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# Qualitative Land Evaluation for Oil Palm Cultivation in Peninsular Malaysia

Adzemi Mat Arshad
Soil Science Laboratory, Food Crop Science Unit, School of Food Science and Technology, Universiti Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu, Malaysia
E-mail: adzemi@umt.edu.my

**Abstract**
The FAO Framework for Land Evaluation was used for the development of a land evaluation system for oil palm cultivation in Peninsular Malaysia. The combined limitation and parametric approach was used as it contributed to a more meaningful interpretation of the results. Twenty four soils were chosen to analyze the land evaluation system. The system of Sys *et. al.* (1991) was used for the evaluation using land characteristics. The results showed that the evaluation using land characteristics for land evaluation was preferred due to its simplicity and the data required are obtainable from soil survey reports.
**Keywords**: Land evaluation, land characteristic, oil palm, Peninsular Malaysia.

## 1. Introduction

The development of qualitative land suitability classification is a prime requisite for land use planning and development because it guides decision on land utilization towards an optional utilization of land resources. The introduction of new agronomic techniques requires serious planning. A first choice to be made in land evaluation is the distinction between quantitative and qualitative classification. Quantitative is reserved to inform the user that the interpretative groupings are distinguished in precise numeral economic terms.
In most tropical countries it is difficult to have precise information on inputs and outputs particularly for the traditional food crops. Therefore most evaluation work will be qualitative and based either on the evaluation of physical land characteristics or land qualities and their limitation. This paper employs parametric approach to determine the qualitative impact of land characteristics on oil palm cultivation in Peninsular Malaysia.

## 2. Materials and Methods

Peninsular Malaysia is located within the equatorial zone between latitudes $1^0$ 5' and $6^0$ 45'N and longitudes $99^0$ and $104^0$ 20'E with South China Sea lies to the east while Straits of Malacca to the west of the peninsula. Peninsular Malaysia has an area of 13.2 million hectares. Its greatest length is about 735 km and the maximum width is about 320 km.
The geology of Peninsular Malaysia is predominated by granite and allied acid igneous intrusive rocks. This group of rocks forms the bulk of the mountain ranges of the peninsula. At the lower elevation sedimentary formations are more predominant. Recent riverine and marine alluvium occurs on coastal plains and low hills inland. The climate is of tropical type. The natural vegetation is tropical rain forest. A total of 24 land units derived from a varied geology and providing a range of particle size class as well as different profile development stages were used in this study. Table 1 shows the soil series and their associated parent material. Figure 1 shows map of Peninsular Malaysia showing the study profiles. The evaluation of land (Table 2) for oil palm cultivation by using land characteristics uses soil and landscape criteria given by Sys *et. al.* (1991) is shown in Table 3. The suitability classification is a qualitative classification. Classes are defined with regard to the number and the intensity of the limitations and are generally related to a specific value of land indices calculated for individual ratings of characteristics according to the general formula:

$$C = A \cdot \frac{B}{100} \cdot \frac{C}{100} \cdot \cdot \cdot$$

Land suitability classification is an agreement with the FAO framework of land evaluation (FAO, 1976) defining orders, classes and subclasses. The class is indicated by an arabic number in sequence of decreasing suitability within each order. Therefore it reflects degree of suitability within each order. Based on these consideration orders and classes are defined as follows:
Order S : Suitable
Land units with no, slight or moderate limitations and no more than two severe limitations that however do not exclude the use of the land. The land index is > 25 to 100
Class S1 : Highly suitable
Land units with no or only slight limitations which in combination give land index values ranging from 75 to 100
Class S2 : Moderately suitable

 

Land units with slight or moderate limitations which in combination give land index values ranging from 50 to 74
Class S3 : Marginally suitable
Land units with moderate limitations or normally not more than two severe limitations which in combination give land index values ranging from 25 to 49.
Order N : Not suitable
Land units with more than two severe limitations or with at least one very severe limitations that exclude the use of the land. The land index is normally 24 or less.
Class N1 : Currently not suitable
Land units with severe or very severe limitations which may be overcome in time but which cannot be corrected with existing knowledge at current acceptable cost.
Class N2 : Permanently not suitable
The following subclasses are considered
t : topography limitations
w : wetness limitations
s : limitations of physical soil conditions
f : soil fertility limitations

Table 1: The Classification of the soils

| Soil | Soil Taxonomy | | FAO | Profile Number |
|---|---|---|---|---|
| | Order | Sub-group Level | | |
| Linau | Entisol | Typic Sulfaquent | Thionic Fluvisol | 1 |
| Briah | Entisol | Typic Fluvaquent | Dystric Gleysol | 2 |
| Selangor | Inceptisol | Aeric Tropic Tropaquepts | Dystric Gleysol | 3 |
| Sedu | Inceptisol | Typic Sulfaquent | Thionic Fluvisol | 4 |
| Lunas | Ultisol | Typic Kandiaquult | Gleyic Acrisol | 5 |
| Rasau | Ultisol | Typic Kandiudult | Haplic Acrisol | 6 |
| Btg Merbau | Ultisol | Typic Paleudult | Haplic Acrisol | 7 |
| Durian | Ultisol | Plinthaquic Paleudult | Ferric Acrisol | 8 |
| Rengam | Ultisol | Typic Kandiudult | Haplic Acrisol | 9 |
| Kawang | Ultisol | Plinthic Kanhapludult | Plinthic Acrisol | 10 |
| Lanchang | Ultisol | Typic Kandiudult | Haplic Acrisol | 11 |
| Jeram | Ultisol | Typic Hapludult | Ferric Acrisol | 12 |
| Bungor | Ultisol | Typic Paleudult | Haplic Acrisol | 13 |
| Baling | Ultisol | Orthoxic Tropudult | Ferric Acrisol | 14 |
| Merapoh | Ultisol | Typic Paleudult | Eutric Nitisol | 15 |
| Tebok | Ultisol | Typic Paleudult | Haplic Acrisol | 16 |
| Kuala Brang | Ultisol | Orthoxic Tropudult | Orthic Acrisol | 17 |
| Malacca | Oxisol | Xanthic Hapludox | Xanthic Ferralsol | 18 |
| Segamat | Oxisol | Typic Kandiudox | Haplic Acrisol | 19 |
| Senai | Oxisol | Typic Hapludox | Haplic Acrisol | 20 |
| Yong Peng | Oxisol | Typic Kandiudox | Orthic Ferralsol | 21 |
| Kuantan | Oxisol | Typic Hapludox | Haplic Ferralsol | 22 |
| Jerangau | Oxisol | Typic Hapludox | Acric Ferralsol | 23 |
| Kg. Kolam | Oxisol | Typic Kandiudox | Acric Ferralsol | 24 |

 

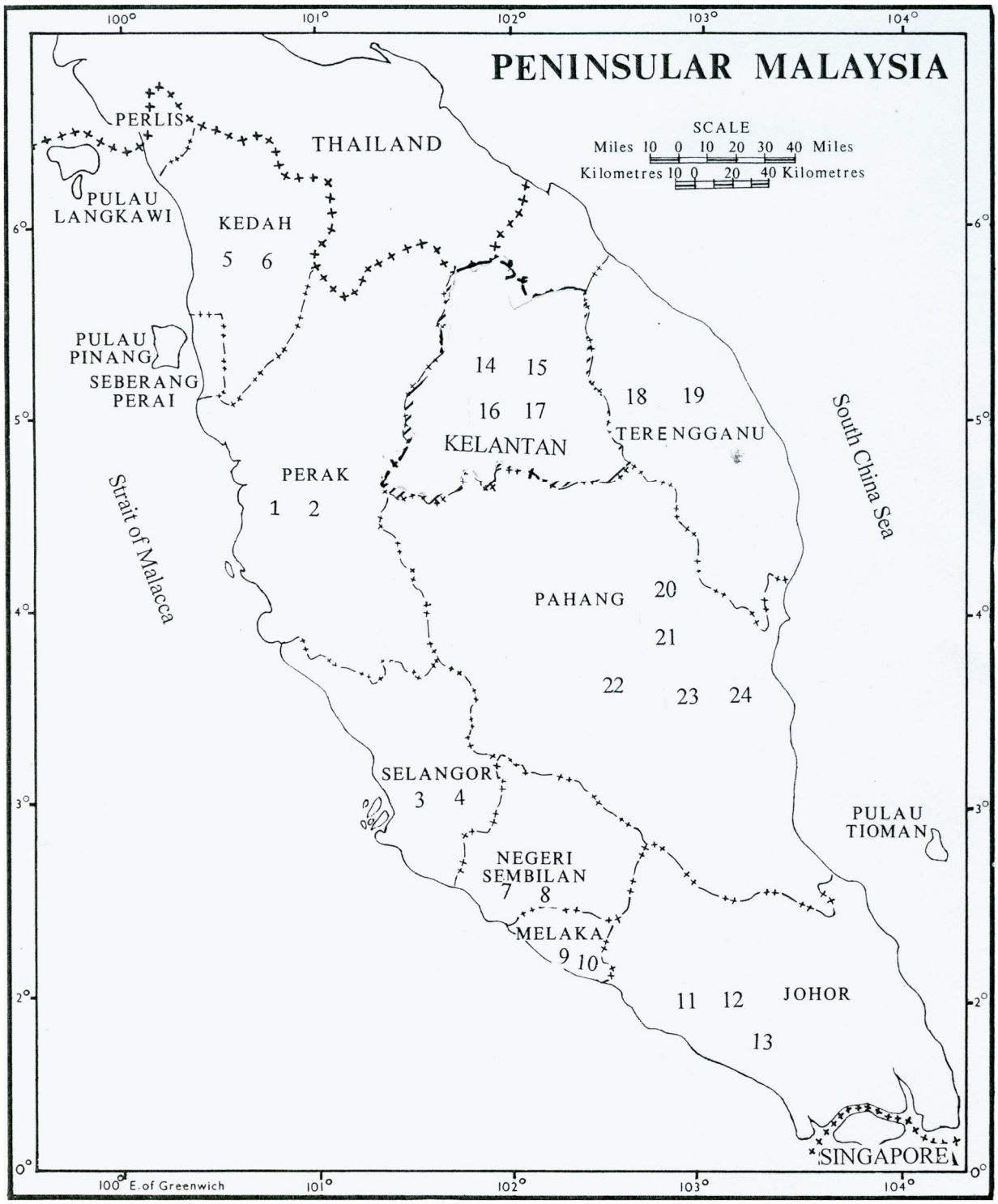


Figure 1: Map of Peninsular Malaysia Showing the Study Profiles

 

Table 2: Land Characteristics of Representative Land Units in Peninsular Malaysia

| Land Unit | Topography/ Slope (t) (%) | Wetness(w) | | Physical Soil Characteristics (s) | | Soil Fertility Characteristics at 50cm depth (f) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Flooding | Drainage | Texture/ Structure | Depth (cm) | CEC (cmol(+)/kg soil | BS (%) | pH ($H_2O$) | Organic carbon (%) |
| Linau | 2 | F2 | Poorly drained | SiCs | 47 | 36.8 | 19.6 | 3.5 | 6.5 |
| Briah | 2 | F2 | Somewhat imperf. drained | SiCs | 98 | 28 | 34 | 4.2 | 2.6 |
| Selangor | 16 | No | Imperf. drained | Cs | 120 | 19.5 | 9.1 | 3.5 | 2.5 |
| Sedu | 2 | No | Imperf. drained | SiCL | 80 | 31.5 | 4 | 2.9 | 5.3 |
| Lunas | 6 | No | Mod. well drained | SCL | 69 | 4.8 | 4.9 | 4.5 | 0.7 |
| Rasau | 1 | No | Well drained | SCL | 148 | 7.3 | 22.3 | 4.2 | 0.9 |
| Btg. Merbau | 2 | No | Mod. Well drained | Cs | 160 | 4.9 | 3.3 | 4.1 | 1.2 |
| Durian | 9 | No | Mod. well drained | C | 140 | 7.7 | 3.8 | 4.2 | 0.4 |
| Rengam | 7 | No | Well drained | SCL | 150 | 3.5 | 6.2 | 4.8 | 1.6 |
| Kawang | 14 | No | Mod. well drained | SC | 66 | 6.1 | 34 | 5.2 | 0.5 |
| Lanchang | 14 | No | Well drained | Cs | 210 | 6.5 | 5.5 | 3.8 | 1.3 |
| Pohoi | 18 | No | Mode. well drained | Cs | 97 | 5.8 | 3.6 | 4.5 | 1.4 |
| Jeram | 18 | No | Well drained | CL,SC | 95 | 7.5 | 6.1 | 4.6 | 0.8 |
| Bungor | 22 | No | Well drained | SCL | 190 | 3.2 | 12.2 | 4.8 | 0.6 |
| Baling | 15 | No | Well drained | SC | 100 | 4.8 | 9.1 | 4.9 | 0.7 |

Table 2: (Cont'd)

| Land Unit | Topography/ Slope (t) (%) | Wetness(w) | | Physical Soil Characteristics (s) | | Soil Fertility Characteristics at 50cm depth (f) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Flood | Drainage | Texture/ Structure | Depth (cm) | CEC (cmol(+)/kg soil | BS (%) | pH ($H_20$) | Organic carbon (%) |
| Merapoh | 4 | No | Mod. well drained | SC | 110 | 6.7 | 186.3 | 6.7 | 3.8 |
| Tebok | 4 | No | Well drained | Cs | 129 | 8.8 | 5.4 | 4.2 | 0.6 |
| Kuala Brang | 10 | No | Well drained | SC | 78 | 6.8 | 8.1 | 4.7 | 1.3 |
| Malacca | | No | Well drained | Cs | 152 | 5.2 | 11.3 | 4.5 | 1.2 |
| Segamat | 8 | No | Well drained | Cs | 137 | 9.2 | 2.4 | 4.4 | 1.1 |
| Senai | 22 | No | Well drained | Cs | 76 | 5.1 | 19.3 | 4.7 | 0.9 |
| Yong Peng | 16 | No | Well drained | Cs | 150 | 8.1 | 10.8 | 4.5 | 0.7 |
| Kuantan | 3 | No | Well drained | Cs | 150 | 11.1 | 2.1 | 4.5 | 1.9 |
| Jerangau | 12 | No | Well drained | Cs | 152 | 3.1 | 4.1 | 4.1 | 0.7 |
| Kg.Kolam | 18 | No | Well drained | SC | 200 | 7.2 | 4.1 | 4.7 | 0.9 |

 

Table 3: Land Suitability Requirements for Oil Palm Based on Land Characteristics

| Land Characteristic | Class, Degree of Limitation and Rating Scale | | | | | |
|---|---|---|---|---|---|---|
| | S1 | | S2 | S3 | N1 | N2 |
| | 0 | 1 | 2 | 3 | 4 | |
| | 100 | 95 85 | 60 | 40 | 25 | 0 |
| Topography (t) | | | | | | |
| Slope (%) | 0 – 4 | 5 – 9 | 10 – 16 | 17 – 30 | 31 – 50 | > 50 |
| Wetness (w) | | | | | | |
| Flooding | $F_0$ | $F_0$ | $F_1$ | $F_2$ | - | $F_3$ |
| Drainage | Well drained | Mod. Well drained | Imperf. drained | Poor (aeric) (easily drained) | Poor (typic) difficult | Very poor |
| Physical Soil Characteristic (s) | | | | | | |
| Texture/ Structure | CL, Co, SC, Cs SiCs | L, SCL SiCL | SL, LSf | LSm, LSc Cm, SiCm Sf | Sm, Sc | LcS, S |
| Soil Depth (m) | >100 | 100 – 80 | 79 – 60 | 59 – 45 | 44 – 25 | < 25 |
| Soil Fertility Characteristic (f) | | | | | | |
| CEC (cmol(+)$kg^{-1}$ soil | > 16 | < 16(-) | < 16(+) | | | |
| Base aturation (%) | > 35 | 34 – 20 | < 20 | | | |
| Organic Carbon (%) | > 1.5 | 1.4 – 0.6 | < 0.6 | | | |

For texture/structure, the suffixes: o = weak structure and consistence of the oxic horizon, s = angular or subangular structure, m = massive, f = fine, m = medium, c = coarse
Source: Sys et al. (1991)

## 3. Results and Discussion

*3.1 Land Evaluation by Land Characteristics*

The actual suitability of the land units consider the land in its original condition without any improvement measures at the time of land clearing from primary forest conditions prior to subsequent cultivation. Even if oil palm can be grown, the control of plant diseases is not done

The results showed that the actual suitability classification of the land unit are ranked as follows: Selangor, Batang Merbau, Segamat, Kuantan soil series are moderately suitable: Lunas, Rasau, Durian, Rengam, Kawang, Lanchang, Jeram, Bungor, Merapoh, Tebok, Baling, Kuala Brang, Malacca, Senai, Yong Peng, Jerangau, and Kampong Kolam soil series are marginally suitable; Linau, Briah, and Sedu soil series are currently not suitable (Table 4).

The potential suitability of the land refers to its suitability after improvements have been made on the land. The improvement that may be required include the control of flooding, the drainage of water-logged land, the control of soil erosion hazards or the construction of roads and paths to increase accessibility and trafficability. Minor improvements of the land include the use of fertilizers to improve soil fertility status for the low nutrient of the soils. The standard agronomic practices include the establishment of legume covers, the control of weeds and diseases.

The ranking of the potential suitability classification of the land units are as follows: Selangor, Rasau, Batang Merbau, Rengam, Tebok, Segamat, Senai, Kuantan, Bungor, Jerangau and Kampong Kolam soil series are highly suitable: Lunas, Durian, Kawang, Jeram, Baling, Benta, Keledang, Kuala Brang, Malacca and Yong Peng Series are moderately suitable: Briah and Sedu soil series are marginally suitable: Linau series is currently not suitable (Table5).

 

Table 4: Actual Suitability Classification of the Land Units for Oil Palm Cultivation by Using Land Characteristics

| Land Unit | Topography Slope (t) | Wetness(w) | | Physical Soil Characteristics (s) | | Soil Fertility Characteristics at 50cm depth (f) | | | Land Index | Suitability Class |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Flood | Drainage | Texture/Structure | Depth | CEC | BS | OC | | |
| Linau | 0 (100) | 3(60) | 3(60) | 1(95) | 3(55) | 0(100) | 2(85) | 0 (100) | 6 | $N_{ws}$ |
| Briah | 0 (100) | 4(30) | 4(40) | 1(95) | 1(92) | 0(100) | 2(80) | 0 (100) | 8 | $N_{wf}$ |
| Selangor | 0 (100) | 0(100) | 1(85) | 0(100) | 0(100) | 0(100) | 2(80) | 0 (100) | 63 | $S2_{wf}$ |
| Sedu | 0 (100) | 3(60) | 3(60) | 1(95) | 1(85) | 0(100) | 2(80) | 0 (100) | 22 | $N_{wf}$ |
| Lunas | 1 (90) | 0(100) | 1(90) | 1(95) | 2(75) | 2(80) | 2(80) | 1(85) | 29 | $S3_{sfc}$ |
| Rasau | 0 (100) | 0(100) | 0(100) | 0(100) | 0(100) | 2(80) | 1(90) | 1(90) | 48 | $S3_{fc}$ |
| Batang Merbau | 0(100) | 0(100) | 1(90) | 0(100) | 0(100) | 1(90) | 2(80) | 1(90) | 54 | $S2_{f}$ |
| Durian | 1(85) | 0(100) | 1(90) | 1(89) | 0(100) | 1(90) | 2(80) | 2(80) | 36 | $S3_{f}$ |
| Rengam | 1(90) | 0(100) | 0(100) | 0(100) | 0(100) | 1(90) | 2(80) | 2(80) | 45 | $S3_{f}$ |
| Kawang | 2(70) | 0(100) | 1(90) | 0(100) | 1(75) | 1(90) | 1(95) | 1(85) | 29 | $S3_{ts}$ |
| Lanchang | 2(70) | 0(100) | 0(100) | 0(100) | 0(100) | 1(90) | 2(80) | 1(90) | 38 | $S3_{tf}$ |
| Jeram | 3(55) | 0(100) | 0(100) | 0(100) | 1(90) | 1(90) | 2(80) | 1(95) | 29 | $S3_{tf}$ |
| Bungor | 3(55) | 0(100) | 0(100) | 1(95) | 0(100) | 1(90) | 2(80) | 1(85) | 27 | $S3_{tf}$ |
| Baling | 2(70) | 0(100) | 0(100) | 0(100) | 2(85) | 2(80) | 2(80) | 1(85) | 25 | $S3_{tf}$ |

Table 4: (Cont'd)

| Land Unit | Topography Slope (t) | Wetness(w) | | Physical Soil Characteristics (s) | | Soil Fertility Characteristics at 50cm depth (f) | | | Land Index | Suitability Class |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Flood | Drainage | Texture/Structure | Depth | CEC | BS | OC | | |
| Merapoh | 0(100) | 0(100) | 1(95) | 0(100) | 1(85) | 1(90) | 1(90) | 1(90) | 39 | $S3_{f}$ |
| Tebok | 0(100) | 0(100) | 0(100) | 0(100) | 1(90) | 1(90) | 1(90) | 1(85) | 41 | $S3_{f}$ |
| Kuala Brang | 2(85) | 0(100) | 0(100) | 0(100) | 2(80) | 1(90) | 1(90) | 1(90) | 33 | $S3_{s}$ |
| Malacca | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 2(80) | 2(80) | 1(90) | 30 | $S3_{sf}$ |
| Segamat | 2(83) | 0(100) | 0(100) | 0(100) | 0(100) | 1(90) | 2(85) | 1(90) | 51 | $S2_{tf}$ |
| Senai | 3(55) | 0(100) | 0(100) | 0(100) | 0(100) | 2(80) | 1(90) | 1(90) | 25 | $S3_{tsf}$ |
| Yong Peng | 2(60) | 0(100) | 0(100) | 0(100) | 2(82) | 2(80) | 2(84) | 2(85) | 31 | $S3_{tf}$ |
| Kuantan | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 2(80) | 2(84) | 0(100) | 57 | $S2_{f}$ |
| Jerangau | 2(80) | 0(100) | 0(100) | 0(100) | 0(100) | 2(70) | 2(84) | 1(85) | 34 | $S3_{tf}$ |
| Kampong Kolam | 2(75) | 0(100) | 0(100) | 0(100) | 0(100) | 2(80) | 2(70) | 1(90) | 32 | $S3_{tf}$ |

Table 5: Potential Suitability Classification of the Land Units for Oil Palm Cultivation by Using Land Characteristics

| Land Unit | Topography Slope (t) | Wetness(w) | | Physical Soil Characteristics (s) | | Soil Fertility Characteristics at 50cm depth (f) | | | Land Index | Suitability Class |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Flooding | Drainage | Texture/ Structure | Depth | CEC | BS | OC | | |
| Linau | 0(100) | 3(65) | 3(65) | 1(95) | 3(55) | 0 (100) | 0 (100) | 0 (100) | 22 | $N_{wf}$ |
| Briah | 0(100) | 2(70) | 2(70) | 1(95) | 1(92) | 0 (100) | 0 (100) | 0 (100) | 40 | $S3_{w}$ |
| Selangor | 0(100) | 0(100) | 2(85) | 0 (100) | 0(100) | 0 (100) | 0 (100) | 0 (100) | 84 | S1 |
| Sedu | 0(100) | 2(75) | 2(75) | 1(95) | 1(85) | 0 (100) | 0 (100) | 0 (100) | 45 | $S3_{w}$ |
| Lunas | 0(100) | 0(100) | 0(100) | 1(95) | 2(75) | 0(100) | 0(100) | 0(100) | 64 | $S2_{s}$ |
| Rasau | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 90 | S1 |
| Btg. Merbau | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 94 | S1 |
| Durian | 0(90) | 0(100) | 0(100) | 1(89) | 0(100) | 0(100) | 0(100) | 0(100) | 71 | $S2_{s}$ |
| Rengam | 0(100) | 0(100) | 0(100) | 1(95) | 0(100) | 0(100) | 0(100) | 0(100)] | 90 | S1 |
| Kawang | 2(75) | 0(100) | 0(100) | 0(100) | 2(75) | 0(100) | 0(100) | 0(100)] | 56 | $S2_{ts}$ |
| Lanchang | 2(75) | 0(100) | 0(100) | 0(100) | 0(100 | 0(100) | 0(100) | 0(100)] | 74 | $S2_{t}$ |
| Jeram | 2(75) | 0(100) | 0(100) | 0(100) | 1(90) | 0(100) | 0(100) | 0(100)] | 67 | $S2_{t}$ |
| Bungor | 1(90) | 0(100) | 0(100) | 1(95) | 0(100) | 0(100) | 0(100) | 0(100)] | 84 | S1 |
| Baling | 2(75) | 0(100) | 0(100) | 0(100) | 2(85) | 0(100) | 0(100) | 0(100)] | 57 | $S2_{t}$ |

 

Table 5: Cont'd

| Land Unit | Topography Slope (t) | Wetness(w) | | Physical Soil Characteristics (s) | | Soil Fertility Characteristics at 50cm depth (f) | | | Land Index | Suitability Class |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Flooding | Drainage | Texture/ Structure | Depth | CEC | BS | OC | | |
| Merapoh | 0(100) | 0(100) | 0(100) | 0(100) | 1(85) | 0(100) | 0(100) | 0(100) | 77 | S1 |
| Tebok | 0(100) | 0(100) | 0(100) | 0(100) | 1(90) | 0(100) | 0(100) | 0(100) | 81 | S1 |
| Kuala Brang | 0(100) | 0(100) | 0(100) | 0(100) | 2(80) | 0(100) | 0(100) | 0(100) | 72 | $S2_s$ |
| Malacca | 0(100) | 0(100) | 0(100) | 2(60) | 0(100) | 0(100) | 0(100) | 0(100) | 54 | $S2_s$ |
| Segamat | 1(95) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 94 | S1 |
| Senai | 2(85) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 80 | S1 |
| Yong Peng | 2(75) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 74 | $S2_t$ |
| Kuantan | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 95 | S1 |
| Jerangau | 1(90) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 86 | S1 |
| Kg.Kolam | 2(85) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 0(100) | 81 | S1 |

*3.2 Soil Properties and Management Implications*

Three soils namely Linau, Briah and Sedu are located in the coastal areas of Peninsular Malaysia at an elevation of less than 15 m a.s.l. In their natural state, they are often water-logged and subjected to constant inundation. Drainage and flood control are pre-requisites before these soils can be cultivated.

However, an efficient flood control is expensive and difficult because of the large seasonal and random variations in river discharges. The oil palm tree is sensitive to wet conditions, resulting in poor growth and yields. During drainage, care has to be taken not to lower the water-table in Linau and Sedu series below 50 cm as the C horizons contain sulfidic materials. An excessive drainage leads to the subsequent oxidation of the sulfidic conditions which are unfavourable for oil palm growth.

Linau and Briah series have a high inherent fertility but Briah series has unfavourable soil physical condition mainly structural for root penetration. Sedu series has low fertility status. The individual soil limitations when combined explain the low suitability of the three soils for oil palm cultivation.

Selangor series has no unfavourable soil physical condition and the fertility status is high (Goh, 1997) except that the soil has low pH. Lime has to be added in sufficient amount to raise the soil pH to maintain good yields of oil palm.

The Ultisols, Lunas series is moderately deep and shallow soil respectively. The Ultisols namely Rasau and Lanchang series are deep soils. The seven soil series namely Batang Merbau, Durian, Rengam, Bungor, Tebok, Baling and Merapoh series are deep soils while Jeram and Kuala Brang series are moderately deep soils. In oil palm cultivation, a good creeping leguminous crop has to be established early during planting to cover the ground and to prevent soil loss. Generally, the fertility status of these soils is low and complete fertilizers have to be added in sufficient amounts to maintain good yields of oil palm.

Oxisols namely Malacca, Segamat, Senai, Yong Peng, Kuantan and Kampong Kolam series have good physical properties which permit easy root penetration. Malacca series contains 50% by volume of loosely packed gravels from 8 cm downwards. The gravels create difficulties during planting. Babalola and Lal (1977) reported that the gravels pose problems to root penetration and proliferation.

It is important to preserve the organic matter in the top soil. The data showed that for impoverished soils such as the Oxisols, the upper horizons with higher organic matter contents contribute significantly to higher cation retention capacities and larger nutrient reserve. Soong (1977) reported that the organic matter also contributes substantially in maintaining a good soil structure. Similarly, the Oxisols are low in nutrients and oil palm grown on these soils requires an ample supply of fertilizers.

**4.0 Conclusion**

Considering the planting of oil palm on the basis of land suitability evaluation showed that Selangor, Rasau, Batang Merbau, Rengam, Tebok, Segamat, Senai, Kuantan, Bungor, Jerangau and Kampong Kolam soil series can be devoted to large scale oil palm plantation while Lunas, Durian, Kawang, Jeram, Baling, Benta, Keledang, Kuala Brang, Malacca and Yong Peng soil series for moderate scale of plantation. Briah and Sedu soil series are marginally suitable and Linau soil series is currently not suitable. For rainfed agriculture oil palm planting on the respective suitable soil series will deal mainly with maintenance of soil fertility. The evaluation work is based on survey of natural resources of land units, the final decision for planting of oil palm should be made after integrating with investigations such as socio-economic conditions, agricultural services and human resources.

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