality product. This will demand high standards of management, particularly to ensure herd health and dairy hygiene.

iv) To identify and solve the practical problems of milk production SE Johor and to evaluate them both from a technical and economic standpoint. To analyse and appraise the results of the various alternative systems used with a view to setting out model types of enterprise for replication by private and public sectors at a later stage.

v) To appraise and analyse the performance of local crossbred dairy cattle at varying degrees of crossing and of pure bred dairy cattle. The initial breed to be used will be Friesian.

In the process of the project achieving these objectives, the information obtained and the experience gained by local personnel will provide a very important and valuable base for both the appraisal of the on-going development of the dairy industry and to the setting up of some national body with responsibility for developing the cattle or dairy industry.

CHAPTER 3

THE PROJECT

3.1 The Project Area

It is proposed that a dairy cattle multiplication and training scheme be established in the Padang Hijau development unit at the northern end of the Johor Tengah region between the Kluang/Mersing road and the Sungei Kahang. (Figs. 3.1-4).

The Project Area extends to about 5,400 gross acres of which about 2,700 acres of land must be made available immediately. It is understood that this is acceptable in principle to the State Government. In the project area the terrain is mostly undulating between 2 degrees and 6 degrees. One small area occurs towards the north with slopes of 6-12 degrees. Several soil series are found but the complex association of Durian-Bungor-Munchong predominates. These are silty to sandy clay soils with the depth varying between the series. The level of survey does not enable a more detailed soil description.

The land use potential classification, indicates that the area is suitable for growing grass as well as other crops.

The area is on the 100 inch rainfall isohyet.

Access is excellent, with a main metalled road running along two of the boundaries and well maintained logging tracks penetrating the area. It is about 9 miles from Kluang and 20 miles from both the Central Animal Husbandry Station and the proposed new Malaysian Agriculture Research Institute (MARDI) Regional Research Station. The area is 80 miles by road from Johor Baharu and Singapore which will be the main markets for the milk and slaughter cattle produced. It is also adjacent to areas where cattle farming, either beef or dairy, could develop within the content of the South East Johor master plan.

3.2 Execution and Timing

3.2.1 Project direction.

The management of the scheme described below in sections 3.3.4 and 3.3.5 will, at the outset, be responsible to the SE Johor Development Authority through its Chief Executive or his deputy. The Development Authority would have four main functions in relation to the project, which is designed to operate with the maximum amount of independence in day to day running and in all technical policy aspects. These functions are as follows:-

i) Act as a channel for funds and approve budgets and annual plans and programmes in the light of the agreed objectives of the scheme.

ii) Be responsible for the initial setting up of the management of the scheme and in initial physical planning. It is proposed that the management of the scheme should undertake as early as possible full responsibility for detailed planning and implementation subject to overall approval in broad terms by the Chief Executive of the Development Authority.

iii) Assist where appropriate in coordinating the activities of other government departments and agencies which are providing services and infrastructure.

iv) Provide a channel for disseminating the information obtained from the project for use by private and public agencies.

If a public sector organisation is set up to develop and coordinate activity in the livestock or dairy industry, it is recommended that the responsibilities and control proposed above should be transferred to this organisation.

3.2.2 Project Timing.

It is recommended that the scheme be started as early as possible. The earliest date for commencement of land clearance is seen as October 1972, and negotiations for technical aid should be put in train by October 1971. The period between January and October 1972 should be utilised in detail planning and studies of the site, with recruitment of local staff and also recruitment of staff in the technical aid donor country. Final negotiation for land for the project should take place by mid 1972 and contracts placed for land clearance and buildings, water supply and roads by July/August 1972. Planting material and fertiliser must be ordered in good time, (there is for example a three month delay on grass seeds ordered from overseas). Finance must be made available at the beginning of 1972 and sources of this must be decided on at the earliest opportunity. Staff brought in from overseas should have ample time allowed for orientation, particularly time, opportunity and incentive to learn to speak Malay as communication with workers is all important.

3.3 Details of farm operation

3.3.1 Land Clearance and Pasture Establishment

The whole of the proposed area has been logged over and the remaining stand of trees does not appear to be thick. Many of the larger trees have been poisoned by the Forestry Department. As far as possible, land should be cleared with as little

topsoil disturbance as possible. Grass is a shallow rooting crop and needs good fertility in the top layers of soil. This virtually means clearing by hand to ground level over the majority of the area. The system evaluated is largely a grazing system based on Guinea grass and Centrosema pastures. It will be advisable to clear, destump and deroot a small portion of the area, planting this to Napier grass, legumes such as Centrosema or Stylosanthes and forage sorghums to be cut and carried to the animals. Stocking rates can be quite high with these fodders and high fertiliser applications will be necessary. The remainder of the area will be felled to ground level, broadcast with grass/legume seed mixture and left for grazing for up to 2 years. By this time all tree stumps and trunks will have rotted and the final fencing can be erected. Sufficient trees should be left during the felling operation to provide subsequent shade for stock.

A land clearance programme over 4 years should provide productive and easily fenced pastures by the time that the herd consists of a majority of F1 crossbred stock. The programme necessary to keep pace with stock build up is shown in Table 6.2.

TABLE 3.1 Land Clearance Pasture Establishment and fencing - phasing

	Mech. clearance	Hand clearance	Fodder	Pasture	Fencing
1972	150	700			
1973	90	545	240	795	11 miles
1974	-	600	-	450	7 "
1975	-	250	-	600	7 "
1976	-	-	-	250	7 "
1977	-	-	-	-	41 "

3.4 Stock

3.4.1 Purchasing.

The crossbred multiplication unit will be based on the purchase of 3,500 LID females acquired selectively from the national herd. As far as possible these will be maiden heifers and all purchases will be completed by 1976. It is recommended that purchases be carried out by an assistant manager responsible for inseminations and general stock health assisted by a Malaysian assistant manager. There may be the opportunity of assistance also by meat buyers who have scouts in most areas working on small commission for each purchase. They could identify areas and farmers where supplies of stock are readily forthcoming. It will be important to purchase and transport the animals at once in each situation as it has been known for farmers to change stock for inferior beasts if given the opportunity.

3.4.2 Breeding.

All inseminations will be carried out using deep frozen semen. The first crosses will all be from Friesian semen, preferably purchased from proven sires. The British Milk Marketing Board, for instance, is an excellent source of semen as all bulls used can be judged on their contemporary comparison rating which measures the genetic influence of the sire on milking performance.

Second crosses can be made with Friesian semen but it may also be advisable to introduce Simmental on some of the second generation. This European breed has a very high heat tolerance, good milk yield and excellent beef quality. The effect on heat tolerance and therefore ease of management of crossing the pure bred animals in the Friesian unit with Simmental semen should be examined.

Breeding policy after the F1 crosses is a national concern and should be investigated by MARDI. If the Friesian unit shows good results then it could be desirable to continue with Friesian crosses. If there are unsurmountable or expensive problems with these cattle then a proportion of zebu strain may have to be maintained. The actual proportion necessary and the breeding system which best retains this proportion is a long term research problem.

3.4.3 Herd Build Up

The technical coefficients used calculating herd build up and composition are:

i) that the net calving percentage of LIDs will be 75 percent. The remaining 25 percent will be culled. Half of these will be sold as potential beef breeding animals and the remainder for slaughter.

ii) The crossbred stock of all generations will have a net calving percentage of 80 percent. The remaining 20 percent will be culled each year. Half of these are also for beef breeding and the remainder for slaughter.

iii) There will be 7 percent mortality of young stock between birth and disposal. This will be at 3.5 percent per year.

iv) Male animals will be raised for beef and will be sold as such at 18-21 months i.e. in their 2nd year.

v) Females will be raised as potential dairy heifers. These will be inseminated so as to calve down at 27-30 months, i.e. in their 3rd year. They will also have an 80 percent calving rate and

20 percent will be culled.

vi) The multiplication herd will be progressively upgraded, the LID animals gradually being replaced. It will be maintained at 2200 milking cows each year. Sufficient down calving heifers will be brought in each year to maintain the herd and the number of calves born at 2,200 per year.

vii) Each year's intake of down-calving heifers will consist of the later generations. Earlier generations will be distributed. The breeding herd will therefore be composed largely of LID animals until 1978/9 but by 1985 it will consist largely of F2 and F3 crosses while in 1992 there will be a preponderance of F4, F5 and F6 generations.

The first release of F1 down-calving heifers will be in 1977 and this will build up from just below 200 to 380 per year.

TABLE 3.2 Herd Build Up and Composition - Crossbred

Year	72	73	74	75	76	77	78	79	80
Milking cows	-	-	750	1312	2014	2200	2200	2200	2200
Calves 0-1 year old	-	-	750	1312	2014	2200	2200	2200	2200
Beef animals 1-2years old	-	-	-	350	611	938	1024	1024	1024
Heifers 1-2 years old	-	-	-	362	633	972	1061	1061	1061
Down calving heifers 2-3 years old	-	-	-	-	280	489	750	819	819
Cull stock	-	-	250	437	648	770	690	692	680
Purchased LID stock	-1000	1000	1000	1000	500	-	-	-	-

3.4.4 Friesian Unit.

The Friesian unit would be established and operated in a similar manner to all the crossbred units. Details are given in Appendix A.

The stock should be brought in as 4 month old heifer calves as this will give them time to acclimatise before being inseminated and calving. Good quality commercial stock must be bought from a number of different lines from reputable exporters and the animals reared under good management before being transported by air. The U.K. is a good source of such stock as its national system of herd performance recording will enable desirable genetic lines to be selected.

Time is allowed for adequate pasture establishment and the Friesians should come into production about the same time as the first crossbreds in 1976. They should not be brought out until early 1974, and should be inseminated at about 18 months old to come into milk during the early part of 1976.

When it is shown that they can be successfully managed in a tropical environment and can compete with heat and disease tolerant crossbreds, then this will rapidly open up new ways of expanding the cattle population quickly and by further importation. That these pure bred animals can be successful in this climate has already been demonstrated on a commercial dairy farm near Johor Baharu.

It is certain that these cattle can give high yields of milk and fast growing beef offspring of good quality.

Friesians have been successful in other hot countries and can be successful in Malaysia given the identification of the type of management and feed input that they will require to operate profitably.

Should the range of technical factors in the management of pure bred Friesians prove more complex than anticipated, then a larger sample would be needed. In this event an additional Friesian unit should be imported without delay.

3.4.5 Stocking rate.

The farm will be carrying around 8000 head of stock by 1978. These have been converted to adult cow equivalents by applying the factors in Table 3.3.

TABLE 3.3 Factors used in calculating cow equivalents

Purchased LID females	0.6 adult cow equivalent
Milking/breeding females	1.0 " " "
Calves 0-1 year old	0.33 " " "
Male calves for beef 1-2 years.	0.6 " " "
Female calves for breeding 1-2 years	0.5
Downcalving heifers 2-3 years.	0.4
Cull cows (allowing for finishing)	0.3

Application of these constants gives a total number of cow equivalents of about 4,600 by 1978/9 and this is judged to be the equilibrium stocking rate.

Assuming that an adult crossbred cow weighs 850 lbs and requires 2.4 percent of bodyweight in terms of dry matter per day, this is a requirement of 3.35 tons dry matter per year. As most of this is to be taken from grass, the overall stocking rate has been matched to anticipated production.

Total utilised production of dry matter from a guinea grass/centrosema pasture is assumed con-

servatively at 7.59 tons per year. That from zero grazed fodder is assumed at 17.86 tons per year. Thus, total dry matter production utilised is estimated at 18,750 tons or 4.00 tons per cow equivalent. This rate of some 16 percent excess of theoretical requirement is deemed necessary to take account of possible variations in the assumptions which may be found in practice and also, more important, to allow for variations in the rate of grass growth which may occur during dry and wet spells.

The possibility of dry spells slowing down the rate of grass production is ever present, due to the relative uncertainties of climate in the short term. Silage or haymaking should be practised and machinery for this has been allowed for in the estimates.

3.5 Selling Policy

The scheme will have milk, beef culls and surplus dairy stock for disposal.

It is proposed that milk be sold to the existing milk wholesale/retail companies on a contract basis as they are in a position to absorb the slowly increasing quantities through their existing marketing system. The daily quantity of milk will rise from about 500 gallons per day in 1974 to 2000 gallons per day by 1978 and 3000 gallons per day by 1984. This excludes milk from the herds developed from the surplus stock of the scheme.

Beef animals and culls for slaughter will be sold through existing meat outlets and will be available from 1974 onwards.

It is envisaged that up to 50 percent of cull dairy cows will be sold for further beef breeding. No specific proposals are incorporated in this report but two beef cattle farms are proposed for the Johor Tenggara area as part of general development policy. The culls will be sold to such farms.

From 1977 onwards there will be a surplus of dairy enterprises which will comprise the on-going development of the industry. The form of scope of these enterprises should emerge as a result of the information obtained from the project.

3.6 Farm Organisation

It is recommended that the scheme should be run using a central administrative and common services unit controlling and serving the production activities of a series of individual units. The central administration will initially at least be responsible to the Chief Executive of the Development Authority, or his deputy.

The central administration would consist of the general manager and his assistant managers and their counterparts and the farm management specialist. There would also be a central office staff maintaining detailed farm records of both herd and grassland performance as well as the normal financial accounting systems. The main offices, stores, a workshop and machinery sheds and a cold room would be sited around the central unit and there will be a pool of fieldworkers and tractor drivers.

The total herd would be split into individual field units of 120 acres (135 acres for the Friesian unit). Each one, consisting of 120 milking cows and their followers, will be under the daily control of a head herdsman subject to the policies of the overall management. He will be expected to carry out the day to day routine, be thoroughly familiar with all the animals under his charge, maintain a recording system and report any untoward happenings. Each head herdsman will be responsible for assessing animal health, for calving down his own cows and for raising the calves, dairy heifers and beef steers. It will also be important for him to be in close contact with the inseminator and, on recognising when an animal is ready for breeding, to report this at the correct time. It may be a good idea to instal a field telephone system for instant contact with the central unit.

Each head herdsman will also train the stockmen under him by teaching and by example, imbuing in them the sense of discipline and close observation necessary in a good stockman.

Some of these trained personnel will become head herdsmen during the course of the project. Thus, although this method of farm organisation may not fully exploit all the apparent economies of scale, it is necessary if workers are to be trained effectively and the animals are to be managed adequately. The system will reduce risk of disease spread and allow concurrent changes in management techniques to be evaluated. Thus the farm will expand with the addition of new units, some of which may be varied in concept and layout to exploit different ground conditions and management possibilities.

Milking of LID cows in the early years of the scheme will probably have to be by hand and all those to be trained as stockmen will have to participate. Scrupulous hygiene will have to be observed to ensure that the milk produced is safe and of good keeping quality. There should be no great problems in this aspect if high standards of cleanliness are established and maintained, and if milk is cooled immediately and stored at well below 50°F.

Cooling should be done in churn coolers using chilled water from an ice bank. The churns would then be transported to the central cooling room for storage until collection. At a later stage, bulk tank cooling and collection may be advisable if the use of refrigerated of insulated tankers is feasible. For the first few years, however, it may be preferable to keep milk from the different units separated for quality reasons.

Milking machines will be required progressively as the crossbreds start coming into the herd and several different parlour layouts can be tried. Probably the most satisfactory standard layout would be a 6 unit herringbone parlour, but both tandem and abreast type parlours should also be used. These would be particularly useful with those units containing a higher proportion of high yielding or slower milking cows as these can then receive slightly more individual attention.

In estimating costs paddock size has been assumed at 10 acres to allow for rotational grazing. While this order of size is thought desirable to lessen chances of parasitic infestations. Variations in paddock size are possible and an assessment of the value of rotational grazing on set stocking to different classes of stock has to be undertaken by the management.

Ground conditions would have to be studied in detail before laying out the units into grazing and fodder areas.

3.7 Management and Labour Requirements

The requirement for experienced management and herdsmen cannot be stressed too strongly. Part of their task will be, during the course of running the scheme, to train people to take over and to continue operation of the multiplication scheme. This training is important at all levels and particularly at field level. The value of the best farm management available is to a great extent lost if herdsmen are incompetent and not in sympathy with their work.

The following management requirement is recommended:

1 General manager	-	responsible for whole operation. Initially responsible to the Chief Executive of the Development Authority or his deputy.
1 Assistant manager	-	responsible for dairy and field operations.
1 Assistant manager	-	responsible for breeding, (A.I. work) nutrition, animal health and livestock purchase.
1 Farm Management Specialist	-	responsible for assisting with the initial planning and thereafter with the evaluation of all the activities of the project and the identification of farm places for future replication outside the project.

These should be provided through technical aid and the main qualities necessary would be that they

a) know their job thoroughly
b) are adaptable to new conditions and sensible in approach to problems
c) are able to communicate well at all levels.

To make up the management team and to ensure continuity there should be, from the outset, three Malaysian assistant managers. They would be concerned respectively with:

Field operations

Dairy operation with quality control and marketing

Animal health, breeding and livestock purchase

The management provided through a technical assistance programme could be expected to phase out by 1980 leaving well trained and confident Malaysian management to continue.

The farm management specialist, although initially concerned with assisting in the detailed planning of the scheme, will spend much of this time in the collection and evaluation of information for dairy development generally. It is important that he be attached to the scheme but the costs of the post, given in Chapter 4, are excluded from the evaluation as it involves a planning function for the industry in general. He would need to be involved from early 1973 until early 1979 when the task would be handed over completely to competent counterpart staff. These latter would be required from 1975 onwards.

The labour complement suggested is intentionally high. It includes those workers who are effectively being trained for dairy work outside the scheme eventually, although these may not be specifically sponsored by any agency. This aspect, however, plays a very important part in the overall conception of the scheme. In the first year or two of the farm it is unlikely that any formal training course will be available and selection of stock workers must be made from suitable school leavers and other young men. When there is a formal practical training programme in operation, then this could be the first step in the selection process. The most important part of training,

however, will be the work carried out on the farm under the guidance of practical and experienced herdsmen.

Whilst one trained man with modern machinery could handle 60-70 milking cows, it is planned to eventually have a ratio of 1 man to 15-20 cows to allow for rest days and training. In the very early years, say to 1976, much of the milking of LID cows will have to be done by hand and this will mean that all stockmen will have to undertake this task. With a unit of 120 milking adult cows, about 90 could be in milk at any one time. This will require a milking gang of 8-9 men to finish each milking within about, 1½-2 hours.

With the eventual distribution of 350-400 head of milking stock per year, it will be necessary to release about 10-12 trained herdsmen each year. These workers should, after 3-5 years on the farm, be highly skilled and should be able to command good wages. A few of them may indeed develop enough skill and possess the initiative to set up their own operation on borrowed capital.

There could be a drop out rate of perhaps 20-30 percent of the work force and therefore close contact will need to be maintained with the sources of new entrants. One initial supply of workers should be the Farm Training School at Serdang and it would also be of benefit to take in more qualified people for short periods, i.e. those who may be planned for extension work at a later date.

Table 3.4 shows the proposed staffing arrangements. Herdsmen brought in under technical aid could be phased out by the end of 1978 and management by the end of 1980.

Local staff would be taken on as the farm expands and a full complement would be reached by 1976.

TABLE 3.4 Staff Requirements for Scheme

	Management (1)	Management (2)	Herdsmen (1)	Herdsmen (2)	Field workers (2)(3)	Office staff (2)
1972	1	1	1	-		2
1973	3	3	7	63	28	4
1974	3	3	11	99	44	4
1975	3	3	15	153	60	4
1976	3	3	10	162	64	4
1977	3	3	5	162	64	4
1978	2	3	3	162	64	4
1979	2	3	-	162	64	4
1980	1	3	-	162	64	4
1981	-	3	-	162	64	4

(1) Obtained through technical assistance programme

(2) Malaysian staff

(3) Some fieldworkers will be assigned to each dairy unit, others will be part of the central pool.

CHAPTER 4

COSTS AND RETURNS

4.1 Cost Estimates

4.1.1 Land clearance.

This is estimated at two different levels. For early fodder areas to ensure a supply of grass it is assumed that 200 acres will be completely cleared, destumped and roots removed to allow complete freedom for mechanisation of planting, fertilising and harvesting. The costs for clearance to this standard are $350 per acre.

The remaining area is to be felled manually leaving shade trees and the costs are $150 per acre.

4.1.2 Pasture establishment.

For the fodder area, it is assumed that the majority will be planted to Napier grass, with a small area of legumes. Costs quoted by CAHS are $180 per acre including fertiliser for establishment.

The pasture area is assumed to be sown to Guinea grass and Centrosema. The actual method of sowing has to be worked out but costs of $120 per acre including fertiliser are taken from CAHS records. This is considerably in excess of similar costs in Queensland where a large ranch has operated with aerial sowing and fertiliser application at $70-90 per acre including fertiliser.

4.1.3 Pasture maintenance.

The fodder area will be cut over about once every three to four weeks. After each cut there should be a dressing of about 40 lbs nitrogen either as urea, sulphate of ammonia or nitro chalk, and once a year about 3-400 lbs of a balanced fertiliser. With urea costing $232 per metric ton and balanced fertiliser compounds about the same, total costs including delivery would be in the region of $200 per acre.

The pasture area which contains legumes should have two to four applications of complete fertiliser per year with high phosphate and potash. This is estimated at a total dressing of about 5-600 lbs and $60 per acre.

Pasture maintenance costs are assumed to start one year after establishment.

4.1.4 Pasture renewal.

It is not known for how long pastures will survive but with proper management a 10-year life is thought possible. A cost of $50 per acre is included for pasture renewal to cover herbicides, seeds and fertiliser and 10 percent of the area is treated annually after 1977.

4.1.5 Fencing.

Barbed wire costs $6.00 per 350 feet roll. Three strand fencing is considered adequate. Posts costing $1-1.20 should be put in every 20 feet with live posts as stretchers in the intervening spaces. A total cost of $640 per mile is allowed for fencing which is similar to figures obtained from a large dairy farm in Fiji. With 10-acre paddocks and a 30 percent allowance for irregularities and roadways the total cost is $20 per acre. For the first four years, perimeter fencing only is required. In 1977 the paddocks will be laid out and fenced.

Maintenance of fencing is taken as 10 percent of the capital cost per year.

4.1.6 Roads.

The main road system will be about 9 miles at $3000 per mile for 15 feet laterite surface. This road system should serve all the units and connect them to the central unit. Cost of road construction is taken as $15 per acre and $1.50 per annum for maintenance. Roads are constructed as the land is cleared and planted.

4.1.7 Buildings and equipment for central administration unit.

The buildings required are:

Offices - at	$ 8,000
Store	8,000
Cooling room	5,000
Tractor and implement store	8,000
Concreting	10,000
Cooling equipment	10,000
Workshop	5,000
Workshop equipment	5,000
Water and electricity	11,000
	$70,000

Maintenance is expected to be 2½ percent per year at $1,750 per year.

4.1.8 Buildings and equipment for individual dairy units.

Buildings and equipment required are:

Cowshed and collecting yard with room for 100 maximum	$ 6,000
Parlour and dairy building	5,000
Milking equipment and cooler	10,000
Spray race	1,000
Calf pens	2,500
Store shed	3,000
Manure pit and pump	4,000
Electricity and water	14,500
	$46,000

Maintenance of all buildings is charged at 2½ percent per year. Milking machinery maintenance at $1,000 per year per machine, and water and electricity at 15 percent of capital cost per year.

The cooling equipment will be installed with the buildings, the milking parlour pipework and machinery later, when there are sufficient cross-breds.

The cowshed will be of open-sided construction, with high roofs and individual standings for the early phase of hand milking.

4.1.9 Field machinery.

TABLE 4.1 Schedule of field equipment.

	1973	1974	1975	Total	Cost/Unit $
Tractors	4	4	2	10	12,000
Trailers	3	2	1	6	3,000
Sprayer	1			1	2,000
Fertiliser distributor	1			1	1,000
Cultivating/ sowing set	1			1	6,000
Manure spreader		2		2	3,000
Forage harvesters	2			2	4,000
Road grader	1			1	1,000
Cost/year	$75,000	60,000	27000		

These will be replaced every 10 years and average running costs and repairs will be $10 per acre.

4.1.10 Transport.

The general transport requirements will be:

1 lorry with cattle truck body	$30,000
3 landrovers	36,000
2 cars/pick-ups	20,000

These are each assumed to do 10,000 miles per year at running costs of 40 cents per mile for the lorry, 30 cents per mile for the landrovers and 15 cents per mile for the cars. Total running costs are thus $13,000 per year. There will be a trade in value of about 30 percent of new value.

4.1.11 Stock purchase.

Purchase of LID virgin heifers should be possible for under $400 each. However, $400 average cost per head of stock purchased is thought reasonable although it may be higher if there are a number of competitive buyers. In practice, stock purchased will probably range from calves and yearlings to selected mature cows.

4.1.12 Concentrates and minerals.

Throughout the period of the scheme, the grass/legume pastures should be capable of providing maintenance plus two gallons of milk per day using parameters obtained in similar condition in Northern Queensland. Therefore there should not be any need for a production ration of concentrates. However, milk yields of individuals will vary from the averages taken and some concentrates will have to be purchased. A total of 100 lbs concentrates for each milking cow and 266 lbs for each calf at 15 cents per lb is allowed for. This is to cover variations in milk yield, steaming up, finishing for market, calf rearing and beef finishing. The ration should contain 17-18 percent protein.

4.1.13 Veterinary medicines and sprays.

This is estimated at $2.00 per cow unit which is equivalent to that spent both at the CAHS and a private dairy farm.

4.1.14 Artificial insemination.

This figure includes the cost of semen only. Insemination will be done by one of the staff. Frozen semen from U.K. from progeny recorded bulls costs about $9 per dose C.I.F. At an average of 2.2 doses per animal to be inseminated, a total cost of $20 per inseminated animal is allowed. At the peak of activity there will be 3224 animals to be inseminated per year.

4.1.15 Office expenses.

Capital cost of equipping the offices is $10,000 and an annual charge of $5000 for stationery, record sheets, telephone and postage is allowed.

4.1.16 Salaries.

Salaries of technical aid personnel are included as follows:

General manager	$50,000
Assistant managers	$35,000 each
Senior herdsmen	$25,000 each

These are assumed to be nett costs payable by the project and the levels of remuneration necessary to attract the necessary expertise. The farm management specialist would require a salary of $40,000 per year together with a house costing about $20,000. These two items are not charged against the project. (Section 3.7).

Salaries of Malaysian management assistants are lower at $20,000 per year each. It is assumed that there will be constant turnover of Malaysian management and that the project will continue to pay at this level.

Table 4.2 Management build up - Numbers and Total Cost

	Technical aid costs			Local costs	
	General Manager	Assistant Managers	Herdsmen	Management Assistants	Cost $
1972	1	1+	1+	1	100,000
1973	1	2	7	3	355,000
1974	1	2	11	3	455,000
1975	1	2	15	3	555,000
1976	1	2	10	3	430,000
1977	1	2	5	3	305,000
1978	1	1	3	3	220,000
1979	1	1	-	3	145,000
1980	1	-	-	3	110,000
1981	-	-	-	3	60,000
Cost/year	$50,000	$35,000	$25,000	$20,000	

+half year only

4.1.17 Wages.

The average level of stockmen's wages is assumed to be $175 per month or $2,100 per year. The average level of field workers and drivers' wages is $120 per month. Office workers and artisans are expected to earn an average of $200 per month.

TABLE 4.3 Labour - numbers and cost

	Stockmen	Fieldworkers/drivers	Artisans	Office	Cost $
1972	-	-	-	2	4,800
1973	63+	23	5	4	120,870
1974	99	34	10	4	290,460
1975	153	48	12	4	428,820
1976	162	52	12	4	453,480
1977	162	52	12	4	453,480
Cost/year	x $2100	x $1,440	x $2,400	x $2,400	

+half year only

4.1.18 Housing.

It is important that the workers on a livestock farm live on or very near to the farm. Provision is therefore made for housing at the following rates.

Management	6 houses @ $20000 each	$120,000
Senior herdsmen -	10 houses @ $15000 each	$150,000
Artisans and office workers	12 houses @ $ 2400 each	$ 30,000
All other workers	140 houses @ $ 2000 each	$280,000

While one house for each management worker is allowed for, the herdsmen only reach a peak of 15 for 1 year and some temporary arrangement will be worked out. All other workers are assumed to be living at the rate of 1.5 workers per house. This is below the figure for many estates where the occupancy rate is 1.9-2.0 workers per house.

TABLE 4.4 Requirement for housing

	Management	Herdsmen	Artisans	Workers	Cost $
1972					
1973	6	7	6	57	354.0
1974		3	5	31	119.5
1975			1	45	92.5
1976				7	14.0
					$580,000

4.1.19 Premium and rent.

The premium taken on the gross acreage is $50 per acre to include survey fees and payable in year 1. The annual rent is taken at the same rate as rubber land at $10 per acre per year.

4.1.20 Costs of Friesian unit.

These costs are entered as a separate item and are shown in detail in Appendix A. The costs are covered under the same headings as above. There is a higher acreage allocated to this unit, 135 instead of 120 acres and a higher proportion of cut fodder area, 30 percent instead of just under 10 percent. A further $12,000 is allowed for machinery and $10,000 for extra transport.

Stock purchase assumes that Friesian heifer calves are airfreighted in at 4 months old and cost $1400 each delivered.

Concentrates are fed at the rate of $40 per calf and 4 lbs per gallon of milk over 600 average. They cost 15 cents per pound making 60 cents per extra gallon.

Total costs vary from year to year but stabilise at around $80,000 per year.

4.2 Output Estimates from crossbreeding herd

The prime object of the scheme is essentially to produce crossbred cattle which can be managed in the Malaysian environment to utilise the abundant grass that can be grown.

However, besides this, there are outputs of milk, beef of various grades and well-trained labour and management.

In financial terms the scheme will rely on the output of dairy heifers, milk, beef and beef breeding stock. In much broader terms, the value of the output of trained labour and management must be high but this will largely depend on the outcome of the scheme in Terms of knowledge gained.

4.2.1 Output of milk.

It is considered that the LID stock under suitable management will give an average of 180 gallons of milk per year for each milking cow. On this basis, the first income to the farm starts in 1974 when 75 percent of the first 1000 LID cattle will enter the milking herd.

The first crossbreds, the F_1 generation are assumed to give an average 460 gallons of milk per milker per year. Each succeeding generation is assumed to give about 5 percent increase on the previous generation.

TABLE 4.5 Assumed milk yield increase of crossbred generations

LID milkers	180 gallons per year
F1 "	460 " " "
F2 "	485 " " "
F3	510
F4	530
F5	560
F6	580
F7	610
F8	640
F9	680

Thus the composition of the herd affects the average yield. The total milk output, average herd yield per cow and average output per day is shown in Table 4.6. The farm gate price received is also shown.

The major variation thought likely from the figures in Table 4.6 is that the build up of milk output from LID stock could be slower in the first 1-2 years if a high proportion of young LID stock is bought.

4.2.2 Output of beef.

The Friesian has a very good beef conformation, a good growth rate of over 2 lbs liveweight gain per day and produces a carcase of good commercial quality.

TABLE 4.6 Milk output of crossbred cattle

	Total milk thousand gal.	gals./cow per day	thousand gal.	price/gal. $
1974	135.0	0.37	180	2.55
1975	236.2	0.65	180	2.50
1976	440.9	1.21	219	2.45
1977	543.1	1.49	247	2.40
1978	663.2	1.82	301	2.35
1979	755.2	2.07	343	2.30
1980	829.7	2.27	377	2.25
1981	879.6	2.41	400	2.15
1982	931.2	2.55	423	2.05
1983	974.2	2.67	443	2.00
1984	1,083.3	2.97	492	1.87
1985	1,096.0	3.00	498	1.85
1986	1,109.8	3.04	504	1.84
1987	1,125.1	3.08	511	1.83
1988	1,140.9	3.13	518	1.82
1989	1,158.0	3.17	526	1.81
1990	1,176.4	3.22	535	1.80
1991	1,193.7	3.27	542	1.79
1991	1,211.4	3.32	550	1.78

The young male calves should be kept growing on good grass and it is anticipated that they should put on an average of 1.1-1.3 lbs per day from birth to 18-20 months. This has been obtained with good zebu cattle in Brunei[1]. They should be sold at about 800 lbs liveweight at a price of 50 cents per lb liveweight or $400 each. It should be possible to raise and finish these animals on good quality grass. Whether this can be done satisfactorily has to be established on the multiplication scheme. By 1978 there should be 1024 beef animals sold per year. First sales of beef start in 1975.

4.2.3 Output of daily heifers.

The object of raising surplus heifers for sale and establishment of new herds is a prime function of the farm. As the breeding herd is maintained at 2200, there is a requirement for replacements annually. With an eventual 20 percent turnover of adult cows and an 80 percent calving and 20 percent culling rate for heifers as well, this limits the numbers that can be sold.

At scheme maturity, say by 1985, there will be 1024 heifers inseminated each year of which 20 percent will be culled for lack of dairy performance. Of the remaining 820, 440 will be

(1) Annual report of Shell Agricultural Research Station, Sinaut, Brunei, 1969.

required for replacements in the grading up programme of the herd. Those taken into the herd should be of the latest generations to have been performance tested. The remaining 380 down calving heifers are available for sale or distribution. These are valued at $750 each but this value will vary according to performance and to demand. The discounted net cash flow of milk and beef produced over the average life of a cow in a new herd will reflect its true value but pricing policies can be adopted according to the circumstances prevailing at the time.

4.2.4 Output of culled stock.

Each year it is assumed that there will be a culling rate varying between 25 and 20 percent. It is further assumed that of those stock culled, at least half will be suitable for further breeding for beef stock. The remainder are assumed to be sold for cow beef.

The price assumed for breeding stock is $450 per animal and for slaughter is $350 per animal.

4.2.5 Output of Friesian unit.

This again is shown separately as the purpose of this unit is to make comparisons. The details are shown in Appendix A.

Milk yields are higher, with a starting average of 700 gallons per cow in milk.

Cull cows are averaged at $400 each to reflect their higher body weight and culled heifers are sold at $360 each for the same reason.

Surplus breeding heifers could be in demand and are estimated to sell for $900 each.

Total output stabilises at $230,000 per year.

4.2.6 Terminal value.

At sale value, the stock on the scheme is valued in year 20 at $2.75 million. At cost price, the value of land and buildings is valued at $2.275 million giving a total terminal value of $5.025 million.

CHAPTER 5

FINANCIAL AND ECONOMIC ANALYSIS

5.1 Financial Analysis

This is evaluated at market prices as shown in the report and appendices over a twenty year period. No account has been taken of possible company taxation as this will vary according to the final form of the operating authority.

The first income to the scheme arises in 1974 and the first year in which annual income exceeds annual expenditure is 1977.

For discounting purposes, the relatively small amount of expenditure incurred in 1972 is added to the expenditure for 1973 and that year is taken as year 1 of the scheme.

The internal rate of return for the whole scheme is 19 percent.

The total capital outflow over the period 1972 to 1976 inclusive is $5.7 million. With interest charges of seven percent this figure is increased to $7.1 million.

At an interest rate of seven percent, the repayments of this sum over ten years is $1,011,000. The surplus over this repayment is available for reinvestment and could amount to between $.7 and 1.0 million per year during the repayment period and rises to $2 million after repayment ceases.

The payback period for the accumulated net capital outflow is nine years i.e. by the end of 1981 net inflow exceeds net outflow.

The rate of return, repayment capacity and payback period are good for a scheme of this type with objectives which deviate from strictly commercial objectives.

5.1.1 Sensitivity to changes in some variables

In order to ascertain the effect on profitability of changes in some of the important variable inputs and outputs, sensitivity analysis has been carried out. This is detailed in Appendix A.

The variables thought most likely to change in the cost estimates are:

Stock purchase price; this may be higher if several schemes are competing for LID stock. They are assumed to double to $800 per head.

Pasture maintenance;
Dairy buildings;
Salaries;
Wages

} These are assumed to be ten percent higher.

The five cost items outlined above together make up over sixty percent of the total cost flow discounted at fifteen percent.

The major variation in income is thought to be most likely in farm gate milk price. A situation is tested where milk price is thirty percent lower than used in the calculations.

Milk price has a much larger effect on profitability than does the increase in costs. The rate of return varies according to the following table.

TABLE 5.1 Variation of rate of return with changes in costs and price assumptions

	Normal milk price	30 percent lower milk price
Normal costs	19 percent	13 percent
Higher costs	15 percent	9 percent

Assuming the worst situation, the project would still show an internal rate of return of nine percent which is considered adequate bearing in mind the multipurpose objectives imposed on the scheme.

5.1.2 Foreign exchange costs

Foreign exchange costs are separated into development costs and operational costs. Under development costs foreign exchange is required for:

- Dairy machinery
- Field machinery
- Transport
- Friesian stock purchase
- Salaries of expatriate personnel.

Operational costs requiring foreign exchange are:

- Fertiliser
- Maintenance of dairy equipment
- Maintenance and running of field equipment
- Maintenance and running of transport
- Concentrates (these may phase out as more grains become available in Malaysia)
- Veterinary medicines.
- Semen for artificial insemination
- +Replacement of machinery

+ After initial purchase, replacement of field machinery and transport becomes an operational cost but is shown as recurring after ten years.

Total development costs of foreign exchange are $2.8 million phased over 1972 to 1980.

The import content of operational costs rises from $87,000 in 1973 to a peak of $473,000 in 1978 and then stabilises at about $360,000 per year. This is about twenty-five percent of total operational costs when the cash flows are stabilised.

5.2 Evaluation of Social Costs and Benefits

5.2.1 Social costs

The major adjustments to the costs of the enterprise are in the valuation of labour and the deletion of transfer cost items.

A shadow wage of $40 per month is applied to unskilled labour. This wage has been calculated and is used by the Economic Planning Unit.

The items in the cost flow affected by adjustments of the unskilled labour wage are:

Land clearance: mechanical clearance of land is reduced by fifteen percent. Hand clearance of land is reduced by 53 percent.

Pasture establishment: establishment of both pasture and fodder areas are reduced by twenty percent.

Wages: field labour is charged at $40 per month. Stockmen come into the farm untrained and leave fully trained. Their wage is reduced by thirty percent from $170 to $118 per month to reflect the value and period of training.

Artisans, office workers and management are charged at their market wage.

The cost of LID stock has been entered at $700 per head. This figure is derived from the expected output per cow under existing conditions less the possible costs. The main cost would be the labour input and the price therefore reflects the expected valuation put on his own labour by a dairy farmer. Assuming that the average output per LID female would be $400 per year (milk at 120 gallons + value of calf), that the cow would be worth say $300 at the end of four years, this gives a value of output, discounted at ten percent. of $1260. Valuing labour at $120 per month and allowing eight cows per man, the discounted value of labour per cow is $570 at ten percent discount rate.

Malaysia is in a strong position with its foreign exchange reserves and no adjustment is made to the value of foreign exchange costs or savings.

5.2.2 Social income

The market prices for milk, beef and culls which may be used for beef breeding are assumed to reflect their true value and remain unchanged. There could be a case for valuing milk at its import price but, considering that part of the liquid milk may be replacing imported milk and part may be an entirely new market, this adjustment is not thought worthwhile.

The value of the new crossbred breeding stock produced by the scheme is assumed to have a value equivalent to the discounted future output less discounted social operational and capital costs.

A crossbred heifer can be expected to have a five year life at, say, 500 gallons of milk per annum plus the value of calves and the cull value. This represents a total output over five years using prices in 1986 and discounted at ten percent of $5,155. Discounted operational costs for the same period are $1,540 and the capital element necessary to provide the required amount of land, pasture and buildings is, at social prices worth $1,015 per acre and per heifer.

The income flow is therefore increased by valuing new dairy stock at $2,600. Terminal value in social terms has been taken as $19 million which is the net cash flow from year twenty to infinity, discounted at fifteen percent.

The social rate of return on the above basis is twenty four percent.

There are also benefits to the project which are either unquantifiable or difficult to quantify until the project has run for several years.

The scheme will turn out trained labour which will have a value equal to its marginal productivity. This in turn will depend on the actual production parameters which will be established by the scheme and the rate of growth of the industry.

The outcome of the scheme in terms of newly established techniques and additional knowledge of problem areas will also be a benefit. Many of the problem areas are in the nature of uncertainties. The resolution of these uncer-

tainties to either risks or established procedures will increase confidence in investment circles. Even if the scheme shows that it is extremely difficult to undertake milk production, this is an uncertainty removed with a consequent benefit.

A modern agricultural production process such as the type of dairying envisaged may well raise the status of agriculture in general and make it an attractive employment opportunity for a wide cross section of workers.

The new technologies that could develop from the industry in terms of manufacture of spare parts in stainless steel and rubber, local fabrication of certain items of equipment, creation of a market for short term grain and root crops, utilisation of by-products from palm kernel, pineapple and coconut is another set of potential benefits.

The value of real diversification must also be counted as a benefit, particularly when it is considered that production from grassland can be switched between several products. For instance, emphasis in any situation could be placed on milk, beef, veal or breeding stock. If these fail in a given situation, then the animals have a value as meat and the costs of converting grass to another crop can be minimal.

Last but not least the amenity aspect can be considered. The variation in the landscape afforded by large open grassland spaces can be very pleasing.

5.3 Conclusions

Returns both from a financial and a social standpoint appear adequate to warrant investment. The investment is considered highly desirable in any event to determine all the techniques and parameters to be used in further planning. If a dairy industry is to develop then it must be on sound lines with sound data and techniques to support it.

The unit will also be producing beef cattle and a Friesian crossbred also has good potential for beef. Any unforeseen changes in the major assumptions which render the viability of dairy farming suspect will not mean that the investment is lost as the objectives of the scheme could be changed at any time to exploit the beef potential.

If the Friesian purebred cattle prove successful and management techniques are developed which ensure their economic operation, the emphasis on crossbreeding can be reduced and more Friesians can be rapidly imported to replace crossbreds which are sold.

APPENDIX A

APPENDIX A

HERD PROJECTION AND FINANCIAL SCHEDULES

This appendix contains tables giving details on the cost and output flows. In the main the tables show details of the requirements for the crossbreeding programme and the Friesian unit costs are included as one item. Details of the Friesian unit are given separately as it may be desirable to increase Friesian in numbers if they prove suitable. It is also discussed in more detail.

Herd composition of the units are shown as maximum stock numbers in any one year as inputs are geared to this figure.

TABLE A1

Herd Composition - No Head of Crossbred Stock-Maximum

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	Cow Units
Purchased LIDs		1000	1000	1000	500																	.6
Milk Cows			750	1312	2014	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	1.0
Calves 0-1 year			750	1312	2014	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	.33
Beef 1-2 years				350	611	938	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024	.6
Heifers 1-2 years				362	633	972	1061	1061	1061	1061	1061	1061	1061	1061	1061	1061	1061	1061	1061	1061	1061	.5
Down Calving Heifers					280	489	750	819	819	819	819	819	819	819	819	819	819	819	819	819	819	.4
Culls			250	437	648	770	690	692	680	673	666	661	840	645	645	645	645	645	645	645	645	.3
Maximum Stock Nos.		1000	2750	4473	6700	7569	7925	7996	7984	7977	7970	7965	8144	7949	7949	7949	7949	7949	7949	7949	7949	
No. of Milking Units			7	11	17	18																
Construction		7	4	6	1																	
Technical Coefficients Calving & weaning %			75	75	75.5	76	77	77.5	78	78.5	79	79.5	80	80	80	80	80	80	80	80	80	
Post weaning mortality %			7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	
Culling %			25	25	24.5	24	23	23.5	22	22.5	21	20.5	20	20	20	20	20	20	20	20	20	

TABLE A2

HERD COMPOSITION - No ADULT CROSSBRED COW UNITS - MAXIMUM

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Purchased LIDs	600	600	600	300																
Milk Cows		750	1312	2014	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
Calves 0-1 year		250	437	671	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733	733
Beef 1-2 year			210	367	563	615	615	615	615	615	615	615	615	615	615	615	615	615	615	615
Heifers 1-2 years		181	316	486	530	530	530	530	530	530	530	530	530	530	530	530	530	530	530	530
Down Calving Heifers			112	196	300	328	328	328	328	328	328	328	328	328	328	328	328	328	328	328
Culls		75	131	195	231	207	208	204	202	200	198	252	194	194	194	194	194	194	194	194
Maximum	600	1675	2871	3975	4409	4585	4614	4610	4608	4606	4604	4658	4600	4600	4600	4600	4600	4600	4600	4600

TABLE A3

CROSSBRED MILKING COWS IN HERD - BALANCE OF GENERATIONS

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	GALLONS MILK/YEAR
LID	-	-	750	1312	1734	1675	1255	942	706	565	424	318	-	-	-	-	-	-	-	-	-	180
F1					280	525	841	797	920	736	589	471	410	328	262	210	168	134	107	86	69	460
F2							104	279	536	765	866	819	874	699	560	448	358	286	225	180	144	485
F3									38	134	307	531	747	818	757	609	487	390	313	250	200	510
F4											14	61	163	328	540	737	798	730	585	468	374	530
F5													6	27	79	184	348	554	739	785	707	560
F6															2	12	40	100	211	375	575	580
F7																	1	6	19	53	121	610
F8																			1	3	9	640
F9																					1	680
	-	-	750	1312	2014	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	

TABLE A4

MILK OUTPUT OF CROSSBRED HERD - THOUSAND GALS/YEAR

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
LID	-	-	135	236.2	312.1	301.5	225.9	169.6	127.1	101.7	76.3	57.2	-	-	-	-	-	-	-	-	-
F1					128.8	241.5	386.9	450.3	423.2	338.6	270.9	216.7	188.6	150.9	120.9	96.6	77.3	61.6	49.2	39.6	31.7
F2							50.4	135.3	260.0	371.0	420.0	397.2	423.9	339.0	271.6	217.3	173.6	138.7	109.1	87.3	69.8
F3									19.4	68.3	156.6	270.8	381.0	417.2	386.1	310.6	248.4	198.9	159.6	127.5	102.0
F4											7.4	32.3	86.4	173.8	286.2	390.6	422.9	386.9	310.1	248.0	198.2
F5													3.4	15.1	44.2	103.0	194.9	310.2	413.8	439.6	395.9
F6															1.2	7.0	23.2	58.0	122.4	217.5	333.5
F7																	0.6	3.7	11.6	32.3	73.8
F8																			0.6	1.9	5.8
F9																					0.7
			135	236.2	440.9	543.0	663.2	755.2	829.7	879.6	931.2	974.2	1083.3	1096.0	1109.8	1125.1	1140.9	1158	1176.4	1193.7	1211.4
Total daily milk production - '000 galls.			0.37	0.65	1.21	1.49	1.82	2.07	2.27	2.41	2.55	2.67	2.97	3.00	3.04	3.08	3.13	3.17	3.22	3.27	3.32
Galls/Cow/year			180	180	219	247	301	343	377	400	423	443	492	498	504	511	518	526	535	542	550
Farm gate Milk price/gall.			2.55	2.50	2.45	2.40	2.35	2.30	2.25	2.15	2.05	2.00	1.87	1.85	1.84	1.83	1.82	1.81	1.80	1.79	1.78
Milk price/gall. 30 percent lower			1.79	1.75	1.72	1.68	1.65	1.61	1.58	1.51	1.44	1.40	1.31	1.30	1.29	1.28	1.27	1.27	1.26	1.25	1.25

TABLE A5

FRIESIAN UNIT - MILK HERD COMPOSITION

Annual entry of stock	1972	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
Imported stock					102	92	82	74	67												
1978							41	37	33	30	27										
1979								9	8	7	6	5									
1980									12	11	10	9	8								
1981										50	45	41	38	33							
1982											32	29	26	23	21						
1983												36	32	29	26	23					
1984													16	14	13	12	10				
1985														21	19	17	15	14			
1986															41	37	33	30	27		
1987																31	28	25	23		
1988																	34	31	27	25	22
1989																		20	18	16	15
1990																			25	22	20
1991																				37	33
1992																					30
Milk cows					102	92	123	120	120	98	120	120	120	120	120	120	120	120	120	120	120

TABLE A6

FRIESIAN UNIT COST BREAKDOWN - THOUSAND DOLLARS

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Land Clear. 1)	20.2																			
Pasture estab. 1)	18.6																			
Pasture maint. 1)		13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
Pasture ren.			0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Fence + maint.			2.7	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Roads + maint.			2.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Buildings + maint.		10.0	20.0	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Housing + maint.		20.0	16.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Dairy + maint.				10.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Machinery	12.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Water & Electricity		14.5	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Transport	10.0	2.0	2.0	2.0	2.0	12.0	2.0	2.0	2.0	2.0	12.0	2.0	2.0	2.0	2.0	12.0	2.0	2.0	2.0	2.0
Wages		29.5	43.1	43.1	43.1	43.1	43.1	43.1	43.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1
Stock purchase		177.6																		
Concentrates				10.1	12.0	17.1	19.8	20.3	13.2	16.9	16.5	18.6	19.2	17.5	17.3	17.1	18.4	18.6	17.7	17.5
Vet. & A.I.			3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Prem./rent	6.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	67.6	270.2	108.3	89.9	82.8	97.9	90.6	91.1	84.0	77.7	99.3	79.6	80.0	78.3	78.1	87.9	79.4	79.6	78.5	78.3

TABLE A7

COST BREAKDOWN OF TOTAL SCHEME

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	TOTAL
1. Land Clearance (1)		70.0																				70.0
Land Clearance (2)		172.5	90.0	37.5																		300.0
2. Pasture Estab. (1)		36.0																				36.0
Pasture Estab. (2)		84.0	54.0	72.0	30.0																	240.0
3. Pasture Maint. (1)			40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	760.0
Pasture Maint. (2)			42.0	69.0	105.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	132.0	2328.0
4. Pasture Renovation						11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	176.0
5. Fencing		4.4	4.8	5.2	5.6	28.1	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	114.1
6. Roads		17.3	10.7	6.4	6.8	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	95.6
7. Buildings Central		70.0																				70.0
8. Buildings Dairy Units		252.0	144.0	216.0	106.0	40.0	60.0	10.0														828.0
Building Maint.			8.0	11.6	17.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	324.6
Milking Machine Maint.					7.0	11.0	17.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	287.0
Electricity/Water		7.0	15.4	24.2	37.5	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	724.1
9. Field Machinery		75.0	60.0	27.0								75.0	60.0	27.0								324.0
Machinery Val. Costs		8.6	13.4	20.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	416.0
10. Transport		86.0					60.0					60.0					60.0					266.0
Running Costs		13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	260.0
11. Stock Purchase		400.0	400.0	400.0	200.0																	1400.0
12. Constructions and Minerals		41.2	72.2	110.7	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	121.0	2281.1
13. Vet., Meds. & Spray		1.2	3.3	5.7	8.0	8.8	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.2	165.0
14. AI Charge		20.0	35.0	53.2	62.4	62.8	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	1199.4
15. Office Equipment and Expenses		15.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	110.0
16. Salaries	100.0	355.0	455.0	555.0	430.0	305.0	220.0	145.0	110.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	3395.0
17. Wages	4.8	120.9	290.5	428.8	453.5	453.5	453.5	453.5	453.5	453.5	453.5	453.5	453.5	453.5	453.5	453.5	453.5	453.5	453.5	453.5	453.5	8554.5
18. Housing		354.0	119.5	92.5	14.0																	580.0
Housing Maint.			9.0	12.0	14.0	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	267.0
19. Premium and Rent		125.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	600.0
20. Extra costs of * Friesian Unit		67.6	270.2	108.3	89.9	82.8	97.9	90.6	91.1	84.0	77.7	99.3	79.6	80.0	78.3	78.1	87.9	79.4	79.6	78.5	78.3	1879.1
TOTAL		2500.5	2180.0	2338.1	1812.7	1436.9	1431.3	1240.0	1195.5	1138.4	1132.1	1288.7	1194.0	1161.4	1132.7	1132.5	1202.3	1133.8	1134.0	1132.9	1132.7	28050.5
Cost of farm management specialist		50.0	40.5	40.5	40.5	40.5	40.5	10.5														

* See Appendix B for details

TABLE A8

FOREIGN EXCHANGE COSTS OF TOTAL SCHEME THOUSAND DOLLARS

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	
Dairy units					80	40	60	10				
Dairy maint.					7	12	18	19	19	19	19	
Fertiliser			62	82	109	129	129	129	129	129	129	
Field machinery		85	60	27								
Spares repairs fuel		10	15	22	24	24	24	24	24	24	24	
Transport		96					70					
Spares repairs fuel		15	15	15	15	15	15	15	15	15	15	
Purchase of Friesians			177									
Concentrates		41	72	111	131	138	141	141	113	100	100	
Vet. meds.		1	3	9	11	12	12	12	12	12	12	
A.I.		20	35	53	62	63	64	64	64	64	64	
Salaries	80	295	395	495	370	245	160	85	50			
Total $M	80	563	835	814	809	678	693	499	426	363	363	
Total US$	26	184	273	266	264	221	226	163	139	118	118	
S£	10.8	76	113	110	109	91	93	67	57	49	49	
M$ Dev. costs	80	476	632	522	450	285	220	95	50			Total Dev. costs $2810.0 (£380.0) (US $918.0)
M$ Op. costs	-	87	203	292	359	393	473	404	376	363	363	
Cost of farm management specialist - extra		30	40	40	40	40	40	10				

TABLE A9

PRICE ASSUMPTIONS - OUTPUT OF CROSSBRED STOCK

	Farm gate milk price $ per gall.		Beef $ per animal	Beef breeding stock $ per animal	Culls for slaughter $ per animal
	I	II			
1974	2.55	1.79	400	450	350
1975	2.50	1.75	400	450	350
1976	2.45	1.72	400	450	350
1977	2.40	1.68	400	450	350
1978	2,35	1.65	400	450	350
1979	2.30	1.61	400	450	350
1980	2.23	1.58	400	450	350
1981	2.15	1.51	400	450	350
1982	2.05	1.44	400	450	350
1983	2.00	1.40	400	450	350
1984	1.87	1.31	400	450	350
1985	1.85	1.30	400	450	350
1986	1.84	1.29	400	450	350
1987	1.83	1.28	400	450	350
1988	1.82	1.27	400	450	350
1989	1.81	1.27	400	450	350
1990	1.80	1.26	400	450	350
1991	1.79	1.25	400	450	350
1992	1.78	1.25	400	450	350

The milk price in column I is that assumed in the milk marketing appendix.

The milk price in column II shows the same rate of decline but is taken 30 percent lower to examine sensitivity to price falls.

Prices for beef are held constant and a conservative 50 cents per pound liveweight for an 800 pound animal is thought to be attainable.

Similarly the prices for cull stock are thought to be conservative.

TABLE A10

INCOME TO SCHEME

PHYSICAL OUTPUT OF CROSSBRED MULTIPLICATION UNIT

	'000 galls. milk	No. Dairy heifers	No. Beef	No. culls Beef breeding	No. slaughter
1972	-	-	-	-	-
1973	-	-	-	-	-
1974	135.0	-	-	125	125
1975	23660	-	350	218	219
1976	440.9	-	611	324	324
1977	543.0	187	938	385	385
1978	663.2	225	1024	345	345
1979	755.2	317	1024	346	346
1980	829.7	330	1024	340	340
1981	879.6	400	1024	336	337
1982	931.2	340	1024	333	333
1983	974.2	357	1024	330	331
1984	1083.3	+125	1024	261	+579
1985	1096.0	352	1024	322	323
1986	1109.8	376	1024	322	323
1987	1125.1	379	1024	322	323
1988	1140.9	380	1024	322	323
1989	1158.0	380	1024	322	323
1990	1176.4	380	1024	322	323
1991	1193.7	380	1024	322	323
1992	1211.4	380	1024	322	323

+ All remaining LID stock disposed of for slaughter.
Increased intake of heifers needed to maintain herd at 2200.

TABLE A11

PHYSICAL OUTPUT OF FRIESIAN UNIT

FRIESIAN UNIT - PHYSICAL OUTPUT

	Milk galls/year	Cull cows 1000 lbs @ 40 cents	Cull heifers 800 lbs @ 45 cents	Beef 800 lbs @ 55 cents	Breeding heifers $900 each	Milk/cow galls/year
1972						
1973						
1974						
1975						
1976	71,400	12				700
1977	69,000	10		46		750
1978	94,300	10		42		767
1979	96,950	12	4	56	29	808
1980	97,750	12	6	56	38	815
1981	74,350	72	6	56	-	758
1982	92,200	10	6	44	18	768
1983	91,650	36	4	56	4	763
1984	95,100	16	6	56	34	792
1985	96,000	21	6	56	29	800
1986	93,300	41	6	56	9	777
1987	92,800	31	6	56	19	773
1988	92,450	34	6	56	16	770
1989	94,650	20	6	56	30	789
1990	95,100	25	6	56	25	792
1991	93,450	37	6	56	13	779
1992	93,200	30	6	56	20	776

TABLE A12

CASH INFLOW - TOTAL SCHEME

THOUSAND DOLLARS

	Milk I	Milk II	Dairy heifers	Beef	Beef breeding stock	Slaughtered	Total I	Total II
1972								
1973								
1974	344.2	241.7			56.3	43.8	444.3	341.8
1975	590.5	413.4		140.0	98.6	76.7	905.8	728.7
1976	1255.1	881.1		244.4	145.8	118.2	1763.5	1389.5
1977	1468.8	1028.1	140.3	395.4	173.3	138.8	2316.6	1875.9
1978	1780.1	1249.9	170.2	428.1	155.3	124.8	2658.5	2128.3
1979	1960.0	1372.0	240.0	434.2	181.8	125.9	2941.9	2353.9
1980	2086.8	1465.3	249.7	434.2	187.2	123.8	3081.7	2460.2
1981	2051.0	1440.5	302.2	434.2	151.2	146.8	3085.4	2474.9
1982	2098.0	1473.7	256.4	428.9	166.2	121.4	3070.9	2446.6
1983	2131.7	1492.2	270.0	434.2	152.1	130.3	3118.3	2478.8
1984	2203.6	1543.7	96.0	434.2	148.1	209.1	3091.0	2431.1
1985	2205.2	1549.6	266.2	434.2	171.1	121.5	3198.2	2542.6
1986	2213.7	1552.0	284.2	434.2	153.1	129.5	3214.7	2553.0
1987	2228.7	1558.9	286.5	434.2	162.1	125.5	3237.0	2567.2
1988	2244.7	1566.3	287.2	434.2	159.4	126.7	3252.2	2573.8
1989	2267.3	1590.9	287.2	434.2	172.0	121.1	3281.8	2605.4
1990	2288.7	1602.1	287.2	434.2	167.5	123.1	3300.7	2614.1
1991	2304.0	1608.9	287.2	434.2	156.7	127.9	3310.0	2614.9
1992	2322.2	1630.8	287.2	434.2	163.0	125.1	3331.7	2640.3
I	9362.5		894.1	1939.8	868.5	696.2	13761.1	
	68.0%		6.5%	14.1%	6.3%	5.1%	100%	
II		6564.0	894.1	1939.8	868.5	696.2		10962.6
		59.8%	8.2%	17.7%	7.9%	6.4%		100%

I and II NPV at 15 percent.

TABLE A13

CASH INFLOW - FRIESIAN UNIT ONLY

	Milk I	Milk II	Dairy Heifers	Beef	Beef breeding stock	Slaughtered	Total I	Total II
1972								
1973								
1974								
1975								
1976	174.9	122.8				4.8	179.7	127.6
1977	165.6	115.9		20.2		4.0	189.8	140.1
1978	221.6	155.6	1.4	18.5		4.0	245.5	179.5
1979	223.0	156.1	2.2	24.6	26.1	4.8	280.7	213.8
1980	220.0	154.4	2.2	24.6	34.2	4.8	285.8	220.2
1981	159.9	112.3	2.2	24.6	-	28.8	215.5	167.9
1982	189.0	132.8	1.4	19.3	16.2	4.8	230.7	174.5
1983	183.3	128.3	2.2	24.6	3.6	14.4	228.1	173.1
1984	177.8	124.6	2.2	24.6	30.6	6.4	241.6	188.4
1985	177.6	124.8	2.2	24.6	26.1	8.4	238.9	186.1
1986	171.7	120.4	2.2	24.6	8.1	16.4	223.0	171.7
1987	169.8	118.8	2.2	24.6	17.1	12.4	226.1	175.1
1988	168.3	117.4	2.2	24.6	14.4	13.6	223.1	172.2
1989	171.3	120.2	2.2	24.6	27.0	8.0	233.1	182.0
1990	171.2	119.8	2.2	24.6	22.5	10.0	230.5	179.1
1991	167.3	116.8	2.2	24.6	11.7	14.8	220.6	170.1
1992	165.9	116.5	2.2	24.6	18.0	12.0	222.7	173.3
I	853.7		6.8	89.2	53.9	38.8	1042.4	
	81.8 percent		0.7 percent	8.6 percent	5.2 percent	3.7 percent	100 percent	
II		598.5	6.8	89.2	53.9	38.8		787.2
		76.1 percent	0.9 percent	11.3 percent	6.8 percent	4.9 percent		100 percent

I and II NPV at 15 percent expressed as percentage of total income

TABLE A14

SOCIAL INCOME OF TOTAL SCHEME

THOUSAND DOLLARS

	Milk	Dairy Heifer	Beef	Beef breeding	Slaughtered	Total
1972						
1973						
1974	344.2			56.3	43.8	444.3
1975	590.5		140.0	98.6	76.7	905.8
1976	1080.2		244.4	145.8	113.4	1583.8
1977	1303.2	486.2	375.2	173.3	134.8	2472.7
1978	1558.5	585.0	409.6	155.3	120.8	2829.2
1979	1737.0	824.2	409.6	155.7	121.1	3247.6
1980	1866.8	858.0	409.6	153.0	119.0	3406.4
1981	1891.1	1040.0	409.6	151.2	118.0	3609.9
1982	1909.0	884.0	409.6	150.0	116.6	3469.2
1983	1948.4	928.2	409.6	148.5	115.9	3550.6
1984	2025.8	325.0	409.6	117.5	202.7	3080.6
1985	2027.6	915.2	409.6	145.0	113.1	3610.5
1986	2042.0	977.6	409.6	145.0	113.1	3687.3
1987	2058.9	985.4	409.6	145.0	113.1	3712.0
1988	2076.4	988.0	409.6	145.0	113.1	3732.1
1989	2096.0	988.0	409.6	145.0	113.1	3751.7
1990	2117.5	988.0	409.6	145.0	113.1	3773.2
1991	2136.7	988.0	409.6	145.0	113.1	3792.4
1992	2156.3	988.0	409.6	145.0	113.1	3812.0

TABLE A15

CASH FLOW AND RATE OF RETURN OF TOTAL SCHEME AT SOCIAL PRICES

	Total Cost	Total Income	NCF
1973	2423.9		-2423.9
1974	2029.8	444.3	-1585.5
1975	2327.7	905.8	-1421.9
1976	1730.5	1583.8	- 146.7
1977	1175.8	2472.7	1296.9
1978	1155.1	2829.2	1674.1
1979	971.1	3247.6	2276.5
1980	926.1	3406.4	2480.3
1981	876.1	3609.9	2733.8
1982	876.1	3469.2	2593.1
1983	1011.1	3550.6	2539.5
1984	936.1	3080.6	2144.5
1985	903.1	3610.5	2707.4
1986	876.1	3687.3	2811.2
1987	876.1	3712.0	2835.9
1988	936.1	3732.1	2796.0
1989	876.1	3751.7	2875.6
1990	876.1	3773.2	2897.1
1991	876.1	3792.4	2916.3
1992	876.1	3812.0	2935.9
Terminal value			19314.0

15 percent = 5319.1

20 percent = 1834.1

25 percent = 134.5

IRR = 24.6 percent.

TABLE A16

FINANCIAL EVALUATION OF TOTAL SCHEME - CASH FLOWS AT NORMAL COSTS

THOUSAND DOLLARS

	Total Cost	Total Income I	NCF	Total Income II	NCF
1973	2500.5		-2500.5		-2500.5
1974	2180.0	444.3	-1735.7	341.8	-1838.2
1975	2338.1	905.8	-1432.3	728.7	-1609.4
1976	1812.7	1763.5	- 49.2	1389.5	- 423.2
1977	1436.9	2316.6	879.7	1875.9	439.0
1978	1431.3	2657.1	1225.8	2126.9	695.6
1979	1240.0	2941.1	1701.1	2353.1	1113.1
1980	1195.5	3081.7	1886.2	2460.2	1264.7
1981	1138.4	3085.4	1947.0	2474.9	1336.5
1982	1132.1	3071.5	1939.4	2447.4	1315.3
1983	1288.7	3117.5	1828.8	2478.0	1189.3
1984	1194.0	3091.0	1897.0	2431.1	1237.1
1985	1161.4	3198.2	2036.8	2542.6	1381.2
1986	1132.7	3214.7	2082.0	2553.0	1420.3
1987	1132.5	3237.0	2104.5	2567.2	1434.7
1988	1202.3	3252.2	2049.9	2573.8	1371.5
1989	1133.8	3281.8	2148.0	2605.4	1471.6
1990	1134.0	3300.7	2166.7	2614.1	1480.1
1991	1132.9	3310.0	2177.1	2614.9	1482.0
1992	1132.7	3331.7	2199.0	2640.3	1507.6
Terminal value			5025.0		5025.0
		15 percent	1815.1	10 percent	1690.3
		20 percent	- 362.8	15 percent	- 982.3
		IRR =	19.2 percent	IRR =	13.1 percent

I Milk at $2.50 per gallon falling to $1.80

II Milk at $1.80 per gallon falling to $1.20

TABLE A17

FINANCIAL CASH FLOWS OF FRIESIAN UNIT ONLY

(THOUSAND DOLLARS)

	Costs	(1) Income	(2) Income	(1) NCF	(2) NCF
1973	67.6			(67.6)	(67.6)
1974	270.2			(270.2)	(270.2)
1975	108.3			(108.3)	(108.3)
1976	89.9	179.7	127.6	89.8	37.7
1977	82.8	189.8	140.1	107.0	57.3
1978	97.9	244.1	178.1	146.2	80.2
1979	90.6	279.9	213.0	189.3	122.4
1980	91.1	285.8	220.2	194.7	129.1
1981	84.0	215.5	167.9	131.5	83.9
1982	77.7	231.5	175.3	153.8	97.6
1983	99.3	227.3	172.3	128.0	73.0
1984	79.6	241.6	188.4	162.0	108.8
1985	80.0	238.9	186.1	158.9	106.1
1986	78.3	223.0	171.7	144.7	93.4
1987	78.1	226.1	175.1	148.0	97.0
1988	87.9	223.1	172.2	135.2	84.3
1989	79.4	233.1	182.0	153.7	102.6
1990	79.6	230.5	179.1	150.9	99.5
1991	78.5	220.6	170.1	142.1	91.6
1992	78.3	222.7	173.3	144.4	95.0
			15%	259 15%	4
			IRR	24.35%	15.2%

(1) Milk at $2.50 per gallon falling to $1.80

(2) Milk at $1.80 per gallon falling to $1.20

TABLE A18

CASH FLOWS OF TOTAL SCHEME - HIGHER COSTS

	Total Cost	Total Income I	NCF	Total Income II	NCF
1973	2997.3		-2997.3		-2997.3
1974	2754.3	444.3	-2310.0	341.8	-2412.5
1975	2886.7	905.8	-1980.9	728.7	-2158.0
1976	2140.2	1763.5	- 376.7	1389.5	- 750.7
1977	1538.3	2316.6	778.3	1875.9	337.6
1978	1527.7	2657.1	1129.4	2126.9	599.2
1979	1323.2	2941.1	1617.9	2353.1	1029.9
1980	1274.2	3081.7	1807.5	2460.2	1186.0
1981	1211.4	3085.4	1874.0	2474.9	1263.5
1982	1204.5	3071.5	1867.0	2447.4	1242.9
1983	1363.2	3117.5	1754.3	2478.0	1114.8
1984	1266.6	3091.0	1824.4	2431.1	1164.5
1985	1234.0	3198.2	1964.2	2542.6	1308.6
1986	1205.1	3214.7	2009.6	2553.0	1347.9
1987	1204.1	3237.0	2032.9	2567.2	1363.1
1988	1275.7	3252.2	1976.5	2573.8	1298.1
1989	1206.3	3281.8	2075.5	2605.4	1399.1
1990	1206.6	3300.7	2094.1	2614.1	1407.5
1991	1205.4	3310.0	2104.6	2614.9	1409.5
1992	1205.1	3331.7	2126.6	2640.3	1435.2
Terminal value			5025.0		5025.0
		10 percent =	3668.39	5 percent =	4632.59
		15 percent =	- 84.04	10 percent =	-775.41
		IRR =	14.90 percent	IRR =	9.3 percent

I Milk at $2.50 per gallon falling to $1.80

II Milk at $1.80 per gallon falling to $1.20

The Friesian Unit

The purpose of including the Friesian dairy unit in the multiplication is to compare the performance of pure bred temperate stock with that of crossbred stock. The proper evaluation of performance in terms of input: output ratios and the establishment of management techniques for Malaysian conditions will be essential to decisions on ways of expanding the industry.

Operation

The unit will be operated in a similar manner to the crossbred units and it will be under the general control of the management of the scheme. The timing of purchases in 1974 has two major advantages. Pastures established in 1973 should be ready for use in 1974/1975 when the stock need them. Secondly, calvings in 1976 coincide with calvings of the F1 generation of crossbreds for purposes of comparison.

Stock

It is recommended that quality commercial heifer calves are contracted for the U.K. and raised to four months old. They would then be flown out to Malaysia in early 1974 and be raised on the farm. They would have to be quarantined and protected against endemic disease on arrival. This would give them time to acclimatize before they are put in calf at about 18-21 months of age. They would be expected to calve and start milking at 27-30 months. They would thus start milking in 1976 and by 1978-79 the unit should have provided enough basic information on which to take a firm decision as to their viability under Malaysian conditions.

For the purpose of this study, the following parameters are assumed.

There will be five percent mortality between purchase and calving of the new stock.

Milk production will be 700 gallons in the first lactation, rising by 50 gallons per year until the fourth and fifth lactations when the production will stabilise at 850 gallons of milk.

They will be sold at the end of the fifth lactation.

There will be a 90 percent calving rate and non breeders will be culled.

The milking herd will be built up to 120 animals and maintained at this level.

There will be a seven percent mortality between birth and sale or maturity.

Feeding

Body weight of a mature cow will be 1200 pounds and appetite will be 2.8 percent of body weight in dry matter.

Production from Guinea grass/Centrosema pasture will be 17,000 pounds dry matter utilised/acre and from cut fodder areas it will be 40,000 pounds dry matter utilised/ acre. This will support maintenance and 600 gallons of milk plus most growth requirements.

Average production per acre will be about 770 gallons milk; dry matter intake will be 12,250 pounds per cow equivalent.

A mixture of 30 percent fodder and 70 percent grazing will give 23,900 pounds dry matter per acre. Six hundred pounds dry matter is obtained from the concentrates required to produce 170 gallons milk. This total of 24,500 pounds dry matter will support two cow equivalents per acre, consisting of a milking cow and her followers.

There will be 270 cow equivalents and thus a requirement for 135 acres of grass, 40 acres of fodder and 95 acres of pasture. Calves will be fed $40 worth of concentrates.

Costs and Returns

The appendix tables give the details of the expected costs and returns of the unit. Basically, these are the extra costs incurred by the unit. Management costs and the majority of machinery costs are not included as this unit can be handled with little additional machinery.

Stock purchase is allowed at $1,400 per head C.I.F.

The general order of running costs is about $80,000 per year against expected income of about $230,000 per year. Milk production is expected to build up to over 90,000 gallons per year and sale of beef at 56 animals per year. Cull cows are expected to sell at 40 cents per pound liveweight and 1000 pounds per animal, cull heifers at 45 cents pound and 800 pounds and beef at 55 cents per pound at 800 pounds.

The internal rate of return on this basis is 24 percent and this falls to 15 percent with a drop in milk price of 30 percent.

On the assumptions made, simple estimates of production costs per gallon of milk are shown below. These do not separate out costs incurred in raising beef or other parts of the enterprise. Thye are the average level of operational cost divided by milk production.

a.	Pure bred Friesians	85 cents/gallon
b.	Crossbreds on multiplication unit	90 cents/gallon
c.	Crossbreds on a commercial farm	60-70 cents/gallon
d.	Purebred Friesians on a commercial farm in Malaysia at the present time	$1.40 per gallon

It should be stressed here that although the rewards appear to be good on this enterprise, it is very difficult to allow for the full effects of an environment to which these cattle are not adapted. There may be a very much higher risk element involved in keeping these cattle on a widespread basis. The inclusion of this unit is designed to assess the extra risks if any, given the high standard of management planned. Management techniques may have to be modified in many ways from those adopted for the crossbreds and until the risk and uncertainty pattern is known in relation to the techniques evolved, it is considered unwise to put large scale importations of these stock in train.

APPENDIX B

APPENDIX B

THE SOUTH EAST JOHOR PROJECT AREA

Area

The gross area covered by the South East Johor master plan is approximately 742,000 acres in the Johor Tengah and Tanjong Penggerang regions together. The location of the project regions is shown on map and the overall land use potential in Table 3.1.

Several slow flowing rivers dissect the area (Figure) forming narrow flood plains which are in general liable to frequent inundation and consist of poorly drained soils. The terrain is very variable in the north and east of the area. In the west more extensive areas of regular terrain occur.

TABLE B.1 Distribution of land use in the Project Area (Gross acre)

	Available and suitable for development	Unavailable or unsuitable for development	Total
Alienated	5,700	212,500	218,200
Reserved land	-	45,500	45,500
Water catchments and urban development	-	47,100	47,100
Excluded - above 20 degree slope	-	74,100	74,100
- swamps and alluvium liable to flooding, unaccessible etc.	-	81,500	81,500
Unalienated and included	275,800	-	275,800
	281,500	460,700	742,200

The physical environment

Climate: the South East Johor area has a typical 'Tropical Wet' climate. The area is monsoonal but there are no distinct dry seasons, all months being warm and wet. Rainfall within the area varies from 90 to 120 inches annually and falls on an average of 130 to 170 days of the year.

Despite the absence of definite seasons, the variability in rainfall is such that droughts (ten days or more without or with very little rain) may be expected to occur during the north east monsoon period: from January to March a drought of up to twenty days may occur. The only other months in which such dry periods are likely to occur are June and July.

Rainfall is generally of high intensity (0.26 inches/hour) and for short periods during many storms the intensity exceeds three inches/hour.

Hours of bright sunshine vary somewhat between the months; Kluang experiences more than seven hours per day in February but only four hours in November. Inland the sky is significantly more cloudy than on the coastal strip.

Topography: (a) Johor Tengah

This region consists mainly of rolling or undulating terrain, the steepland being confined to large tracts along the north-eastern project boundary.

(b) Tanjong Penggerang

The majority of the area consists of level or nearly level land with very little steepland. The topography is generally more complicated than in Johor Tengah, due to the underlying parent material. In the undulating to hilly classes, valley incision in some localities is severe. The west and northwest of the area consists mainly of undulating to hilly terrain. A central spinal ridge runs from the north of the area in a south east direction to the coast.

The central part of the area is a complex of the undulating to hilly classes. The main feature along the east and south coasts are the extensive peat swamps. The general elevation of these swamps is five to thirty feet above sea level.

With the exception of the three major river systems, the valleys are generally narrow belts liable to frequent flooding.

Soils: (a) Johor Tengah

The two series Rengam and Harimau occur extensively throughout the area. They are deep and moderately friable soils with a good available water capacity and are suitable for a wide variety of crops. The next most common soil series is Durian, a soil suitable for rubber but marginal for oil palms. The

Yong Peng Series also occurs fairly widely. It is a heavy textured, rather compacted moderately deep to deep soil.

Riverine Alluvium and Local Alluvium are soils located in river valleys and vary considerably in their texture and drainage. They may be liable to flooding, depending on location, and are, with present knowledge, judged suitable mainly for certain grasses.

(b) Tanjong Penggerang

The distribution and range of the soils series in this area are more complex than in Johor Tengah. The Rengam Series is again predominant and is mainly concentrated in the northern half of the area. The Yong Peng Series commonly occurs and is concentrated along the western boundary. A large number of soils series, derived from sandstones, shales and metasediments are to be found in very small areas throughout the peninsula.

The Marang Series occurs along the east coast and in the headwaters of the Sungei Papan. This series has fine sandy loam friable topsoil overlying a firm compacted sandy clay loam. Vein quartz fragments commonly occur within the compacted layer restricting rooting depth. Soil depth is very variable and ranges from shallow to deep. The latter are suitable for a very wide range of crops, but the restricted rooting depth offered by the shallower phases downgrades many of the areas.

Riverine Alluvium, Local Alluvium and Organic Clays and Mucks are associated with the river valleys and the edges of the peat swamps.

Peat, underlain by sand, occurs in two large areas along the east coast with a maximum depth of more than ten feet. It is poorly humified, woody, very acid with a recorded pH of around 2.5 and has a very low potential for any type of cropping.

General suitability

The accompanying maps (Figures 3.1 and 3.2 in the report) show the extent of the land suitable for the growth of grass and its exploitation by cattle. This is supported by soils, terrain, climate and land use potential analysis. With over ninety percent of the total area of land available for agricultural development suited to grass growth, land does not constrain the development potential of a cattle industry.

APPENDIX C

APPENDIX C

TECHNICAL REQUIREMENTS OF A MALAYSIAN DAIRY INDUSTRY

This appendix outlines the technical problems which face the development of a modern dairy industry. These problems have been taken into account in considering the form of project that should be undertaken.

1 AVAILABILITY OF SUITABLE DAIRY STOCK

The indigenous Local Indian Dairy (LID) cattle do not possess the necessary milking qualities for the establishment of a prosperous dairy industry. Purebred exotic Friesians (in limited numbers) have performed well in south Johor, but only with a highly skilled and expensive management input designed particularly to prevent heat stress and to control tick borne diseases.

The work carried out at the Central Animal Husbandry Research Station has shown that crossbred Friesian x LID females are capable of giving lactation yields of 400-600 gallons, and that they combine an acceptable tolerance to both heat and tick borne diseases with this milking ability. Such stock should form the basis for expanding the dairy industry; at present, however, there are very few in the country, and a massive effort will be needed to multiply the number.

The Government Veterinary Division has plans for establishing multiplication units in Negri Sembilan, Selangor and in Trengganu. Each unit will consist of 2000 LID cows, most of whose progeny are likely to be absorbed into commercial production - certainly in the early years - near the original multiplication centres.

If the potential market thought to be available to Johor producers is to be captured within the foreseeable future. multiplication of suitable cattle in Johor must be on an ambitious scale. Fortunately it appears that there are sufficient LID female breeding stock to make this possible. The national herd of adult LID cows is currently about 35,000. It is considered that at least five percent (1700) of these could be bought annually for about $400 each without unduly unsettling existing dairy businesses. At present their potential value is not being exploited. Indeed, the potential asset the best breeders amongst them is probably being reduced by slaughter in and around many towns, following Town Cleansing programmes which make inadequate provision for resettling cattle farmers in the suburbs. Such slaughter is a waste that cannot be afforded if the country is to launch a programme to expand and improve its dairy industry.

2 CATTLE BREEDING

At present there are indications that the F2 generation will out-perform the F1 generation. At some stage, and probably before the F3 stage gets underway, a decision as to the type of breeding programme will have to be taken. It will not be desirable to attempt to fix the breed in the early stages as for many years there will be insufficient performance records available for adequate selection. A back crossing or criss crossing system may have to be used with Friesian and Bos Indicus semen. At this stage a considerable effort will have to go into the genetic aspects of breeding and it may be expected that, while average milk yield from the whole herd will continue to rise by about five percent in each generation, the variation in yields between different lines and within lines will become much greater. It is stressed that a full herd recording system must be undertaken from the outset in order to provide the necessary information for future breeding work.

The multiplication programme envisages the introduction of LID cattle for nine years, and it will be at least six to eight years before more than half of the improved herd consists of crossbreds. Problems could arise over time from the use of LID stock because of their low potential milk yield and the relatively small genetic pool they provide. It may be advisable later to enlarge this pool by importing females from other countries. However such imports must be strictly controlled to avoid introducing exotic diseases, particularly foot-and-mouth. West Malaysia is free of all strains of this virus and the maintenance of this freedom could pay handsome dividends to the future cattle industry.

3 PASTURE ESTABLISHMENT AND MAINTENANCE

There are two different views about the best type of pasture. The first, which has been proven so far in Malaysia, is to use pure stands of either Napier or Guinea Grass with very heavy dressings of nitrogen fertiliser. This type is relatively easy to establish and maintain. Handled in this way Napier and Guinea grass will provide for the maintenance

of, and a proportion of the production from, four and three cow equivalents per acre respectively. The nutrient balance is poor however, and an appreciable expenditure on concentrate feeding would be necessary to provide sufficient nutrients for both maintenance and full production. Grazing systems which involve these very high stocking rates, up to an average of eight animals per acre, may result in a severe build up of internal parasite infestations. The quality of management input required has to be high if full utilisation is to be achieved.

The second system involves the establishment of a grass/legume pasture mixture with very much lower inputs of fertiliser-particularly nitrogen. This has been successfully done in Northern Australia under similar climatic conditions on poor soils. It has not yet, however, been successful on the C.A.H.S. This is thought to be due to faulty technique and it is a problem that could be overcome, say, with one to two years intensive work. Some successful guinea grass/centrosema pastures have been established on one of the commercial farms mentioned earlier. Basing calculations on Australian production results, the carrying capacity is lower than the all grass s system - two cow equivalents to the acre - but costs of fertiliser and fencing are lower and the stock management requirement is possibly less stringent. One major advantage of the grass/legume mixture is that the nutrient content is adequate for the requirements of all classes of stock except for young calves and those cows which yield, say, over six hundred gallons.

For both systems correct management practices have to be evolved if the grass is to be maintained in high productive condition; in particular the most suitable fertiliser programmes must be ascertained by field experiments and commercial scale trials. Some weeds may be serious; lallang, (Imperata cylindrica), commonly grows in open spaces and typically on infertile soils. Its value for stock is very low. Another potentially serious weed is the sedge, Cyperus aromaticus. This is present at the Research Station at Ayer Hitam and can be seen on roadside banks across the country. It should be viewed with concern. On dairy pastures in Fiji, in a climate very similar to that of Johor for much of the year, this sedge has spread with alarming rapidity. It is valueless as stock feed and difficult and expensive to eradicate. Other weeds of importance could be the thorny and unpalatable sensitive plant (Mimosa pudica) and the lantana shrubs (Lantana aculeata and Lantana indica) which in Fiji and elsewhere have been found to be poisonous to cattle.

4 UTILISATION OF GRASS

Grass may be used directly by grazing animals or may be cut and carried to stock in houses or yards. There it may be fed fresh as green fodder or, after conservation, as silage. These alternative systems have to be evaluated, and the best methods of practising all of them must be worked out. Compared to most parts of the world, south Johor's climate is favourable for all the year round growth, and the need to conserve excesses of growth as silage may not be so important. Cut and carry systems could have a place in certain conditions, especially in poorly drained soils where grazing stock could cause serious damage by poaching. In general, however, it is likely that the stock will feed themselves by direct grazing, and this has been taken to be the standard practice in the formulation of the project. Ten acre paddocks have been assumed to be intensively grazed on a rotation basis, but the size of paddock, stocking rates and grazing intervals are all matters that require to be established by trial and practice. One problem during excessively wet periods could be that the grazing stock will not be able to take in enough dry matter. Cutting and wilting the grass ahead of the grazing stock could help, but this has not yet been tested in Malaysia.

5 GRASS AND FODDER BREEDING

It may be possible to breed fodders more suitable to the local environment. Work should start on this at an early stage, while at the same time identifying those strains of imported varieties which perform best in Malaysia. There may also be indigenous grasses which are suitable for cattle farming and which could be collected, evaluated and bred up for performance.

6 MILK EXTRACTION, STORAGE AND TRANSPORT

Both hand and machine milking are likely to be practised, and suitable buildings will range from simple standings to very sophisticated modern parlours, designed to suit specific management systems. Various types and sizes will need to be tested to find those most suited to the local environment and systems of management. Particular attention should be paid to designs that will reduce bacterial contamination to the minimum and so increase the keeping

quality of the milk. Research into methods of storage and transport will need high priority. Transport in cars or in the back of a Land Rover for distances of two hundred miles, as is now sometimes done, is not likely to be satisfactory for bulk quantities. Collection and marketing are certain to create organisation problems and it is recommended that early expansion of the industry should take place round nucleus estates, which would undertake marketing.

7 INSTITUTIONAL CONSIDERATIONS

It must be recognised that the dairy industry as envisaged in the future scarcely exists in Malaysia at present. Except on two or three private farms and the existing government research stations there is no source of trained management and labour in the country. Those farmers who are currently operating, do so at present in a specialised economic situation in which they can sell their milk for a high price. Such prices can support luxurious management techniques and for management errors due to lack of knowledge.

a) Farm management and labour

both management expertise and stockmanship skill are in extremely short supply. Management of government sponsored multiplication units should certainly be of the very highest quality and should be brought in, either as part of a technical aid package or under private contract. Experience of large scale dairy farming is probably of more importance than specific experience in the tropics but managers and stockmen should be adaptable to the new conditions to be found in tropical dairy farming.

Work on dairy farms can be divided into three classes:

(i) Work involving handling stock, for example milking, feeding, health and first aid treatment. This demands considerable skills.

(ii) Work among or associated with the stock, not involving handling; for example cleaning of cowsheds, dairy equipment etc. No special skills are required, but conscientious application on these unattractive jobs is necessary to maintain hygiene.

(iii) Work on the farm away from the cattle for example in the pastures; fencing; weeding, etc. No special skills required.

All aspiring specialist stockmen must learn the skills for the first class of work and be prepared to do the second class of work. The best way to acquire the necessary skills is to serve a practical apprenticeship on the farm under an experienced working cowman or dairy farmer. In the early years of development these cowmen will need to be brought in from overseas dairying countries; they can be phased out as local experience and skill grows.

It is recommended that the apprenticeship period be preceded by a three to six months course in the theory and practice of dairy husbandry, with the accent placed heavily on the practical aspects. This course would serve a primary selection purpose.

The duration of the apprenticeship cannot be fixed. It will depend entirely on the aptitude and keenness of the apprentice. The apprenticeship would be completed when the individual was considered capable of managing his own holding or of taking up a specialist stockman post unsupervised. The period could be as little as one to two years or more than five years. It is suggested that, if there is a demand for places as apprentices, five years should be the maximum.

One successful dairy farmer in Johor has been training his own labour force along the above lines for some seven to eight years. He has to maintain quite high management standards and his judgement is that thirty percent of those who have passed through his hands have had the necessary capabilities to become skilled stockmen. All his staff has been selected from Malay school leavers.

In addition to specialist stockmen there will be a growing requirement in the Government extension services for men with experience of animal and grassland management. It is suggested that a year spent on a multiplication unit, during which the trainee worked for some time in every section of activity, would form a second basis for Field Assistants to be employed on livestock advisory work.

b) Provision of services

The provision of essential research, development and extension services must be kept in phase with the requirements of the developing industry. Three phases of growth may be recognised

(i) Development
(ii) Expansion
(iii) Consolidation

In the first phase plans are implemented to overcome existing problems. Appropriate techniques are worked out and existing unknowns and assumptions are more rigorously quantified.

Through this phase, multiplication of good grade stock is of paramount importance to establish the industry on a good footing. So too is the training of future dairy farmers.

In the second phase most of the basic commercial techniques are available to broaden the base of dairy production. New problems, however, will arise at this stage. These are most likely to be connected with the establishment of new farmers, the organisation of collection and marketing of milk and extension and animal health. Early expansion should be organised on the nucleus estate principle.

In the last phase growth will become self-sustaining; the services' role will be to support rather than to stimulate production. As supply catches up with demand greater emphasis will be required on marketing strategies to maintain producer prices.

Specialist services will be required to a greater or lesser extent, from the outset and through time in the following disciplines:-

Animal husbandry
Animal nutrition
Genetics and breeding - both plant and animal and including A.I.
Agricultural engineering
Dairy technology
Pasture agronomy
Animal health
Milk and milk product marketing and quality control
Public health
Management
Administration
Extension

Until recently the Veterinary Division was responsible for research in and development and extension of most of these services. With the establishment of MARDI a start has been made to hand over all aspects of agricultural research. Not all the above disciplines fall under the strict heading of agricultural research and development, and several public departments and more than one Ministry will be involved. Some of the services could be provided by the private sector.

These services as a whole must be orientated towards the creation and maintenance of a thriving commercial industry. The needs during the different phases of growth are not the same and the functions and activities of the various service components will require shifts of emphasis through time. In the first phase, and in at least the early part of the second, the emphasis must be on policies designed to stimulate efficient production; in the third phase on those designed to support and strengthen.

c) Coordination of services

If all these interacting specialist services are to operate efficiently and along the right paths at the right time, some overall policy direction and coordination will be required. It is considered that this would best be supplied through a National livestock development authority, which would identify the changing needs, channel detailed problems to the appropriate quarters and ensure that adequate resources were made available to deal with them.

Although it is outside the terms of reference of this report to make detailed recommendations about the formation and functions of new national bodies, it is considered that inadequate coordination in the early stages of development could seriously hamper future growth of the dairy industry and that to plan and develop milk production in Johor in isolation from the national effort, could lead to long term difficulties. A bare outline of the possible responsibilities, functions and framework of a national development authority is therefore suggested below as a basis for discussion and decision. This is not essential to the initiation of the project neither should it delay the project but it should receive early priority attention.

The Authority should

(1) be responsible for
   a) advice and recommendations in regard to the supply and coordination of government services.
   b) applying inputs to ensure rapid and successful development.
   c) implementing early public sector cattle production schemes.

(2) have the capacity to
   a) plan and implement in the short term.
   b) make and direct policy in the medium and long term.
   c) monitor development effectively through time.

(3) operate with
   a) a small but high powered staff which has first class contacts

with Government agencies, private sector agencies and State planning boards.

b) Funds from government, at least initially, but be allowed to direct itself outside of full government detailed control.

c) The realisation that its role in various aspects will change through time and thus have a flexibility to accommodate what may be quite rapidly changing roles.

The authority would therefore be in a position of control in the first development phase with the emphasis placed on continuous planning, implementation, evaluation and formulation of development policy.

In the second phase, it should be much more concerned with the implementation of the policies worked out for development and expansion. Policy making is a continuous process and policies need continual evaluation in the light of results.

By the time a soundly based expansion is underway, the authority can turn the major part of its attention to a long term view of the industry. In particular, the emphasis would leave development and expansion and be concerned with the level and quality of services necessary to support the now thriving industry. As mentioned previously, marketing strategies will probably assume major importance as the supply catches up with the potential demand for fresh milk. This latter aspect can be a short term fluctuation of supply in the early years.

It is suggested that this type of approach will make the best use of time and effort, avoiding unnecessary duplication. It does however require goodwill on the part of the providers of the participating services.

8 ORGANISATIONS FOR IMPLEMENTATION OF DEVELOPMENT

There are several types of production organisation through which the authority could implement development. In the first phase the main emphasis is on multiplying the number of superior quality cattle. The following types of organisation may be used for this purposes:-

(i) Multiplication units
(ii) Dairy colonies
(iii) Artificial insemination programmes.

The first two types can be adapted to play also important roles in the expansionary and consolidatory phases, and their original siting and design should be planned with this in view.

a) Multiplication units

As implied by their name these are centres at which female breeding stock are mated either naturally or by artificial insemination with bulls of superior quality. Suitable progeny from the first and subsequent generations, surplus to the breeding replacements required by the centre, are distributed to future dairy farmers as foundation and, later, replacement stock. Milk, cull cattle and steers are sold in the appropriate markets.

These centres can be used for other development activities, such as

(i) The focussing of <u>research</u> on, for example,
  i) grass and fodder breeding
  ii) grassland utilisation
  iii) grassland agronomy
  iv) animal nutrition
  v) animal health
  vi) dairy technology.

(ii) Training of apprentice dairy farmers and future extension officers.

(iii) Collection, processing and marketing of milk from surrounding farms.

(iv) Advisory service to surrounding farmers eventually.

The multiplication and production functions can be provided equally well by public or private enterprise. So too can collection, processing and marketing services. The provision of basic research training and advisory services is usually regarded as a public sector role. Two types of multiplication centre may therefore be envisaged, one under public auspices, incorporating any or all services, one under private management with the emphasis on commercial production and the provision of the more easily saleable services. However the difference in functions between public and private units should not be overstressed. Private sector organisations have been known to run very successful advisory services, especially when the production is linked with a processing/marketing service provided by the same organisation. It is also usual for the private sector to provide training facilities for both management and labour, and this it will certainly have to do in any multiplication unit that is established early.

It is likely that the initiative in establishing units will have to come from Government,

but if these units are successful, private enterprise can be expected to enter the field. There is certainly room for both sectors; however the number of suitable LID female stock is limited, and the private sector might have to import (under strict control regulations) exotic breeding cows. The risks inherent in doing so could be commercially acceptable when weighed against the chances of obtaining high productivity early, when the price of milk will be at its highest.

b) Dairy colonies

Where town cleansing programmes have forced dairy farmers out of towns, every effort should be made to provide them with blocks of grazing land in the suburbs. The aggregation of these individuals into a single colony, such as that at Batu Arang, provides an opportunity for starting a crossbreeding programme. If each colony were provided with a trainee from a multiplication unit, artificial insemination facilities and a marketing service, they should be operating successfully with more than half of crossbred stock after six to eight years.

c) Rural urban artificial insemination programmes

An artificial insemination programme has already been started by the Veterinary Department, centred on Seremban. Although such programmes scattered through kampongs do increase the numbers of crossbred stock, they are likely to be less effective than if carried out on compact dairy colonies and farms. Difficulties of communication between the service and the farmer are likely to result in many missed insemination opportunities, especially as cows' heat periods may be short and erratic and not noticed by farmers who lack technical knowledge.

One inseminator working under kampong conditions might expect to be responsible for about 1,200 services per year at a thirty percent success rate or about 120-130 female animals entering the milk herd in two to three years' time. Under farm and dairy colony conditions he could expect to increase this number many times. Programmes in kampongs should therefore be pursued only until there are sufficient stock in dairy colonies for all the artificial insemination requirement to be concentrated in these colonies.

For success any artificial insemination programme must be accompanied by a rigorous castration programme. All existing bulls in the locality and all bull calves born (except perhaps a few very select ones that might be acceptable for breeding) must be castrated. This requirement applies equally whether the programme is on a dairy colony or in kampongs, but, as with the insemination, it is much easier to implement in a colony.

d) Herd performance recording

If a national breeding programme is to be successfully implemented and future breeding policies worked out, large numbers of herd performance records must be studied. It is suggested that the Dairy Development Authority should be responsible for establishing and ensuring the maintenance of herd performance recording on all new production units, from major centres down to individual smallholders. At Government centres and on large scale private schemes the records could be required in detail; for individual producers a simpler standardised form could be used.

9 CURRENT PROPOSALS FOR DAIRY DEVELOPMENT

The major initiative and effort is provided by the Veterinary Divisions who have performed the basic observations on the suitability of crossbred cattle.

The basic worth of the crossbred in the Malaysian environment has been proved to the satisfaction of the Division, which is now planning a large expansion programme along two main lines.

1. Establishment of multiplication units.
2. Expansion into a nationalAA.I. programme.

These, it proposes should operate under a nucleus dairy development planning unit set up within the Division.

a) Central animal husbandry station

In addition to this, the Central Animal Husbandry Station has changed its original role of a research station and is now concentrating almost entirely on multiplication of crossbred dairy cattle.

The plan is to expand to 2,500 breeding cows for multiplication purposes.

TABLE C.1 Composition of C.A.H.S. breeding herd - March 1971

Zebu	L.I.D.	1044	
	LID/Sindhi	553	
	Sindhi	70	
	Kelantan/Sindhi	100	
			1767
Temperate	Friesian	97	
	A.I.S.	10	
	Jersey	2	
			109

Temperate x Zebu	Friesian/Zebu	65	
	Jersey/Zebu	16	
			81
	Total females over three years		1957

In addition there are the following heifers

Friesian/Zebu	80
Jersey/Zebu	10
	90
Total breeding herd:	2047

The present herd multiplication policy gives priority to a rapid build up of quantity rather than selection on quality grounds. It is noticeable that the quality of the multiplication stock used is not as good as LID animals seen elsewhere in the country. This policy of purchasing in quantity has also led to the introduction of reproductive and other diseases amongst the multiplication herd.

A dairy herd of the size outlined is a very large operation and must call upon a highly skilled management and labour force. The management of the CAHS is basically trained in veterinary skills only and operating as they do with workers hired on a casual labour basis face an uphill task in carrying out their programme. It is inevitable that the skills demanded do not exist at present in Malaysia. Skill at stock management can only be learned after years of the right type of experience and close practical association with animals on a daily basis.

Use of labour hired under the Governments' IMG/Casual heading is also a short term expedient which, while allowing adequate staffing in terms of numbers contributes little to long term success. This use of labour is reflected in poor insemination performance and unnoticed early signs of sickness. Management is almost entirely dependent on virtually unskilled stockmen for the identification of heat and early signs of disease.

b) Proposed new multiplication units

The establishment of three cattle multiplication units is proposed by the Veterinary Division over the Second Malaysia Plan; one each in Perak, Negri Sembilan and Trengganu. Each unit is to commence with 2000 head of LID females and cover 2500 acres. The staffing of each of these is proposed as follows:-(1)

TABLE C.2 Proposed management of Veterinary Division multiplication scheme

Division		Post	When required 1st Year	2nd Year
I	1	Manager Super-scale H	1	-
	1	Veterinary officer	1	-
	1	Agronomist	1	-
	1	Artificial Insemination officer	-	1
	1	Parasitologist	-	1
	1	Deputy Veterinary officer	1	-
II	1	Assistant Veterinary officer	1	-
III	2	Veterinary assistants Sp. Grade	2	-
	13	Veterinary assistants	7	6
	3	Clerks	2	1
	1	Typist	1	-
	1	Storekeeper I.M.G.	1	-
	27		18	9

(1) Veterinary Division - Memorandum on staff requirements for Dairy Development 1971 - Undated.

Thus, there will be twenty one veterinarians at various levels and one agronomist to look after each station. About 200 stock and field workers are thought to be necessary for each scheme. It is proposed to employ these as casual workers.

Scheme layout consists of four field units of 600 acres each with a central unit for common user services. Management of each of the field units would consist of three Veterinary assistants.

The conception of these schemes owes much to the operations learned from the CAHS. Training of labour is mentioned as a possible outcome but is not considered as an integral part of any scheme.

It has been further proposed by the Veterinary Division to set up a training programme by building a training institute which would offer

short courses in practical dairying and stock management. This would possibly be associated with a scheme. A further training programme which should start shortly is to send selected young men to Australia where they would work on dairy farms for one year as employees before returning home to enter the industry in Malaysia. There are also several students in Animal Sciences at present undergoing training at overseas universities.

c) National artificial insemination programme

The second main method of multiplication proposed is to develop a national artificial insemination scheme(2). This depends on the assumptions that half the national LID and Kedah/Kelantan herds can be inseminated annually, that is, a total of 59,420 head of stock to be inseminated twice and that this will result in 40,000 calves which will have an increased value due to their superior performance. It also assumes that each inseminator will carry out 2,400 inseminations per year and that there will be a fifty percent conception rate at each insemination, that is, seventy-five percent cumulative after two inseminations. This performance seems most unlikely taking account of the present cumulative conception rates of LID and Kelantan animals at the CAHS (56.1 and 66.0 percent respectively after second insemination). It is also unlikely that inseminators will carry out much more than half the number of inseminations given the difficulties of communication in the rural areas.

The memorandum states Benefit:Cost ratios of 5.5:1 and 4.4:1 for LID and Kedah/Kelantan inseminations respectively. Benefits are based on an assumed additional value of revenue from the sale of sale price of the beef or dairy heifers because they are crossbreds. This, of course, arises three and a half years after successful insemination.

A more valid figure would be: 2.3:1 for LID crosses and 2.2:1 for Kedah/Kelantan crosses.

These adjusted figures assume that staff and service costs will double due to the difficulties of running the service in the rural areas and are based on an average of 1200 inseminations per man year. It is also assumed that calving percentage will be the same as that achieved by the CAHS (it is in fact unlikely to be as high). Further a discount rate of ten percent has been assumed with benefits arising three years after costs are incurred. This may be so with the beef animals but dairy heifers are likely to give their benefits o over a longer period in the form of increased milk.

The programmes outlined will undoubtedly have a major effect on the multiplication of crossbreds and should halt the decline in local stock numbers. It is considered, however, that they will not set the industry off on the right footing as much too little attention is being paid to management input, stock quality, training of labour and managers and attention to the basic problems of production. Planning at all levels is based on continuing the experience gained at CAHS and the first cattle insemination service. Improvement of the performances of these pioneers are assumed.

d) Overall planning body

An overall body which supervises all aspects of dairy development is proposed by the Veterinary Division and they suggest that this be done by the establishment of a nucleus Dairy Unit within the Veterinary Division with the ultimate objective of it developing into the Livestock Development Corporation(1).

The executive staff considered necessary for this unit by the Veterinary Division is:

1 Senior Dairy Development Officer
(Senior Veterinary Officer F)
1 Agronomist
1 Economist

This would be the main planning body.

e) State Government schemes

The Johor State Government has shown interest in the development of a cattle industry and has made a higher allocation of funds available for this purpose in the current year than in any previous year at $150,000.

They are particularly concentrating their efforts in the coconut growing areas of the West Johor coast around Sri Melong and Sri Menanti. The coconut farms have an abundance of grass cover and this is to be utilised by LID and Kelantan cattle, initially being bred with bulls of their own type selected from the CAHS. The programme envisaged is to purchase 100 LID cattle and 300 Kelantan cattle and distribute these to the farmers at the rate of two to three per farmer in a fairly concentrated area. The selected zebu bulls will also be put into the area.

(1) Veterinary Division - Memorandum on Staff Requirements for Dairy Development 1971 - Undated.

(2) An Economic Evaluation of Expanding the Artificial Insemination Service - Veterinary Division Memorandum - 1971 - Undated.

Another scheme, at present in the planning stage, is to purchase calves from the Cold Storage Dairy Farm in Singapore at the rate of ten per month and raise these in Johor Baharu. These calves will all be of temperate breeds.

APPENDIX D

APPENDIX D

THE MARKET FOR FRESH MILK

Production of milk in West Malaysia has been estimated by the Veterinary Department to be about four million gallons per year, mainly produced by small Indian dairy farmers. Production in Singapore itself is much less than this. Because of the lack of local supplies of fresh milk most of the dairy products consumed in Malaysia and Singapore are imported. These imports come either as liquid milk or in the form of other milk products principally skim milk powder and anhydrous butter fat.

Liquid milk is imported in the following forms:

1. Long life milk in Tetrapak,
2. Frozen fresh milk,
3. Sterilized in tins or bottles.

Skim milk powder and butter fat are imported for use as raw materials for the domestic production of:

1. Sweetened condensed milk,
2. Evaporated milk (unsweetened),
3. Recombined milk, sterilized either by ultra-high-temperature or conventional methods and often flavoured,
4. Ice-cream,
5. Reconstituted butter.

Items 1-5 above are also imported in finished form. In addition there are substantial imports of milk based infant foods, full cream milk powder, butter, cheese, ghee and skim milk powder for animal feed. The last four items are not included in the totals in Table D1 below.

Because of the wide variety of forms in which these products are obtained they cannot be simply combined together by weight or value to get an indication of the relative amounts imported into the country. For comparative purposes each product has been converted to its equivalent quantity of fresh milk. This gives a much better indication of the relative importance of the various products in total consumption. Table D1 shows the net imports, that is imports minus exports, of milk and milk products into West Malaysia and Singapore for the years 1966-1969, in terms of fresh milk equivalent.

In West Malaysia net imports of total milk products were virtually static between 1966 and at about 46 million gallons f.m.e. However net exports of sweetened condensed milk were substantial in three years, and there were in fact rises of 20, 40 and 80 percent in imports of sterilised, powdered full cream milk and infant food respectively.

TABLE D1

ESTIMATED NET IMPORTS OF MILK AND MILK PRODUCTS, WEST MALAYSIA AND SINGAPORE, 1966-69
(THOUSAND GALLONS FRESH MILK EQUIVALENT)

(1) West Malaysia

Item	Year 1966	1967	1968	1969	Percent Change 1966 - 1969
Butter fat)	25,950	33,700	40,500	42,600	+ 21
Skim milk powder)					
Sterilized in tins	63	51	81	76	-
Frozen milk and cream	30	25	36	30	+ 42
Milk and cream, other	121	93	24	3	+ 81
Powdered full cream	5,500	6,180	7,210	7,820	-
Infant food	4,730	5,510	6,040	8,540	-
Evaporated, unsweetened	2,020	1,465	- 90	- 1,310	- 0.9
Sweetened, condensed	8,320	- 5,010	- 8,340	- 6,490	
Total	46,730	42,194	45,475	46,304	

(2) Singapore

Butter fat)	7,850	9,220	12,350	16,320	+190
Skim milk powder)					
Sterilized in tins	123	190	226	357	+ 51
Frozen milk and cream	132	238	192	200	+145
Milk and cream, other	104	53	197	255	+126
Powdered full cream	3,050	4,100	5,120	6,880	
Infant food	n.a.	n.a.	1,740	n.a.	
Evaporated unsweetened	1,395	1,365	1,585	1,285	
Sweetened, condensed	3,240	3,580	1,840	- 588	+ 55
Total(1)	15,900	18,750	22,010	24,700	

(1) Excludes infant food.

Over the same period imports of milk products into Singapore rose by about 55 percent overall. The greatest increases were in sterilised, (190 percent), frozen, (51 percent), milk and cream, other, (145 percent) and powdered full cream (126 percent).

The imports in 1969 indicate a per capita consumption of about 75 gallons in West Malaysia and of about ten gallons in Singapore. The larger consumption in Singapore is probably explained by the higher incomes enjoyed there and by the greater urbanisation of the population.

As noted earlier, the milk products imported are used to produce a wide range of finished products, Table D2 shows estimates of sales in 1969 of various milk products in West Malaysia and Singapore. This table shows that overall in West Malaysia and Singapore more than two-thirds of consumption is in the form of sweetened condensed milk. However, this is probably the slowest growing section of the overall market for milk products. The final column of Table D1 shows the percent change in imports for various milk products and it is noticeable that imports into both Singapore and Malaysia for liquid and powdered forms of milk rose much more rapidly than for total milk products. Similarly in Singapore the proportion of consumption accounted for by sweetened condensed milk is considerably smaller than in West Malaysia, being 55 percent as compared with 75 percent.

Because (a) nearly all present requirements are imported (b) imports will remain predominant for many years and (c) the numerous products have widely different income elasticities of demand, the potential market for locally produced milk cannot be validly projected by considering the overall consumption figures. It is necessary to examine the major individual components of the market. To assist in making market projections a survey was carried out by the Consultants in April 1970 into the consumption of a number of fish, meat and dairy products. Members of some 1900 households in South Johor were interviewed. Table D3 shows, by race and income group, the proportion of households purchasing sweetened, condensed milk and their median monthly expenditure per adult male equivalent. The results shown in this table indicate that the proportion of households consuming condensed milk is high at all income levels and among all three of the major racial groups, except among low income Chinese families. As incomes rise the proportion of households consuming this product hardly rises at all and expenditure per adult male equivalent on this product is virtually static once the household income has passed beyond the $200 per month level. This suggests a very low income elasticity of demand for this product, possibly almost equal to zero, and supports the claim of manufacturers of condensed milk that the market for their product is virtually stagnant.

TABLE D2

ESTIMATED SALES OF MILK, 1969, IN THOUSAND GALLONS FRESH MILK EQUIVALENT

	Singapore	West Malaysia	Total	Source
Sweetened condensed	8,400-10,500	31,500	41,000	1 2
Unsweetened evaporated	1,475	1,625	3,100	3
Reconstituted milks	275	750	1,025	3
Sterilized, frozen and	(1,125)	875	2,000	
Other imported milks	850	125	975	3
Full cream powdered	6,880	7,210	14,090(a)	4
Total	19,000	41,200	60,200	

(a) 1968 figure

Source: (1) Estimates by Singapore producers
(2) Straits Times May 1970
(3) A local producer.

TABLE D3

PROPORTION OF HOUSEHOLDS PURCHASING SWEETENED CONDENSED MILK, AND MEDIAN MONTHLY EXPENDITURE PER ADULT MALE EQUIVALENT, BY RACE, AND INCOME GROUP

Household Income Group	MALAY		CHINESE		INDIAN	
	Proportion Buying	Median Expenditure $	Proportion Buying	Median Expenditure $	Proportion Buying	Median Expenditure $
Less than $100	84	0.60	40	0.87	100	1.00
$100 - 199	92	0.92	74	1.27	83	1.54
$200 - 299	93	1.17	86	1.28	71	2.19
$300 - 499	91	1.26	92	1.38	70	2.0
$500 & over	92	1.26	91	1.58	76	2.06

The imported constituents for condensed milk, that is butter fat and skim milk powder are obtained at very low prices, principally from New Zealand, Australia and a number of West European countries. In 1969 the average landed value c.i.f. Singapore of skim milk powder was 29 cents per pound and of anhydrous butter fat 85 cents per pound. Combining them in the ratio 8.5 to 3.5 gives a price in fresh milk equivalent terms of about 50 cents per gallon. There is in the near future some prospect of an agreement within GATT to fix a price for skim milk powder higher than the present level. This could raise the price in Singapore to about 40 cents per pound. Such an increase would result in the raw material costs in Singapore and Malaysia rising to about 67 cents per gallon fresh milk equivalent. On the basis of available data it does not appear at present that fresh milk could be produced in West Malaysia at prices to compete with these products. However, fresh milk is much more readily substitutable for a number of other milk products, especially imported forms of liquid milk and also powdered milk type products, which are usually combined with water to make a liquid product for consumption purposes. Table D4 shows the quantity of imported products falling within these categories plus present domestic milk production for the year 1968. The total for these items is equivalent to just under 25 million gallons of fresh milk or approximately 2.26 gallons per head per year of the population of West Malaysia and Singapore.

TABLE D4 NET IMPORTS OF LIQUID AND POWDERED MILKS, WEST MALAYSIA AND SINGAPORE, AND MILK PRODUCTION WEST MALAYSIA, 1968

	Thousand Gallons Fresh Milk Equivalent
Net Imports Singapore	7,476
Net Imports West Malaysia	13,389
Production West Malaysia	4,000
	24,865

Four major questions now arise in considering the potential market for milk producers in the Project Area:-

(a) How fast will the market grow for liquid and powdered milks?
(b) How much of this market could be taken by fresh milk?
(c) How big a market will there be for production in Johor?
(d) What will be the price level for fresh milk at the farm?

The figures given in Table D1 indicated that imports of liquid and powdered milk products into West Malaysia and Singapore have been expanding in recent years. A further insight into the potential future growth in the market for these products was given by the results of the household survey carried out by the South East Johor Project, (Table D5).

The overall proportion of households interviewed buying fresh milk was low, three percent of Malay households, seven percent of Chinese and 21 percent of Indians. The median expenditure per adult by consuming families showed considerable variations but did tend to increase at high income levels. Above $500 per month ($300 for Indians) there was also a significant increase in the proportion of households buying milk. In order to give some idea of the market, respondents were asked why they did not buy more (or any) fresh milk. The responses are indicated in Table D6. The majority of Malays, except for those households with incomes of less than $100 per month, said they did not buy more milk because they did not like it. Those with lowest incomes may never have tested it so would not know and possibly gave cost as their reason. Similarly more than 50 percent of Chinese in all income groups said that they did not like milk. The dislike for milk was less prevalent among Indians but still amounted to about 40 percent of the population.

TABLE D6 PROPORTION OF HOUSEHOLDS BY REASON FOR NOT BUYING FRESH MILK, BY RACE AND INCOME GROUP

Reason	Less than $100	$100-199	$200-299	$300 499	$500 and over
(a) Malays					
Don't like it	44	60	59	63	58
Too expensive	24	12	9	7	7
Not available	28	21	24	20	25
Other	3	7	8	10	9
(b) Chinese					
Don't like it	65	53	53	57	58
Too expensive	30	28	19	9	8
Not available		10	18	25	25
Other	5	8	10	9	9
(c) Indian					
Don't like it	50	48	38	35	24
Too expensive	50	17	29	10	8
Not available	-	21	29	15	28
Other	4	14	5	40	40

TABLE D5

PROPORTION OF HOUSEHOLDS PURCHASING FRESH MILK AND MEDIAN MONTHLY EXPENDITURE PER ADULT MALE EQUIVALENT, BY RACE AND INCOME GROUP

Income Group	MALAYS		CHINESE		INDIANS	
	Proportion Buying	Median Expenditure $	Proportion Buying	Median Expenditure $	Proportion Buying	Median Expenditure $
Less than $100	3	0.17	5	0.07	25	0.07
$100 - 199	2	0.21	3	0.14	6	2.5
$200 - 299	4	0.37	5	1.50	5	7.0
$300 - 499	2	0.75	7	0.19	45	2.25
$500 & over	8	2.5	22	0.62	44	1.25

The most readily available substitute for fresh milk is powdered milk which can be mixed with water to produce a very similar product. The results obtained in the survey for this product are summarized in Table D7.

Because of the small number of families consuming fresh milk the data obtained in the survey for this product are not substantial enough for valid projection of future demand changes. However the data for powdered milk provide a more reliable base. The values obtained, (Table D7), indicate income elasticities of demand for powdered milk in the region 1.0 for the Malays, 1.5 for Chinese and 0.5 for Indians. Since Indians comprise only 10 percent of the population it may be reasonable to assume that for the population as a whole the income elasticity of demand for powdered milk (and for products which are close substitutes) lies within the range of 1.0 to 1.3. This means that a one percent rise in per capita incomes will be accompanied by a rise in consumption of these products of between one and 1.3 percent at constant prices.

TABLE D7

PROPORTION OF HOUSEHOLDS PURCHASING POWDERED MILK AND MEDIAN EXPENDITURE PER ADULT MALE EQUIVALENT, BY RACE AND INCOME GROUP

Income Group	MALAYS		CHINESE		INDIANS	
	Proportion Buying	Median Expenditure $	Proportion Buying	Median Expenditure $	Proportion Buying	Median Expenditure $
Less than $100	9	0.91	-	-	50	3.0+
$100 - 199	18	1.31	12	0.95	50	1.7
$200 - 299	23	1.29	14	1.00	67	2.0
$300 - 499	33	1.48	35	1.27	80	1.3
$500 & over	50	1.89	51	2.92	84	2.5

+ two respondents only

These results indicate a rapid rise among all groups, both in the number of households purchasing powdered milk and also in the expenditure by those consuming households. The percentage increase in the Indian group is lower only because this group uses powdered milk widely even at low income levels. Although more than 50 percent of Malay and Chinese respondents in the highest income group previously indicated that they did not like fresh milk, 50 percent of all households indicated here that they did buy powdered milk. Table D8 below shows that the product was usually purchased only for the children, but it also reveals that, as incomes rise, an increasing proportion of households use powdered milk for other purposes.

TABLE D8

PROPORTION OF HOUSEHOLDS BY USE OF POWDERED MILK, BY RACE AND INCOME GROUP

Use	INCOME GROUP				
	Less than $100	$100-199	$200-299	$300-499	$500 and over
(a) Malays					
In coffee and tea	2.6	1.7	1.5	2.1	3.4
As a drink alone	2.6	1.4	5.1	5.7	9.4
Just for children	7.8	19.2	17.4	26.0	31.6
Combination of above	1.3	4.8	8.2	8.3	12.6
Other	0.4	0.2	0.5	0.5	1.7
No answer	85.3	72.9	67.2	57.3	40.2
(b) Chinese					
In coffee and tea	-	-	0.6	0.9	4.7
As a drink alone	-	2.5	4.3	6.0	7.8
Just for children	10.0	10.1	8.6	19.7	31.2
Combination of above		3.1	3.7	8.5	14.1
Other				0.9	1.6
No answer	90.0	84.3	82.7	67.5	42.2
(c) Indians					
In coffee and tea	-	7.7	9.5	10.0	12.0
As a drink alone	25.0	1.9	4.8	20.0	12.0
Just for children	25.0	25.0	28.6	20.0	8.0
Combination of above	25.0	19.2	23.8	30.0	40.0
Other			-	5.0	40.0
No answer	25.0	46.2	33.3	15.0	16.0

Table D9 shows the growth in per capita consumption of liquid and powdered milk product in Malaysia and Singapore for income elasticities of demand of 1.0 and 1.3. Per capita income has been assumed to grow at four percent per annum in Malaysia. These per capita consumption figures have been converted to total consumption assuming a population growth rate of two percent per annum in Singapore and 2.8 percent per annum in West Malaysia, (Table D10).

Total consumption in the two countries is expected to grow from around 27 million gallons of fresh milk equivalent in 1970 to 100 million gallons by 1990.

TABLE D9 ESTIMATED PER CAPITA DEMAND OF LIQUID AND POWDERED MILK PRODUCTS, WEST MALAYSIA AND SINGAPORE, 1970-1990 (GALLONS FRESH MILK EQUIVALENT)

	West Malaysia		Singapore	
Income Elasticity	1.0	1.3	1.0	1.3
1970	2.071	2.083	4.124	4.148
1975	2.462	2.513	5.273	5.382
1980	2.928	3.032	6.743	6.984
1985	3.481	3.649	8.623	9.038
1990	4.140	4.403	11.026	11.726

TABLE D10 ESTIMATED TOTAL DEMAND FOR LIQUID AND POWDERED MILK PRODUCTS, WEST MALAYSIA AND SINGAPORE 1970-1990 (MILLION GALLONS FRESH MILK EQUIVALENT)

	West Malaysia		Singapore	
Income Elasticity	1.0	1.3	1.0	1.3
1970	19.701	19.816	8.148	8.196
1975	26.934	27.492	11.643	11.883
1980	36.892	38.203	16.439	17.027
1985	50.126	52.546	23.211	24.328
1990	67.068	71.329	32.767	34.847

The whole of the above requirement is unlikely to be met in the foreseeable future by fresh milk. The extent to which the latter will take over from imported products will be determined by several factors, among them the following:-

(1) The continued use of proprietary baby foods, principally based on milk but containing other ingredients, in infant diets.

(2) The present popularity of powdered milk for young children.

(3) The impossibility of keeping milk fresh for any length of time without adequate refrigeration in the warm humid conditions that prevail in West Malaysia and Singapore. In this connection it is of some interest to note that the consumption survey carried out in South Johor indicated a marked similarity between the main racial groups in the relationship between ownership of refrigerators and incomes. About ten percent in the $100-$199 per month income group, rising to about 70 percent in households with incomes of over $500 per month, owned refrigerators. Thus the majority of households might reasonably be expected to afford a refrigerator by 1990.

(4) The price of fresh milk relative to the various alternative products. Imported liquid milks are at present retailed in Singapore at prices from 60 cents to over $1.00 per pint. Powdered milks are sold at retail prices equivalent to between 25 and 35 cents per pint according to quality, those with better dissolving properties selling for the higher prices. It seems reasonable to expect that fresh milk could compete successfully with powdered forms at a retail price of 40 cents per pint ($3.20 per gallon). Taking the above factors into account it is considered reasonable to assume that half of the combined projected consumption of liquid and powdered milk products could be replaced by fresh milk retailed at 40 cents per pint. This would mean a market for 50 million gallons of fresh milk in West Malaysia and Singapore by 1990.

The whole of this market will not be supplied by Johor, but South Johor, which embraces the project area, is in a preferential position to supply fresh milk to meet both the Singapore demand and Johor's share of the West Malaysian requirement. Assuming the latter to be in line with the State's share of the West Malaysian population (15 percent) then it will amount to about five million gallons per year by 1990. Added to the estimated 16 million gallons for Singapore this would make a potential market for Johor producers of something over 20 million gallons of fresh milk per year by 1990. This indeed could well be an underestimate because in highly urbanised Singapore income levels are about double those in Malaysia and the proportion of the total market taken by liquid milk could easily be higher than 50 percent.

The potential market for South Johor milk producers is therefore taken at about 20 million gallons per year in 1990. In the absence of firm collection, processing and distribution costs the farm gate value of the production has been assumed to be 40 percent of the retail price. This is equivalent to:

$3.20 per gallon at farm gate for milk retailing at $1 per pint } Present High-low retail prices in Singapore.
$1.92 per gallon at farm gate for milk retailing at 60 cents per pint }

$1.28 per gallon at farm gate for milk retailing at 40 cents } Future estimated price for 20 million gallons demand.

In the long term, when supplies of fresh milk are sufficient to meet the potential market, the retail price is likely to go down to the 40 cents a pint level. In the immediate future it could be as $1 per pint, although existing retailers might drop the price of the imported products in order to safeguard their market if local supplies threatened to make serious inroads on it. Prudence suggests a starting price of 85 cents a pint retail, that is $2.75 per gallon at the farm gate, and this has been assumed in this report.

Supply forecasts have to be made also in order to ascertain the quantity of fresh milk put onto the market at any time and therefore the likely equilibrium price. On the basis of an estimate of possible production of 11-12 million gallons extra by 1990 a retail price of 55 cents per pint and $1.80 per gallon at the farm gate is suggested.

The basic farm gate price projections are as follows:- ($ per gallon)

1970	1975	1980	1985	1990
2.75	2.50	2.25	1.85	1.80

These estimates are derived from annual demand curves which show the demand/price relationships that result from the assumptions made in the preceding paragraphs. In summary these are:-

(1) That half the projected market for liquid and powdered milk can be taken up by fresh

milk at a retail price of 40 cents per pint.

(2) That demand for liquid and powdered milks will grow in accordance with (a) an increase in population of two percent per annum in Singapore and 2.8 percent per annum in West Malaysia. (b) a per capita income increase of four percent per annum in Singapore and 2.5 percent per annum in West Malaysia. (c) an income elasticity of demand between 1.0 and 1.3 in both countries.

(3) That assumptions 2(a), (b), and (c) remain constant throughout.

(4) That the present retail price in 1970 was 85 cents per pint.

Marketing of Milk

The companies which market imported milk and milk products at the present time are all willing to receive and market fresh milk in the most profitable way they can find. Hitherto little effort has gone into the promotion of fresh locally produced milk as supplies have been small and erratic in both quantity and quality. At least one large company has indicated that it is prepared to take up to 2 million gallons per year almost immediately.

There is no doubt that liquid milk has its maximum keeping quality when it has undergone the Ultra High Temperature (UHT) process involving aseptic packaging. The process, which can be used for both fresh and reconstituted milk, gives the product a shelf life of at least 3 months while still packaged. One UHT plant is currently being erected in Kuala Lumpur and another operates in Singapore. This process will probably become widespread if milk becomes cheap enough to spread to the rural areas where refrigeration is lacking. It will also be a highly suitable process for shop and supermarket sales. Short term fluctuations in supply could be treated and stored.

Pasteurised milk can also be satisfactory if the distribution system is good - as is likely in urban areas. A new process from France, involving treatment with infra-red heat is said to provide milk which keeps in its packaging for up to 2-3 weeks in European conditions. This type of plant has an advantage in that it can be operated economically in small units with relatively low investment in capital equipment.

It is recommended that, at least in the early stages, the present milk trade should handle retail sales. Any requirement for future modifications of marketing policy would be identified by the proposed Livestock Development Authority and the situation dealt with in the light of the factors involved.

APPENDIX E

APPENDIX E

CONSIDERATION IN THE EXPANSION OF DAIRYING

The development unit selected for the multiplication scheme is 5000 acres in total. With 2700 acres required for the scheme, the remaining 2300 acres should be set aside for initial expansion efforts.

1 ORGANISATIONAL CONSIDERATIONS

It is considered too early to state categorically how this expansion should be organised in detail. Much will depend on the outcome of the scheme in terms of actual profitability. Early expansion should however be concentrated round the scheme area to make full use of the expertise and demonstration on the farm. This will also serve to minimise milk collection difficulties which may arise in the early years.

Certain pointers and ideas may be appropriate here but it will be the task of the coordinating body to plan details according to the lessons learned.

It is recommended that free competition for the output of dairy stock be allowed in order that a wide range of entrepreneurs be able to enter the industry.

In general, the nature of the constraints of at the outset of the scheme is such as to preclude consideration of planning smallholder schemes for some years although large cooperatives which are able to set high standards of hygiene may achieve the same social effect. This however is not to say that small farms should not develop. It is certainly possible to see a case for a smallholder with a few cows, who is trained to a high level of competence and able to meet the standards of quality, operate close to a ready outlet. Quality standards are very important and it is necessary to see that these are observed. Such a smallholder should make a good living from a small dairy farm. If his milk is constantly rejected, however, he will quickly have to turn to some other source of income.

A more desirable form of participation by the smallholder is that he might take over some of the stock raising activities of a larger commercial milk production unit.

The production processes that can be broken down to discrete types of operation are:

i) the production of milk, dairy heifers and beef from the same herd - basically as described in this report.

ii) The production of milk only, with dairy heifers being bought in as replacements and all calves and culls sold.

iii) The raising of dairy heifers from one month old to two and a half years when they are about to calve for sale to flying herds as in (ii) above.

iv) The raising of beef animals, bought as calves and either finished for beef or sold to feed lots for finishing.

v) The operation of a feed lot, buying in fifteen to eighteen month old male animals and finishing them on a high plane of nutrition for the quality market.

vi) The raising of beef cattle - using culls from the dairy herd and breeding them to a beef bull, selling all offspring for beef with the possibility of the heifers being sold to specialist beef breeders. Under this system, each cow would suckle its calf for four to five months when it should be about 300 pounds liveweight.

vii) The use of dairy culls for the multiple suckling of beef calves. The dairy culls may be still giving ample milk for two to three calves and these can be bought in from other production units.

Farms on the lines of (iii) to (vii) above give smallholder operators less management problems and less risk. This would especially be the case if these particular facets of production were let out on a partnership/contract basis by the larger milk producers, especially the operators of flying herds (ii) above.

2 MARKETING CONSIDERATIONS

The section on marketing of milk stresses the point that the liquid milk market is likely to be the most lucrative and the aim should be to satisfy this first before considering the processing of milk into by-products such as butter, cheese, yoghourt, skim milk and powders and canned milks. Whilst the enormous surpluses of skim milk and butter in the EEC and other dairy countries seem to have disappeared in recent months, it is still true to say that even with price rises of twenty to fifty percent for imports of these products, the producer will get a better return on the

liquid milk market.

However, a close watch should be kept on the markets because a drastic fall in the average price of milk through over production can be averted by intelligently applied price equalisation systems.

There are three important factors involved in selling a quality liquid milk product. It must be stressed from the outset that standards are followed rigidly. These are:

(i) quality of composition in terms of fat and solids.
(ii) keeping quality.
(iii) safeguarding of public health.

They are all equally important. The consumer will expect standards of composition to be maintained and this must be laid down by law. Minimum standards for butterfat and solids-not-fat content are open to analysis and inspection but the tests, although relatively simple, are not capable of being performed by the general public. It is possible to stabilise milk of good fat content to an acceptable three percent butterfat with further processing of surplus fat to butter or double fresh cream resulting in an increase in total value of production.

Keeping quality is important from the consumer's point of view and thus for sales. The consumer has a right to expect milk to keep for a certain minimum length of time. The simplest way of preserving milk is pasteurisation and where milk deliveries can be organised well this may be adequate. The normal length of time that pasteurised milk can keep is two to three days in Europe and it may be one to two days only in the tropics. A new pasteurisation process involves passing thin films of milk through infra-red heat for pasteurisation and ultra-violet light to build up the vitamin D content. Under European conditions milk treated by this process keeps for two or three weeks packed in plastic bottles or cartons.

For maximum keeping quality, the most satisfactory process is U.H.T. treatment (Ultra High Temperature). Milk treated in this way is packed in sterile conditions and will keep for three to six months. For maximum distribution this process will be necessary. One U.H.T. plant is expected to be commissioned in Kuala Lumpur in 1972 and one or two are being opened in Singapore. These plants are expensive - $500,000-600,000 to commission and require a throughput of about 2000 gallons per day to provide acceptable operating costs.

Public health has to be guarded; this responsibility will belong to the Ministry of Health. In particular milk must be free of tuberculosis and must be known to be safe.

For both this and the quality aspects, the Food Technology Division should be responsible for analysis testing and the setting of standards in conjunction with the relevant Ministries.

3 PROJECTIONS OF EXPANSION

The overall rate of growth of the milking herd is likely to be about nine percent compound per year. Assuming that the scheme reaches its designed herd size of 2320 by 1976, the total number of extra adult milk cows increase by this factor annually. The implications of this are that the extra milking herd produced as a direct result of the scheme would be in the region of 6200 by 1992.

TABLE E.1 Increase in milk cow numbers, value of produce at farm-gate and retail prices

Year	Extra milk cows	$ million Value of output farm gate(1)	$ million Value of output retail(2)
1980	700	0,98	2.0
1985	2,300	3.35	7.0
1990	4,800	7.2	15.0
+1992	6,150	9.3	20.0
1995	8,600	12.9	27.0

+1992 - end of evaluation period for dairy multiplication project. It is assumed to continue.

(1) Farm gate value of output includes all sales, dairy heifers as well as milk, beef and culls.

(2) Retail value of output is assumed to be just over 100 percent above farm gate value. It reflects the total volume of business generated and includes costs of marketing and distribution.

4 PROFITABILITY TO INDIVIDUAL PRODUCERS

Two farm situations have been evaluated on much the same parameters as those used for the multiplication unit. The calculations suggest that a large farm having a herd of 120 cows, with 500 gallons average output would show over thirty percent financial rate of return whilst a successful small farmer who is able to produce an average of 400 gallons of milk per year from ten cows might only obtain a financial rate of return of about twenty percent. This assumes that milk is sold at $1.80 per gallon at the farm gate.

The smallholder situation further assumes costs for labour of $3000 per year for labour,

which would probably be supplied by the farmer himself.

These evaluations indicate the order of profitability that may be attained with the input assumptions made. Care must be taken in drawing over hasty conclusions from the smallholder exercise which further assumes that the farmer is well trained, his farm is in a suitable location for milk collection and he is able to deliver milk to the highest standards of hygiene and quality. It is on this latter point that most emphasis in the planning of the expansion phase must be placed. The market will in fact tend to sort out the good producers from the bad. Milk of low keeping and nutritional quality will not find a market and new smallholder cattle farmers should only be encouraged in systems of production which involve risks that they are easily able to bear. Thus emphasis should be on beef and heifer raising, avoiding those systems which need very high management standards.

(a) Large Dairy Farm

This situation assumes a milking herd of 120 cows giving an average yield of 500 gallons increasing by one and a half percent per year. The area covered is 130 acres. There is a case for increasing yield assumptions of larger units over smallholders and this is assumed to be a benefit of trained management.

All male calves are raised for beef and surplus females are sold off as down calving heifers.

(i) Inputs and cost flows

Land clearance is at $165 per net acre.

Machinery is at $120/acre and $5/acre running costs.

Management is provided for at the rate of $22,000/year.

Labour consists of ten men of varying skills and training paid an average wage of $200/month.

Housing is provided for sixty percent of the men at $3,500 per house.

Electricity and water are provided at a capital cost of $14,500 and $700 running costs.

Fertiliser and lime is at $60/acre.

The cost flow is:

Year	Costs
1	264,0100
2	68,000
3	65,070
9	65,430
10	80,430
20	65,430

The breakdown of the major cost items discounted at fifteen percent is:

Item	Costs	Percent of total cost
Labour	$172,758	25.5
Management	158,363	23.4
Stock purchase	75,000	11.07
Fertiliser	52,626	7.77
Buildings	45,899	6.77
Concentrates	33,352	4.92
Machinery	29,969	4.42
Housing	24,409	3.60
Land clearance	21,450	3.17
Electricity and water	18,839	2.78
Pastures	17,323	2.56
Premium and rent	14,557	2.15
Roads, fences and Vets.	13,130	1.9

(ii) Output and gross income flow

Milk output provides the major proportion of the income with beef second.

	Discounted value of output (15 percent)	Percent total output
Milk	$402,981	53.65
Beef	173,549	23.1
Culls	95,243	12.7
Heifers	79,369	10.6

This is comprised of annual sales of 60,000 + gallons of milk, 56 beef animals, 21 down calving heifers and 35 cull cows and heifers. The income flow is:

Year	Gross income
1	-
2	$136,000
5	169,808
10	178,536
15	187,938
20	198,567

(iii) Net cash flow and profitability

The net cash flow from the enterprise gives the following shape:

Year	Net cash flow
1	-264,010
2	+ 68,000
3	+ 72,550
4	+104,269
9	+111,308
14	+122,131
20	+132,637

This represents a Net Present Value of $353,307 at fifteen percent discount rate and an Internal Rate of Return of thirty four percent.

Repayment of the whole of the first year's costs can be covered readily over the first six to ten years of the project life.

Repayment term	Repayment amount per year at ten percent
5 years	$78,757
6 years	69,760
8 years	58,835
10 years	52,604

(iv) Sensitivity to input and output changes

Three further situations have been examined.

Situation	NPV Dollars	IRR percent
I. As described above.	353,307	34.0
II. As I but Land Clearance cost doubled.		
Livestock purchase cost doubled.	283,611	26.5
Concentrate use doubled		
III. As I but milk yield at 400 gallons constant	163,427	25.0
IV. As I but Milk Price reduced from $1.80/ gallon to $1.20/ gallon.	111,504	21.5

The increased profitability over that shown in the small farm situation is due to the increase in milk yield assumed.

(b) Smallholder Dairy Farm

This situation assumes that the herd consists of ten milking cows and that it is maintained at this level. The cows are milked with a bucket milking machine and the input in buildings and machinery are minimal. Ten acres of grass are required for the enterprise and costs are based on this within a gross area of eleven acres.

(i) Inputs and cost flow

The major cost items are:

Land clearance - at $165/net acre.

Pasture establishment at $120/acre and $60 for renewal.

Purchase of stock at average price $750 each.

Buildings - cowshed at $1,000
store at $500
dairy at $2,000
machinery at $3,000 + $500 running costs.

Machinery and tools at $1,500

Farm house at $3,500

Labour is included at $250/month. One man can handle the whole operation.

The total cost flow is:-

Year	Total cost
1	$27,465
2	5,297
3	5,425
4-8	5,185
9-13	5,305
14-20	5,185

(ii) Output and income flow

Milk provides the major income. This has been assumed at 400 gallons/cow/year and is valued at $1.80 per gallon at the farm gate for the whole twenty years.

Five beef animals per year are sold, together with one surplus down calving heifer, one cull heifer and two cull cows. These are priced at:

Beef $400 each
Cull $350 each
Heifer $750 each
} Held constant throughout the period

The gross income flow is:

Year	Gross income
1	-
2	7,200
3	9,200
4-20	11,700

(iii) Net cash flow and profitability

The net cash flow using the above assumptions is:

Year	Net cash flow
1	-27,465
2	+ 1,903
3	+ 3,775
4-20	+ 6,515

This is after the operation pays a wage of $3,000 per year. The Net Present Value at fifteen percent is $9,620 and the Internal Rate of Return is nineteen percent.

It is obvious that any loans can be paid off rather quickly. If the whole of the first years outflow of $27,500 is borrowed at seven percent and compounded forward to year 3 it could be paid back in ten years, at a rate of $4,200 per year. This would leave a surplus of $2,300 in year 4 onwards. This is in addition to the $3,000 already paid as wages.