SAGO PALM 15: 29－33 (2007)

On a Sago Palm (*Metroxylon sagu* Rottb.) Mini-Plantation in Bogor, Indonesia

Yoshinori Yamamoto[1], Pranamuda Hardaning[2], Akira Miyazaki[1], Nadirman Haska[2] and Tetsushi Yoshida[1]

[1] Faculty of Agriculture, Kochi University, Nankoku-shi, Kochi 783-8502, Japan

[2] BPPT (Agency for the Assessment and Application of Technology), Gedung 630, Kawasan Puspiptek Serpong, Tangerang 15314, Indonesia

Key words: Bogor, BPPT, Indonesia, sago palm, mini-plantation

インドネシア，ボゴールにおけるサゴヤシ（*Metroxylon sagu* Rottb.）ミニ・プランテーションについて

山本由徳[1]・P. Hardaning[2]・宮崎彰[1]・N. Haska[2]・吉田徹志[1]

[1] 高知大学農学部

[2] インドネシア技術評価応用庁

キーワード：インドネシア，技術評価応用庁（BPPT），サゴヤシ，ボゴール，ミニプランテーション

Badan Pengkajian dan Penerapan Teknologi, Agency for the Assessment and Application of Technology (BPPT), Indonesia, established a laboratory for agricultural technology and biotechnology (Laboratorium Teknologi Agroindustri dan Bioteknologi, Lab. TAB) to improve the extraction technology of starch from sago palm and promote the utilization of sago starch as an industrial as well as food material at Ciampea, Bogor, in 1984 (Fig. 1A, B). At the same time, BPPT bought a 1.725 ha paddy field at Cilubang, Bogor, about 10km from Ciampea, and developed a sago palm mini-plantation (Fig. 1C, D). This plantation was designed to collect various kinds of sago palm in Indonesia and to establish cultivation techniques. Lab. TAB worked towards the aim of establishing the laboratory until around 1990, but now, with a relatively few staff members (1 researcher, 2 technicians, and 1 field worker), its main objective is the tissue cultures of teak tree, zinger, and turmeric.

On the other hand, the sago palm mini-plantation has been well managed for 20 years since its establishment. The current status of sago palms in this mini-plantation is reported in this paper.

Sago palms were introduced from Maluku Islands and various places in Java Island from 1984-1986. The sago palm suckers collected from Ambon and Seram in 1984 failed to grow because of damage as a result of seawater. Seawater entered the bag holding the suckers during transportation by boat from the collection site to the airport. A total of 132 clumps of sago palms are now growing at this plantation, and they were introduced from Ambon and Seram Islands in 1985 and from the outskirts of Bogor, West Java, in

Fig. 1. Laboratory for agricultural technology and biotechnology (Lab. TAB) and sago palm mini-plantation of BPPT.
A: Signboard of Lab. TAB of BPPT at Ciampea, Bogor.
B: Inside of Lab. TAB;rs: rotary sieve for sago starch extraction; st: sedimentation tank of sago starch.
C: Overview of sago palm mini-plantation of BPPT at Cilubang, Bogor.
D: Sago palms growing in a sago palm mini-plantation.

1984 (Fig. 2). The area of sago palm planted is 1.425 ha, with a planting density of 10 m × 10 m. All palms, except for one introduced from Ambon Island, are of the non-spiny type, i.e., Molat (Yamamoto 1999). The sago palms in this plantation had been utilized as the materials for tissue culture research at Lab. TAB until around 1990. Weeding, removal of dead leaves, and sucker thinning twice a year have been performed since the plantation establishment, but fertilization at a rate of 1 kg urea per clump every 6 months was halted in 1989 due to financial problems, although irregular fertilization is still practiced. When we visited the plantation in early September 2006, the plantation was clear of weeds. Occasional empty clumps, with the remains of harvested palms and palms with flowering and fruiting, were observed. The following studies were conducted on this plantation on Sept. 2, 2004.

Materials and Methods

The maximum plant height of a clump, estimated age (years after emergence of a sucker) of each palm, and trunk height and diameter of trunk-formed palms were measured on 29 (Clump No. 1-29) and 21 clumps (Clump No. 30-50) in plots A and B, shown in Fig. 2. The clumps were numbered from the southwest to the northeast side. Planting rows were around 10 m in each plot. The trunk diameter was measured for palms with a trunk height of ≧ 3 m at breast height. The SPAD (SPAD-502, Minolta, Co.) values at the central portion of the middle leaflets of the lowest healthy living leaf were also measured on 9 and 11 three-year-old palms randomly selected in plots A and B, respectively.

Results and Discussion

The land of this plantation slopes slightly from the

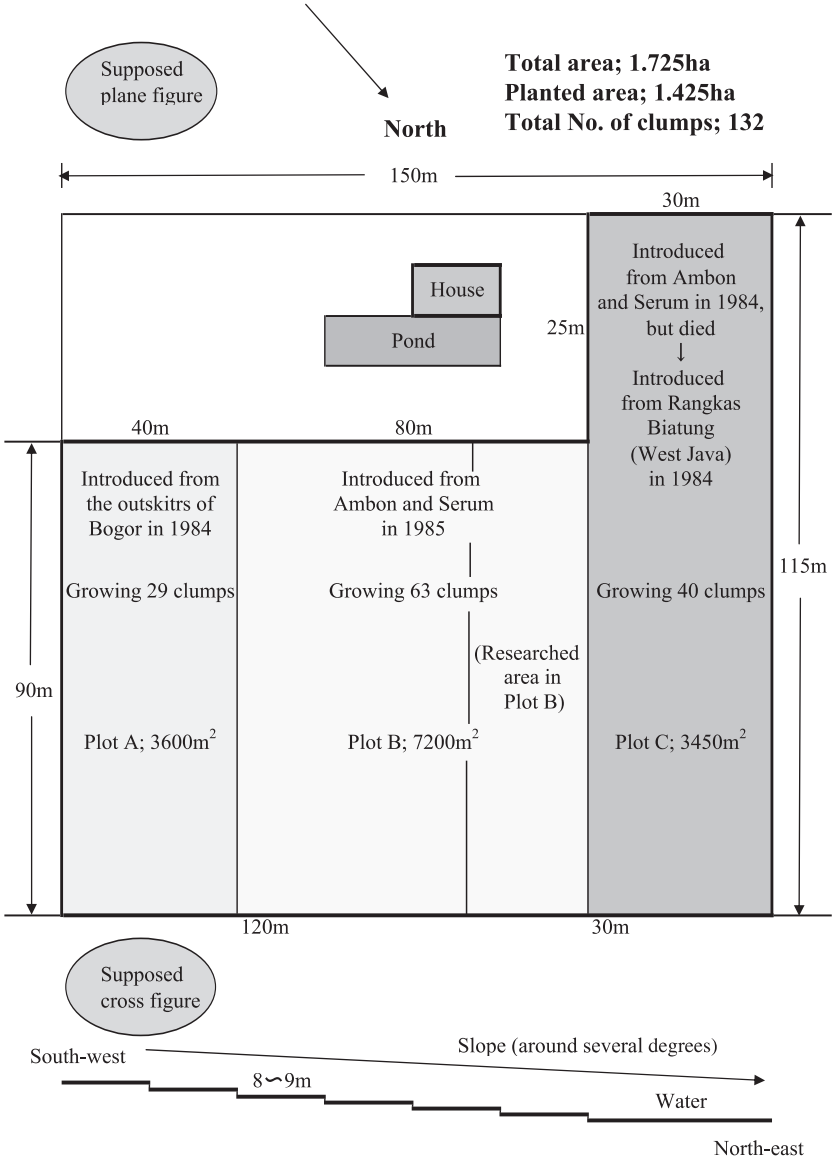

Fig. 2. Outline of a sago palm mini-plantation in Bogor, Indonesia.

southeast to the northeast, and the northeast is under swampy or lightly flooded conditions (Fig. 2). The occurrence of an empty clump was not affected by location in either plot. The percentage of empty clumps among the 50 clumps measured was 16% (8 clumps). The maximum palm height of the clump ranged from 2-15 m, with an average of 9.1 m in plot A and 10.9 m in plot B (Fig. 3), and less than 9 m and 10 m of rosette stage clumps could be observed in plots A and B, respectively. According to information from plantation staff, the trunk formation stage was estimated to be about 5 years after sucker emergence, which coincides with the reported values (Yamamoto 1998). The percentage of trunk-formed clumps was higher in plot B (76%) than in plot A (56%). The maximum number of trunk-formed palms per clump was only 2 in both plots, and the average number of trunk-formed palms per clump was 0.8 and 0.9 in plots A and B, respectively (Fig. 4). The average

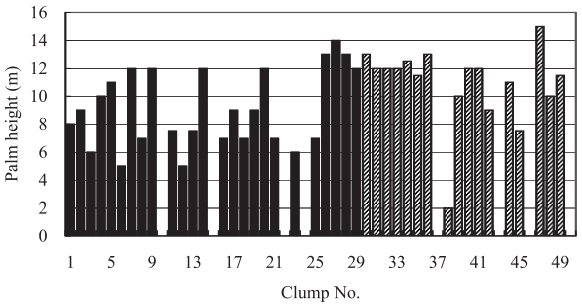

Fig. 3. Maximum palm height of clumps in plot A (clump Nos. 1-29) and plot B (clump Nos. 30-50). Clump Nos.10, 15, 22, and 24 in plot A and Nos. 37, 43, 46, and 50 in plot B were dead and empty. Refer to Fig. 2.

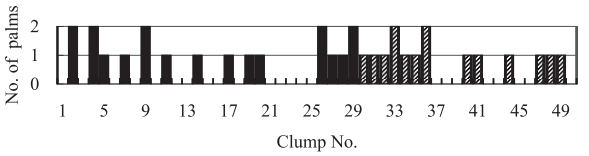

Fig. 4. Number of trunk-formed palms in plot A (clump Nos. 1-29) and in plot B (clump Nos. 30-50). Refer to Figs. 2 and 3.

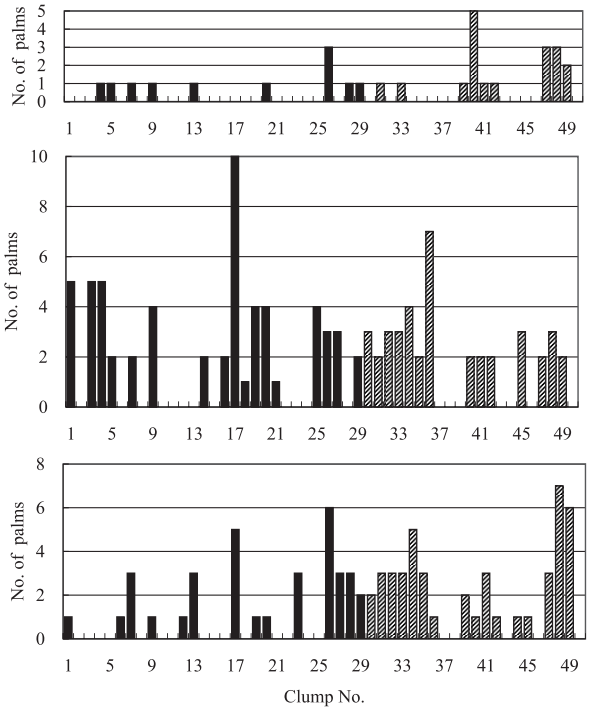

Fig. 5. Number of palms at the rosette stage of five- (upper), four- (middle), and three-year old (bottom) plants in plot A (clump Nos. 1-29) and in plot B (clump Nos. 30-50). Refer to Figs. 2 and 3.

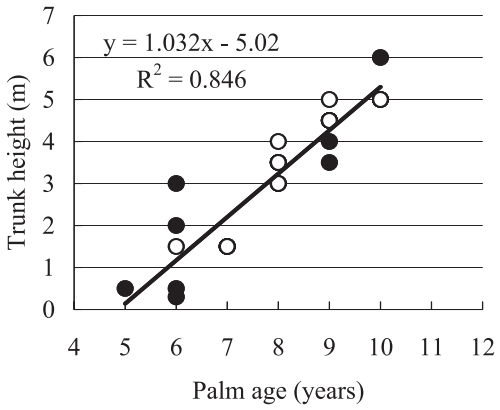

Fig. 6. Relationship between the estimated palm age and the trunk height.
●Sago palms growing in plot A, ○Sago palms growing in plot B (Refer to Fig. 2).

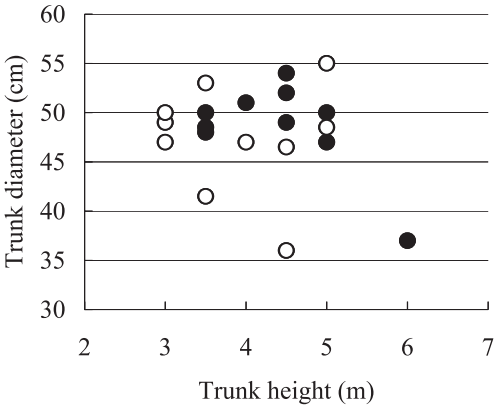

Fig. 7. Relationship between the trunk height and diameter. The trunk diameter was measured only for palms with a trunk height of ≧ 3 m.
● Sago palms growing in plot A, ○Sago palms growing in plot B (Refer to Fig. 2).

number of 5-, 4-, and 3-year-old palms in the rosette stage per clump was 0.4, 2.4, and 1.4 in plot A and 1.1, 2.4, and 2.6 in plot B, respectively (Fig. 5). These results show that the average number of trunk-formed palms per clump was almost the same in plots A and B but that in the rosette stage in 5- and 2-year-old trees was higher in plot B than in plot A. Rosette-stage palms younger than 2 years of age were profuse in many clumps, whereas, in clumps, no younger rosette stage palms were observed. These results suggested that a systematic sucker control to promote trunk formation should be adopted at this plantation, although the suckers have been thinned for a long time. Trunks were harvested at a height of 7 m, and this stage was estimated to occur 11-12 years after sucker emergence (Fig. 6). Eleven to 12 years to harvest was required, almost the same as the time for sago palms growing on mineral soil and shallow peat soil in Sarawak, Malaysia (Jong 1995, Yamamoto et al. 2003). The trunk diameter of most palms with a trunk height of ≧3 m ranged from 45-55 cm, and no clear difference was observed between the palms in plots A and B (Fig. 7). The trunk height was not closely correlated with the trunk diameter. A fruit-bearing palm in plot A showed the highest trunk height, 6m. The average SPAD value and its CV% were 68.3 and 8.7% and 70.1 and 4.4% in plots A and B, respectively, and no clear difference was observed between the two plots.

Harvested palms yielding about 60 kg dry-starch per palm were sold to a starch-processing factory for cassava at Ciluer, about 20 km from the plantation, at

a price of 20,000 Rupiah per palm. Sago starch is utilized as an ingredient of cakes and a material mixed with wheat flour. The price of the starch was 1,000 Rp. and 2,000 Rp. per kg at a factory and market, respectively. The leaf of sago palm in this plantation was also used as a roofing material at a price of 500 Rp. per leaf.

All the growth parameters and SPAD values of sago palms reported above were not affected by the growing locations, where the soil and water conditions differed from plot to plot. Moreover, no remarkable differences in growth parameters, such as trunk height and diameter, at the same palm ages were observed between the sago palms growing in plots A and B, although they were collected from different origins, i.e., the outskirts of Bogor (plot A) and Ambon and Seram (plot B). This suggested that the genetic backgrounds of sago palms collected from these two areas are similar.

This sago palm mini-plantation was well managed, as reported above, and we could easily take sago palm samples of different ages from suckers recently emerged to mature palms bearing fruit. Besides, the location of this plantation is near the Lab. TAB and Institute Pertanian Bogor (IPB), Bogor Agricultural University; it may be possible to conduct some physiological experiments using raw materials. In addition to these advantages, the easy access to this plantation makes long-term experiments possible, and we expect that the use of this plantation for additional study will be promoted.

References

Jong, F. S. 1995 Research for the development of sago palm (*Metroxylon sagu* Rottb.) cultivation in Sarawak, Malaysia (PhD Dissertation of Wageningen University, Netherlands) 1-139.

Yamamoto, Y. 1998 Sago palm. Handbook of tropical crop No.25, Association for International Cooperation of Agriculture and Forestry. (Tokyo) 1-109. (in Japanese)

Yamamoto, Y. 1999 The present condition of sago palm cultivation and utilization in Ambon, Serum, and Southeast area in Sulawesi Island in Indonesia. Jpn. J. Trop. Agr. 43: 206-212. (in Japanese)

Yamamoto, Y., T. Yoshida, Y. Gotoh, F. S. Jong, and L. B. Hilary 2003 Starch accumulation process in the pith of sago palm (*Metroxylon sagu* Rottb.). Jpn. J. Trop. Agr. 47: 124-131. (in Japanese with an English abstract)