

Collection of Oil Palm (*Elaeis guineensis* Jacq.) Germplasm in the Northern Regions of Ghana

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Abstract: Oil palm germplasm collection was carried out in the Northern Regions of Ghana for evaluation, screening for drought tolerance and further incorporation into breeding programmes of Ghana's Council for Scientific and Industrial Research (C.S.I.R)-Oil Palm Research Institute (O.P.R.I.). The study highlights the collection of 22 oil palm (*Elaeis guineensis*) accessions from 5 locations in the Northern Regions of Ghana. The Northern Regions are not suitable for oil palm cultivation due to unfavourable weather conditions. Only Dura (D) forms of Oil palm were present without the existence of the other forms. The smallest shell thickness recorded was 1.6 mm. Data on stem height, bunch weight, bunch length, bunch depth, bunch diameter, bunch width, bunch spine length, bunch stalk weight, fruit length and width were recorded *in-situ*. Mesocarp, kernel and shell to fruit ratios were computed. Data collected were analysed using standard procedures; Elementary statistics (mean values, standard error, range and co-efficient of variation) were computed. Results revealed some variation for both qualitative and quantitative traits assessed on the accessions. Seedlings have been raised from these accessions for testing for drought screening and yield evaluation.

Keywords: Accessions, Dura (D), *Elaeis guineensis*

INTRODUCTION

The role of germplasm in the improvement of cultivated plants has been well recognised. However, the use of germplasm collections, particularly in the developing countries, is still limited despite this wide recognition (Frankel and Hawkes, 1975; Hawkes, 1981; Holden and Williams, 1984; Gill, 1984). Until a collection has been properly evaluated and its attributes become known to breeders, it has little practical use. Germplasm evaluation, in the broad sense and in the context of genetic resources, is the description of the material in a collection. It covers the whole range of activities starting from the receipt of the new samples by the curator and growing these for seed increase, characterisation and preliminary evaluation and also for further or detailed evaluation and documentation. The Oil palm (*Elaeis guineensis*), grows in the wild, semi wild and cultivated parts of the tropics, within $\pm 10^\circ$ latitude of the equator, in Africa, South East Asia and South and Central America. However, it is endemic to the tropical lowlands of West and Central Africa, spreading from 16°N in Senegal to 15°S in Angola (Hartley, 1977). Collection and conservation of germplasm has been accelerated in the past decades to prevent the extinction of landraces and wild relatives. Since then, germplasm collection and conservation have become integral components of crop improvement

programmes for many research institutes (Reddy *et al.*, 2006). Conservation of oil palm genetic resources provides a reservoir of genes for the development of novel traits, a pre-requisite for the improvement of profitability of the crop (Hayati *et al.*, 2004).

The Northern Regions of Ghana are characterised by erratic rainfall pattern and very high temperatures, but there are some natural oil palms growing in these areas. The Oil palms growing in the Northern Regions may have some drought tolerant genes. In order to widen the genetic base of oil palm breeding materials, C.S.I.R-Oil Palm Research Institute (OPRI) in collaboration with Sumatra-Bioscience undertook a joint prospection of oil palm germplasm in the Northern Regions of Ghana to screen for resistance to drought tolerance and further incorporation into breeding programmes. This study reports the collection of oil palm germplasm from Northern Regions of Ghana and assesses the variability in the qualitative and quantitative data recorded.

MATERIALS AND METHODS

Area of study: The main area for the collection of the oil palm germplasm is in the Northern Regions of Ghana. Most of the locations were above sea level and the soil is slightly and mostly sandy, loamy but is highly heterogeneous. The vegetation in the Northern



Fig. 1: Map showing Northern part of Ghana

Regions is strictly Savanna grassland. The sampling was dependant on the availability of the local or wild oil palms within every location. There were twenty two accessions collected from five locations and not more than 8 accessions were collected from a specific location. The areas in the Northern Regions prospected were: Vogoni Korri Nadowli, Vogoni Korri Forest Nadowli, Bugri Corner Koka Bawku, Saaka Bawku and Damango Canteen Bredi Farm. The sample from Vogoni Korri Nadowli was collected by farmers in that area. The map indicates the Northern part of Ghana where the oil palm germplasm were prospected (Fig. 1).

METHODOLOGY

The sampling number for each location was neither more than eight. The sampled Oil palms had data taken on the population density, location, population size, nature of stem and a fruit and bunch analysis was done on the fruit form, fruit colour, spine characteristics, stem height, bunch weight, bunch length, bunch depth, bunch breadth, stalk weight, weight of ten fruits, weight of ten nuts, mesocarp to fruit ratio, length of fruit, diameter of fruit, diameter of kernel and thickness of shell. The means, standard deviations, standard errors and Co-efficient of Variation (CV) were computed using standard statistical methods and presented in tables.

RESULTS AND DISCUSSION

There were variations in qualitative traits such as nature of stem and spine characteristics in the Oil palm germplasm prospected in the Northern Regions. Variations in the population size were observed at the prospection sites during the collection. Only Dura (D) fruit types were observed during the prospection and all of them were nigrescens (Table 1). The lowest stem height was recorded on the germplasm collected at Damango Canteen Bredi Farm (DCBF). Short stem height is an important trait, because Oil palms with low stem height can be exploited for a long time due to their shortness which facilitates harvesting. This creates the need for such oil palms to be prospected and used in dumpy palms improvement programmes. Wide variations were also measured in some of the quantitative traits observed among oil palm collected (Table 2). Wide variations recorded on stem height, bunch weight, stalk weight and percentage shell (47.75, 61.77, 63.68 and 40.35%, respectively) suggest that these traits can lend itself to selection in plant breeding (Table 2). The range for Mesocarp to Fruit ratio (M/F) was 29.40-52.63%; this is because all the germplasm prospected were of the Dura (D) type. Okwuagwu *et al.* (2011) also reported 31.2-48.2% for Dura (D) fruit type. The general low levels of variation observed in the other traits (Table 3) suggest little potential for their

Table 1: Oil palm collection sites and their qualitative traits

Location NR	Population size	Nature of stem	Fruit form	Fruit colour	Spine characteristics
VK-F	Dense	Smooth	D	NIG	Stout, prominent, profuse
VKF-N	Dense	Smooth	D	NIG	Short, stout, disperse, sparse
BCKBM	Isolated/scattered	Rough/smooth	D	NIG	Thin, short, slender, sparse, profuse
SBW	Isolated	Rough/smooth	D	NIG	Thin, short, slender, sparse, profuse
DCBF	Isolated/dense/scattered	Rough/smooth	D	NIG	Thin, short, slender, sparse, profuse, few, scattered, very short

*NR: Northern Region; *VK/F: Vogoni Korri Nadowli; VKF/N: Vogoni Korri Forest Nadowli; BCKBM: Bugri Corner Koka Bawku; SBW: Saaka Bawku; DCBF: Damango Canteen Bredi Farm; *D: Dura; *NIG: Nigrescens

Table 2: Oil palm collection sites and their quantitative traits

Location NR	SH (m)	BW (kg)	BL (cm)	BB (cm)	BD (cm)	STW (g)	WTF (g)	WTN (g)	M/F (%)	FL (cm)	FD (cm)	ND (cm)	KD (cm)	ST (mm)
VK-F	12.5	5.2	28.5	26.0	20.5	0.7	45.7	30.5	33.0	3.2	1.5	1.1	1.2	1.6
VKF-N	13.3	10.3	37.0	34.3	26.7	1.3	47.3	31.4	33.6	3.5	1.8	1.5	1.0	2.2
BCKBM	7.7	8.0	32.4	31.4	23.2	0.8	69.9	45.0	35.1	3.2	2.0	1.6	1.1	2.7
SBW	15.0	6.5	35.8	28.5	22.1	0.9	72.4	45.3	37.8	3.5	1.8	1.5	1.1	1.8
DCBF	7.3	4.9	28.2	24.4	18.5	0.5	75.2	44.5	40.6	3.5	2.0	1.6	1.1	2.8

*NR: Northern Region; *VK/F: Vogoni Korri Nadowli; VKF/N: Vogoni Korri Forest Nadowli; BCKBM: Bugri Corner Koka Bawku; SBW: Saaka Bawku; DCBF: Damango Canteen Bredi Farm; *SH: Stem Height; BW: Bunch Weight; BL: Bunch Length; BB: Bunch Breadth; BD: Bunch Depth; STW: Stalk Weight; WTF: Weight of Ten Fruits; WTN: Weight of Ten Nuts; M/F (%): Mesocarp to Fruit Ratio; LF: Fruit Length; DF: Fruit Diameter; DN: Nut Diameter; DK: Kernel Diameter; ST: Shell Thickness

Table 3: Quantitative traits of Dura (D) fruit form

Traits	Range	CV (%)
Stem height (m)	0.50-18.00	47.75
Bunch weight (Kg)	3.00-16.00	61.77
Bunch length (cm)	22.00-41.00	19.00
Bunch length (cm)	20.50-39.00	21.83
Bunch depth (cm)	15.00-30.00	22.62
Stalk weight (g)	0.14-1.83	63.68
Fruit weight (g)	41.30-122.70	32.68
Nut weight (g)	27.50-74.90	32.08
Mesocarp to fruit ratio (%)	29.40-52.63	17.44
Shell (%)	12.20-56.20	40.35
Kernel (%)	6.30-17.90	31.95
Fruit length (cm)	2.20-4.20	13.38
Fruit diameter (cm)	1.40-2.50	15.16
Nut diameter (cm)	1.10-2.20	16.81
Kernel diameter (cm)	0.60-1.60	22.07
Shell thickness (mm)	1.00-1.75	23.44

improvement through selection in the accessions collected from the locations sampled in the Northern Regions. Low levels of variations in the collections may also be attributed to relatively few natural oil palms in the Northern Regions as a result of unfavourable climatic conditions for the growth of the crop.

CONCLUSION

From the results presented, some level of variation exists in the accessions that were collected. Seedlings have been raised from these accessions. Progeny testing will be done for drought tolerance and yield since these accessions were collected from areas which experience drought for about 6 months annually. Leaves were also sampled from the seedlings for genetic diversity studies using microsatellites.

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