Oil Palm in Sri Lanka Under Irrigated Conditions

(Report from a study by the Science and Technology Advisory Committee of the SLAAS).

The government's proposal to lease land to Guthrie, the Malaysian Government — controlled plantation giant, and the agreement in principle, (on October 12, 1981) to establish a 24,000 acre oil palm plantation in Sri Lanka met with opposition from some officials in connected Government Ministries and from the Sri Lanka Association for the Advancement of Science. The Science and Technology Advisory Committee of the SLAAS in a study of this project points out that a number of new issues are raised by this proposal. These include the leasing of land and provision of irrigation facilities to trans-national organizations in projects funded under international aid agreements ostensibly meant to benefit rural peasant farmers, large scale estate type holdings in irrigation projects, implications for the coconut industry, potential conflict areas with other settlers under Mahaveli System B, and long term leasing effects. It emphasises that growing of oil palm under irrigated land would be a loss to the Government and people of Sri Lanka. It concluded that inadequate studies appear to have been done on the project. If any feasibility studies have been done they have not been made available to the appropriate technical officers of the Ministries and Departments concerned.

This report, prepared under the auspices of the most eminent body of scientists in Sri Lanka, has been forwarded to the President and the relevant Ministries and is now under discussion.

Oil palm *(Elaeis guineensis)* was first introduced into Sri Lanka well over a century ago. Palms which are over 35 to 40 years old can be seen at Peradeniya, Agalawatte, Ruwanwella and Udugama. The first oil palm nursery in this country was established at Nakiyadeniya, in 1966 and a total of 150 ha (hectares) had been planted by 1972. By 1981, the area under oil palm had expanded to 870 ha. All these are grown under rainfed conditions.

The only commercial oil palm plantation in Sri Lanka is the estate at Nakiyadeniya, located in the Wet Zone which contains mostly Red-Yellow Podzolic soils. There is no experence of growing oil palm under irrigation in this country. The proposed venture in System B of the Mahaweli Project will be the first of its kind here and indeed the first in Asia.

This proposal to cultivate oil palm in the Dry Zone of Sri Lanka *under irrigation* in System B of the Accelerated Mahaweli Programme has been made by Guthrie's, a large international agricultural firm with extensive interests in Malaysia and other parts of the world. According to available information, the project proposal calls for the cultivation of 5,000 ha. of oil palm initially under plantation conditions followed by another 5,000 ha. to be planted and distributed among the small holders. The project is apparently to be funded entirely by the firm inclusive of processing plant. This Agricultural firm proposes to get irrigation water at Rs. 500 per hectare per year with a guaranteed supply of the quantity of irrigation water required for cultivation.

A number of new issues are raised by this proposal. These include the leasing of land and provision of irrigation facilities to trans-national organizations in projects funded under international aid agreements ostensibly meant to benefit rural peasant farmers, large scale estate type holdings in irrigation projects, implications for the coconut industry, potential conflict areas with other settlers under System B, long term ecological effects and many others. The Science and Technology Advisory Committee (STAC) of the Sri Lanka Association for the Advancement of Science has been rather concerned about these matters and decided that it would be in the national interest to study the technical feasibility/implications of this project.

(This report is the outcome of that study which has been suitably summarised for this publication).

2. ECOLOGICAL REQUIREMENTS OF OIL PALM

The ecological requirements of oil palm are discussed below in terms of climate, soil and topography.

a. Climate

The ideal mean maximum temperature should be 29—30 degrees c and the mean minimum temperature about 22—24 degrees c (Hartley, 1967). When the temperature falls below 27 degrees c a markedly reduced yield is obtained.

The mean annual rainfall should be well distributed and in excess of 2000 mm per annum for optimum production. However, areas having summer rainfall and winter drought appear to support oil palm at reasonable levels of yield. In situations of summer drought and high evapotranspiration (7—8 mm/day), irrigation will be required to maintain high production levels. These conditions are general requirements which may vary with moisture holding capacity of the soil, high wind velocities, relative humidity, sunshine hours and the like.

High relative humidity is conducive to the growth of oil palm and lowering of evaporative demand. Strong winds make pollination difficult, step up evapo-transpiration sharply and in extreme cases may cause premature fruit-fall or even scorching of the fronds of the palm. A cyclone would of course destroy a plantation completely. A radiation level of 330 cal/cm2/day is said to be the threshold requirement (Olivin, 1980). In terms of sunshine hours, a minimum of 4½ hours a day or 1600 hrs/yr are considered to be necessary (Davies, 1967).

b. Soils

Oil palm is well adapted to widely different soil conditions. Soils that have been depleted of nutrients by leaching or uptake can be re-supplied by fertilizer applications. However, some soil limiting factors are expensive or impossible to overcome These include extremes of texture (very sandy or very clayey soils), excessive stone and gravel especially as a semi-compact layer, hydromorphism, extreme acidity (PH—4) or alkalinity (PH—7.5), salinity, toxicities and inadequate depth.

c. Topography

While oil palm can grow on all kinds of terrain, flat or undulating topography is preferred from the point of view of harvesting, transport to collecting points and cultural operations. Elevation is important on account of its effect on temperature. Generally, elevations of less than about 200 metres above m.s.l. are considered most suitable (Davies, 1967).

The above requirements of climate, soils and topography are met with only in the lowland wet zone of Sri Lanka (FL1, WL2, WL4, and WL3, agro-ecological regions). Unfortunately, most of these lands are under tea, rubber or coconut at present and only relatively limited extents are available for possible cultivation with oil palm.

4. SYSTEM B — PHYSICAL FEATURES AND LAND SUITABILITY FOR OIL PALM

System B lies in the lower catchment of the Maduru Oya and Mahaweli ganga. It is bounded on the North by System A, on the West by the Mahaweli Ganga flood plain, on the South by System C and on the East by the Meeyankolla Ela and the adjacent lagoon.

The climate in the project area is characterised by an unevenly distributed rainfall of about 1750mm, more than three fourths of which falls during the North-East monsoon period, October to February. The average monthly rainfall figures for Welikanda, lying more or less in the centre of the project area show the general climatic characteristics of the area. However, the rainfall variability from year to year is very high and the 75% expectancy of dryness give much better indications of the agro-climate of the area. These values show that the area has a 75% expectancy of annual rainfall of 875 mm and has a 75% expectancy of dryness in January, second half of February, March, May, June, July, August and September and falls within the DL2 Agro-ecological region (Land and Water Use Division, 1979).

High temperatures, which reach their peak during the dry months of June, July and August, obtain throughout the year. Strong desiccating winds blow during the dry season.

SOME CLIMATIC CRARACTERISTIC

The Climate is mainly dry with an uneven distribution of rainfall totalling 1,765 mm per year falling in one season, the averae temperature being 30.6° with a mean minimum temperature of 24.2 degrees while the average relative humidity is around 74.

From the standpoint of suitability for oil palm, the climate is too dry and oil-palm can hardly survive, leave alone give economic returns. If irrigation is provided, however, oil palm should grow quite well and provide reasonably good yields probably even better than at Nakiyadeniya on account of greater insolation.

Two climatic factors which could pose real hazards to oil palm cultivation in this area still remain. The first, causing difficulty of pollination, scorching of the palms and premature fruit-fall is the strong, dry, hot wind (Kachan) which blows from June to August. The second and possibly greater hazard is the rare but deadly cyclone. This area lies right in the cyclonic belt and what befell the coconut and teak plantations in the region could well happen to oil-palm. With the government going to the extent of planning to construct cyclone-proof houses in this area, it stands to reason that serious consideration should also be given to the wisdom of establishing perennial tree crops on a plantation scale.

The soils of System B belong to seven great soil groups viz.

Reddish Brown Earths (RBE)
Non-Calcic Brown Soils (NCB)
Low Humic Gley Soils (LHG)
Alluvial Soils (AL)
Old Alluvial Soils (OAL)
Solodized Solonetz (SS)
Regosols (REG).

The morphological physical and chemical characteristics of each of these great soil groups are given in the Handbook of the Soils of Sri Lanka (de Alwis and Panabokke, 1972) and the Maduru Oya Project Feasibility Report (Acres International, 1980). Broadly, the soils can be characterised on the basis of drainage, depth, texture, salinity, alkalinity and gravelliness to assess their suitability for oil palm.

It will be evident that only the deeper Reddish Brown Earths and Non-Calcic Brown Soils and the imperfectly drained Alluvial and old Alluvial soils are suitable for oil palm cultivation in their present state: if sub-surface drainage is provided, however, Low Humic Gley soils, Alluvial soils and Old Alluvial soils will also become suitable.

The topography of System B area is mostly flat to undulating and presents no problems for the cultivation of oil palm.

The available irrigable land in the whole of System B comprises 2,580 ha of well-drained uplands and 37,180 ha of imperfectly to poorly drained lowlands. This includes land which may have to be left out to achieve a water balance and land which would be required for settlements. Since a substantial part of the 2,580 ha of upland occurs in small scattered blocks and would be needed for settlement anyway, it could be assumed that nearly all the land in the proposed oil palm project would have to come from the lowlands presently earmarked for paddy. These lands would therefore require sub-surface drainage, which would have to be added as a development cost. *The net field-water requirement* for oil palm calculated by a modified Penmann method using a crop coefficient (kc) of 1.0 throughout the year is 2308 mm or 7.7 ac. feet assuming even an 80% efficiency of irrigation. This compares with 2600 mm or 8.5 ac. ft. on Class I lands and 3,890 or 12.8 ac. ft. on Class 2 lands for two crops of rice.

Wild animal damage should be a serious concern in the proposed oil palm plantation . Damage by elephants, birds (especially crows and parrots), monkeys, rats and bandicoots would have to be contended with. Since the proposed project would be contiguous with the Somawathie Wild Life Reserve, the plantation would be a potential conflict area for wild life.

3. ECONOMIC ASPECTS

Most of the land that is likely to come under oil palm in the proposed project will, as shown above, necessarily have to come from lands allocated for rice in the feasibility report of Maduru Oya Project (Acres Int., 1980). Therefore a comparison of the costs and returns for oil palm and rice cultivation would be necessary to assess the economic advantages, if any, of substituting oil palm for rice in System B. Factors not shown by such a simple comparison of costs and returns would of course be the additional cost of drainage for oil palm and the differential cost of irrigation water. These factors are dealt with separately below.

The respective costs and returns of oil palm and rice cultivation given below have been computed on the basis of economic rather than commercial prices as oil palm will be largely for export or for import substitution and as this country will be a net exporter of rice in the near future.

3.1. COSTS AND RETURNS OF OIL PALM

The projected target yield of 3 tonnes of oil/ha has been compared with actual yields of 1.03/ha obtained at Nakiyadeniya in 1980. The higher target yield is assumed on the basis of higher radiation levels and anticipated better management in system B. "Kachan" winds and pest damage will tend to depress yields in System B. For this study this has been ignored.

Another major difference between the returns in oil palm and rice will be the long period during which oil palm will give no return at all (3 yrs.) or give only a partial return (up to about 10 yrs) in contrast to rice which will give substantial yields in the first season and target yields in the 2nd or 3rd season.

At this point, it may be useful to consider the cost of irrigation water. The sharing of the costs of upstream regulatory reservoirs is difficult. Maduru Oya costs not only consist of the trans-basin tunnel from Ratkinda, the cost of the Maduru Oya dam and the cost of the main irrigation canals, but should have components for the trans-basin canal and the upstream regulation.

OILPALM

Target yield = 3 tonnes/ha of palm oil/yr at maturity.

(i) Return/ha of Rs. 10/- per kg of oil = Rs. 30,000.00

Costs — General charges/ha = Rs. 3,300.00

Cultivation cost/ha = Rs. 2,750.00

Harvesting and manufacturing cost = Rs. 5,500.00

(Rs. 1.83/kg at yield level of 15t/ha)

(ii) Total cost = Rs. 11,550.00

Net return per hectare: (i) — (ii)

= Rs. 18,450.00

NOTE: The cost of cultivation is based on the 1980 figures for Nakiyadeniya Estate under wet zone rainfall conditions. The actual cost is very much higher on account of the additional labour required for irrigation.

To simplify the computation, a compact irrigation project currently under construction, the Kirindi Oya Project, was used to compute the present cost of irrigation water. This yielded a value of between Rs. 350/- to Rs. 400/- per acre foot of water without considering the infra-structure development and settlement costs. (M. Botejue, Irrigation Department; personal communication). Since the field-water requirement for oil palm is 7.7 ac.ft/acre., this would yield a cost of at least *Rs. 2700/- per acre per year not counting transmission losses.* A more realistic annual charge for water would be in the region of Rs. 3500/- per acre (Rs. 8700/- per ha.) if the water is being provided on a non-profit basis or Rs. 4200/- per acre (Rs. 10,500/- per ha) if a 20% return is envisaged. If the actual costs are taken it would be more than double this figure.

Now if we take the cost of irrigation water as the cost of providing water as in our major irrigation schemes at Rs. 10,500 per ha. per year, then the cost of water added to the cost of production of the Nakiyadeniya figures would work out at Rs. 22,500 per ha and the return would work out to Rs. 7,950 per ha at full maturity in the 10th year.

The break even point would only be reached after the 7th. year of planting. In the mean time water would have to be issued upto Rs. 80 million per annum with no returns.

If we take the ACTUAL cost of Mahaweli waters to the oil palm plantation, then the cost of water would exceed Rs. 21,000 per ha per year, in which case the cost of production would work out to Rs. 33,550/- per ha per annum, while giving an annual return at full maturity of Rs. 30,000/- per annum. This therefore clearly shows that even at full maturity we would not be in a position even to recover costs and therefore the project is totally non viable and would be a loss.

It would be clearly seen that this oil palm project could be made viable to the private sector only if the Government and the People Of Sri Lanka subsidise it. In fact the water subsidy would be 200% of the other costs of production of oil palm.

3.2 COST OF WATER AND RETURNS ON RICE

Now let us examine the cost of water and returns if rice is grown as in our normal colonisation schemes

Target yield = 4.1 t/ha/crop

(i) Return on 2 crops at Rs. 3,467/- per ton = 28,439.00

NOTE: The source of these figures is the Maduru Oya Project Feasibility Report (1980).

If we take the cost of irrigation water as the cost of providing water as in our major irrigation schemes at non commercial rates we would have to add Rs. 8750/- to the other costs of production, while if we take the ACTUAL costs of water under the Mahaweli Project the cost of water would be Rs. 17,500 per ha. per year. Since in the entire country irrigation water is subsidised for the peasant farmer, this cost is subsidised and not added, as it is government policy because it directly assists in the import-food substitution programme.

It is thus seen that in the case of oil palm the nett return per acre is negative even after we assumed a very much higher yield than what is now obtained at Nakiyadeniya, and even so it is a loss.

The added danger in the case of oil palm is, if a government subsidy is given, in effect it would directly contribute to profits to a commercial enterprise, which in turn would be feretted out of the country in hard currency as profits. So any subsidy to oil palm would.

(i) deprive the government and people of this country of actual rates or dues:

(ii) this very same subsidy given for water rates would be siphoned out as profits in hard currency.

4. OTHER IMPORTANT ASPECTS TO BE CONSIDERED

4.1. (a) IRRIGATION ORDINANCE

The Irrigation Ordinance is very clear in the charge of water rates. It distinguishes the costing for a commercial enterprise as against for a peasant farmer.

(1) for capital works Rs. 21,000 per hectare per year for the water used for one ha. of oil palm.

(2) In addition, for maintenance of these capital works and providing other service charges, a further charge would have to be made.

4.2 ENVIRONMENT

The environmental conditions in the early years of the plantation also encourages the proliferation of rodents which attack, the oil palm and other crops in the vicinity. The greatest changes recorded following the planting of oil palm are in the entomofaunal populations (Olivin, 1980). Many dangerous diseases related to insect vectors and capable of destroying a whole plantation can spread rapidly when oil palm is introduced into new areas. This was in fact the case when oil palm was first introduced to Latin America (Genty, 1979). Due to the continuity of the leaf mass of oil palm over large areas, new populations of pests originally present in forest species may proliferate.

In the past few years, over 70 insect pests of oil palm attacking the spear, foliage, bunches, stem and roots have been studied. These seem to behave somewhat differently in different microclimates. It would be logical to expect that new pests of oil palm could be lurking in the dry zone environment of System B, a type of environment in which oil palm has not been grown before on a plantation scale anywhere in the world.

A host of common diseases, many of them fungal in nature could spread rapidly under the ecological conditions that will prevail in the plantation unless a vigorous plant protection cum breeding programme is pursued. Some of the common conditions are blast, ring spot disease sudden wilt disease, Fusarium wilt, Ganoderma, etc. (Olivin, 1980). A pilot-scale plantation would help identify the diseases and possibly the vectors that would have to be dealt with in a larger plantation.

Several pests and diseases of oil palm could be transmitted to coconut. This is a risk that has to be faced with the introduction of commercial scale oil palm to the dry zone. At the very least, quarrantine belts should be established around the oil palm plantation.

Other environmental hazards that could arise from a large-scale oil palm plantation are those associated with the large scale use of weedicides, fungicides and insecticides, excessive use of fertilizers, especially nitrates and phosphates, and the discharge of effluents from the factory into streams and drainageways. Such contamination of streams and channels either directly or through return flows need to be vigorously monitored and controlled. Legislation specifying maximum permissible levels of each harmful ingredient should be passed and strictly enforced if major health hazards to the populations living downstream of the proposed plantation and factory are to be avoided.

Malaysia has legislation which forbids the discharge of effluents from palm oil factories into streams or channels. These effluents have high contents (—5%) of organic wastes and large amounts of oxygen are used up in their decomposition. The effluent from an oil mill of 20t/ha capacity causes as much pollution as the sewage from a city with a 70,000 population (Olvin, 1980). In this respect, we cannot do better than to emulate Malaysia and pass similar legislation. The safe disposal of the effluent from the oil mill will therefore have to be added as a production cost to the enterprise.

Then there is the aspect of environmental pollution by the release of toxic effluents that would cause irreparable damage to the gene pools; that we expect to conserve for posterity by having WILD LIFE SANCTUARIES.

4.3 SETTLEMENT

Normally in the proposed area of 24,000 acres (10,000 ha) the Government would have settled 10,000 land holding peasants, who would get a reasonable income to live independently whilst contributing to the economy of the country. In the case of oil palm as would be seen it will totally have to be sustained by government subsidy, while even if we have peasant oil palm out - growers their incomes will be totally determined on the arbitary price that would be determined by Guthrie's Ltd. whilst 12,000 acres would be run like a plantation with paid labourers and the connected social conditions that prevail in large scale rubber and tea plantations.

5. CONCLUSIONS

It would be seem that the growing of oil palm under irrigated conditions would be a loss to the government and people of Sri Lanka. The other conclusions that can be drawn on the basis of this study by the SLAAS are as follows:

1. The area best suited for oil palm cultivation in Sri Lanka is the lowland Wet Zone under rain fed conditions in which, unfortunately, available land is limited.

2. Oil palm can be grown in System B of the Accelerated Mahaweli Programme if irrigation and sub surface drainage are provided. Localised areas of unsuitable soils would have to be left out. The hazards posed by strong winds, cyclone and animal damage still bring in an element of risk.

3. Nearly all of the land for oil palm would have to come from lands presently allocated for rice.

4. Comparison with rice shows that oil palm is not more profitable than double-cropped rice even at full maturity, but may use slightly less water. However, oil palm would take much longer to come into full production than rice.

5. The cost of irrigation water is Rs. 350/- to 400/- per acre-foot in present-day irrigation schemes. The on-farm irrigation requirement of oil palm is 7.7 ac. ft/ac. If transmission losses are also taken into account, annual water charges of Rs. 3,500/- per acre (Rs. 8,700/- per ha) on a non-profit basis, or Rs. 4,200/- (Rs. 10,500/- per ha) at a 20% return would have to be made for a commercial venture. If actual Mahaweli costs are taken this figure should be more than double.

6. Oil palm would benefit the coconut industry if the palm oil is used to substitute for coconut oil and release the latter for export. If exported, palm oil would compete with coconut oil but not to any significant degree.

7. The employment potential of System B will be drastically reduced if 10,000 ha are shifted from paddy to oil palm. The size of farm for oil palm outgrowers will be difficult to fix.

8. Government may lose control over settler/labour selection in the oil palm project area, especially in the nucleus estate.

9. A major potential conflict area between the downstream settlers and the oil palm plantation would be in respect of water supply.

10. New pests and diseases could develop with the introduction of oil palm to a new ecological situation. This could pose a threat to the oil palm plantation itself.

11. Pollution from weedicides, fungicides, insecticides, fertilizers and effluents from the factory could constitute a health and environmental hazard to other settlers. Strict laws will be required to prevent the discharge of harmful effluents into waterways.

12. Diseases may be transmitted from oil palm to coconut.

13. Experience with irrigated oil palm in other countries is very limited, the total extent in the whole world being less than 5,000 ha and the biggest single plantation being only 2,000 ha (in Columbia.)

14. Donor agencies and foreign governments which are aiding the Accelerated Mahaweli Programme and the Maduru Oya Project may feel cheated if aid designed to help the rural poor is used to assist transnational companies in business enterprises.

15. The desirability of depending on foreign planting material, foreign technology and foreign marketing, all from the same organization should be carefully considered.

16. Pulling out land that is naturally suited for rice, draining it and then using it to grow upland crops while, elsewhere, the main effort in the country is to diversify well-drained lands on which rice is grown into upland crops, is an unsound and contradictory land use policy.

17. Owing to recent major investments in oil palm in many countries, the long term marketing prospects are dubious.

18. Future policy on releasing lands under major irrigation projects for oil palm has to be decided upon now, as a national palm-oil industry cannot be based on one single 10,000 ha plantation.

19. If lands are committed for oil palm cultivation, they are being committed for at least 25 — 30 years.

20. Inadequate studies appear to have been done on the project. If any feasibility studies have been done they have not been made available to the appropriate technical officers of the Ministries and Departments concerned for their assessment and appear to have been treated as classified material.