

CHAPTER 1

INTRODUCTION

The oil palm, (*Elaeis guineensis* Jacq.) was originated from the tropical rain forest of West Africa, spreading from Senegal to Angola (Zeven, 1967). It has spread to most parts of the tropical and subtropical countries. Four oil palm seedlings planted in Bogor Botanical Gardens, Indonesia in 1848 and the seeds derived from these four palms were instrumental for the expansion of palm industry in Southeast Asia including Malaysia (Rajanaidu and Jalani, 1999). The oil palm gives the highest yield per hectare compared to other oil bearing crops (Corley and Tinker, 2016). The fruit of the palm is a central hard-shelled nut surrounded by an outer pulp called as mesocarp which contains the palm oil of commerce. The nut contains the palm kernel, from which a different type of oil, palm kernel oil is extracted. The origin of oil palm is believed to have been in Africa, but the most productive areas of the industry at present are in Malaysia and Indonesia, which supply most of the oil for international trade (Corley and Tinker, 2003). According to Corley and Tinker (2016), the average oil yield in Malaysia in 2011 was 4.42 tonnes. The average oil yield in Sarawak is lower than the Peninsular Malaysia and Sabah.

Oil palm is the highest oil yielding crop and has the potential to become the major supplier of edible oil and renewable industrial feedstock. It is a perennial crop, so a long

period of time is needed for the selection of the best parents which could give a potential high yield. It is important to obtain the basic knowledge of the variation, inheritance and genetic pattern of the materials studied. Selection in oil palm is based on the phenotypic characters, thus breeding programme of oil palm ends up with many crosses and many progeny palms (Rafii et al., 2008). The oil palm has gone through several cycles of improvement and conventional breeding methods have been the main tool in the oil palm breeding programmes. The oil palm progeny trials require large areas and high cost of maintenance. A long period of time is also required to produce good planting materials with the combination of traits of interest because economically important traits are controlled by many genes.

The main emphasis of oil palm improvement is towards higher oil yield that contributes to plantation profit. However, several other traits such as high iodine value, high kernel oil content, slow yearly height increment and resistance to pest and diseases have received attention from the breeders (Jalani et al., 1997). The domestication of oil palm has led to its improvement mainly through breeding. The breeders will select parent palms for high yield of bunches, high oil and kernel content and will make crosses between the best individuals. The breeders also must start the breeding programme with a population of palms in which there is genetic variation. The first step of genetic improvement in oil palm was based on the discovery of shell thickness inheritance where homozygous dominant, thick shelled *dura* (sh^+sh^+) was crossed with homozygous recessive shell-less, *pisifera* (sh^-sh^-) producing a 100% heterozygous, *tenera* (sh^+sh^-) (Beirnaert and Vanderweyen, 1941). Since 1960, seed producers and research institutions

used Deli *dura* and also elite *pisiferas* for the production of high yielding *tenera* (*dura* × *pisifera*) as commercial planting materials (Jalani et al., 1997).

However, the performance of the *tenera* materials was based on the Deli *dura* that originated from four Bogor palms planted in 1848 so they have a narrow genetic base. After several generations of selection, the level of additive genetic variation left in the Deli *dura* is low and most of the genetic variability present is non-additive. To increase the genetic variability, crossing with wild *dura* populations is essential. Furthermore, the ever increasing world demand for oils and fats, local demands, potential profitability and the need for the diversification of crops causes the expansion of oil palm industry. The narrow origin of these Deli *dura* populations requires the widening of genetic variability by intercrossing or by introgressing this material with new introductions from wild materials. Since the selection of the original material was likely to have been more or less at random, there should be a good chance of finding material in the primary and secondary groves of West Africa that is at least equal to or even better than presently used by breeder (Hardon, 1974). Oil palm has a long breeding cycle of 10-12 years. It is therefore of utmost importance to obtain the basic knowledge on the variability, inheritance and genetic pattern of the material studied. This information is useful in designing breeding programme for better selection and improvement.

In order to broaden the genetic base of the oil palm populations, Malaysian Palm Oil Board (MPOB) formerly known as PORIM has been collecting oil palm germplasm in Africa for the past twenty years (Rajanaidu, 1994). The collections have been made in Cameroon (1984), Zaire (1984), Tanzania (1986), Madagascar (1986), Angola (1991,

2010), Senegal (1993), Gambia (1993), Sierra Leone (1994), Guinea (1994) and Ghana (1996). These materials were evaluated and selections were carried out in various populations to see the potentials for future breeding and selections.

During July-August 1993, 104 samples of *dura* oil palm germplasm were collected from 13 sites in Senegal. A random sample of five families from each of the 13 sites (populations) was collected to provide information on differences between populations, families and seedlings. The germplasm was planted within the world largest oil palm genebank established by MPOB in Kluang, Johor in June 1996. A total of 415 open-pollinated palms were planted in trial 0.352 using Independent Completely Randomized Design (ICRD) with two replicates; 41 progenies in replicate 1 and 15 progenies in replicate 2. The materials were evaluated for the bunch yield, bunch quality components, vegetative and physiological traits. A total of 35 traits were evaluated in this study.

The objectives of the studies were:

1. To determine the performance and the genetic structure of the natural population in Senegal.
2. To determine the genetic variability among the Senegal progenies.
3. To estimate the heritability of the 35 traits studied.
4. To study the phenotypic correlation among all the traits.
5. To identify potential genotype for breeding and seed production.