TODDY PRODUCTION MODELS OF PB-121 AND KHINA-1 COCONUT HYBRIDS

By

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SUMMARY

Tapping PB-121 for coconut toddy can possibly reduce the loss ofproduction due to Phytophora infection and increasesfarmers income. Experiment was conducted in order to know the potential production of toddy of PB-121 hybrid compared to KHINA-1. The experiment was carried out at Pandu Experimental Garden of Research Institute for Coconut and Palmae Manado, North Sulawesi. Fourteen spathes of sixty palms or each hybrid was tappedfrom May 1991 to May 1992. Observations were made on toddy volume and its sucrose content measured daily in the morning (07:00-09:00) and afternoon (14:00-18:00). Multiple regression models were used to fit the production and sucrose content pattern of toddy. The result showed that coconut toddy production of PB-121 was higher than KHINA-1 from each spathe. Ae average toddy production of PB-121 was 52.99 litre per spathe and KHINA-1 was 46 65 litre per spathe. The sucrose contents of KHINA-1 and PB-121 were not significantly different. Model of the toddy production of KHINA-l and PB-121 differed but there was no difference between the model ofsucrose content of those two hybrid coconut varieties.

INTRODUCTION

Since 1987 PB-121 coconut hybrid from Ivory Coast, West Africa has been introduced to Indonesia for supporting the coconut improvement programme. The hybrid is a progeny of the crossed pollination between Malayan Yellow Dwarf (MYD) and West African Tall (WAT) which has been cultivated and extensively developed by coconut smallholder and estate plantation through the Smallholder Coconut Development Project (SCDP).

The characteristics of this palm are leaf production of 16-17 per year, number of fluit bunches at 14-16 per tree per year, start bearing at 3.5 to 5 years after planting, production capacity of 100-150 nuts/tree/year and ihe copra yield of 00-210 g/nut with the oil content of 69.2% (de Nuce de Lamothe, 1985).

After 10 years of its extension, there were two main problems experienced by farmers involved in this hybrid development program. Firstly the appearance of budrot brought about the death of palms. Observations in some hybrid plantations in Indonesia showed that death of palms ranging from 5 -35% has been attributed to this fungi. (Sitepu, 1990). In hybrid plantations of North Sulawesi number of palms attacked ranged from 0.3 to 81.8% per unit area (Akuba et al, 1992). The economic loss due to budrot in 1990 to 1991 was as high as Rp 736 million per year (Waroka and Mangindaan, 1992). Secondly there was a claim from farmers that the nuts produced were smaller than those of the other types of coconut. The smaller the nuts the higher the cost of processing per kg of copra or coconut oil. In spite of this, the production variability was very high according to the seasons. In the rainy season (November - April) the production was high (l 5 -20 nuts per bunch), but in the drought season (May - October) the production can drop to 5-7 nuts per bunch.

Those problems had bad impact on farmers image to coconut hybrids. They tended to refuse coconut hybrid development program even if the hybrids used are not PB-121. Consequently farmers were not interested in implementing the appropriate technology in their farms. As a result, the

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productivity of this hybrid dropped to less than 2.0 tons of copra per ha per year whilst the potential production that had been exposed to farmers would be 4.0 to 6.0 tons of copra per ha, per year. Most farmers found it difficult to pay back their loans to the bank.

In order to solve these problems, there was a recommendation to tap the spathe for getting toddy that could be processed into coconut sugar. The considerations were: 1) by tapping the spathe, coconut canopy is always 'clean' from potential stuff that can act as host or carrier of *Phytophthora palmivora;* 2) the premature nutfall disease can. be avoided; 3) farmers have a regular source of income and 4) income earned from tapping activities are higher than from processing nuts into copra.

The research was done to assess the productivity of PB-121 compared to KHINA-l hybrid. KHINA-l hybrid (Nias, Yellow Dwarf x Tenga Tall) which stands for *Kelapa Hibrida Indonesia* (Indonesia's Coconut Hybrid) have been planted and developed by coconut smallholders and estate entrepreneurs. The main characteristics of KHINA-1 are: yearly leaf production of 16-17 per palm and 14-16 fruit bunches per tree per year and starts bearing at 3.5 to 5 years after planting. Production capacity is 100- 150 nuts/tree/year with copra yield of 250 to 300 g per nut and 69% oil content (Balitka, 1990).

MATERIALS AND METHOD

This experiment was carried out at Pandu Experimental Garden of the Research Institute for Coconut and Palmae, Manado, North Sulawesi in May 1991 to May 1992. Tapping was done, on PB-121 hybrid (Malayan Yellow Dwarf x West African Tall) and KFHNA-1 hybrid (Nias YeUow Dwarf x Tenga Tall). Age of these hybrids were l l years with 12-15 m height and nut production capacity of about 100-120 nuts per tree per annum. The experiments were held in November -March and dry season in April -October.

Sixty coconut trees of each hybrid were tapped and toddy was collected from sequential fourteen inflorescences. The palm samples of PB-121 were drawn from populations of 275 palms (about 2 ha of plantations). KHINA-I palms were sampled from population of 143 palms (l ha of plantations). The unopened spathe about 70-80 cm length and 10-15 cm width and approximately three month old (it can be identified from nearly opened spathe and counted up to the third spathe) was tapped according to the method introduced by Rumokoi, Joseph and Akuba (l 992).

The observations for toddy yield and sucrose content were made daily for each spathe. Regression model was used to fit the pattern of toddy yield and sucrose content. The average of total volume of toddy on each spathe (YI) and sucrose content (Y2) were treated as dependent variable, spathe's number (XI) and type of hybrid (X2) were independent variables. The type of hybrid was dummy variable (l =KHINA- 1, and 0=PB- 12 1).

The hypothetical regression model adopted was:

$$E(Y)=Bo + BIXI + B2X\,1^2 + B3X2 + E \quad \text{.....(1)}$$

E (Y) was an estimated value of coconut toddy production (in volume). Xl was the spathe's number and X2 was the dummy variable to the coconut varieties. If X2= l then it meant KHINA- l and if X2=0 that would be PB-121.

Production and sucrose content model of KHINA-1 was as follows:

$$E(Y) = Bo + B\,l\,XI + B2XI^2 + B3X2 + E$$
$$=Bo + BIXI + B2X\,1^2 + B3(1)+E$$
$$=(Bo+B3)+BIXI+B2X\,l^2+E \quad \text{.....(2)}$$

Production and sucrose content model of PB-121 was:

$$E(Y) = Bo + B IXI + B2XI^2 + B3X2 + E$$
$$= Bo + BIXI + B2XI^2 + B3 (0) + E$$
$$= Bo+BIXI+B2XI^2 + E \quad \text{...} (3)$$

F statistical distribution was used to compare these two models.

RESULTS AND DISCUSSIONS

Toddy Production

Toddy production of both KHINA-1 and PB-121 hybrids are presented in Table 1. Toddy volume of PB-121, in average, was higher than those of KHINA-1. Respective average toddy volume of PB-121 and KHINA-1 was 53.0 litre and 46.7 litre per spathe. Toddy production of PB-121 was higher and vary more than that of KHINA-1, as figured by coefficient of variation as high as 4.06% for PB-121 and 3.8% for KHINA-1. Experiments conducted at the Bandar Kuala Coconut Research Institute, North Sumatera, found that the average amount of toddy of PB-121 hybrid was 30.9 litre per spathe (Hamzah and Jatmika, 1990). There was no previous report on toddy production of KHINA-l hybrid coconut. Jeganathan (1974) found in Sri Lanka that the amount of toddy of hybrid palm Typica x Nana was 44.8 litre and ranging from 1.8 litre to 53.21 litre per spathe.

Table 1: Average coconut toddy production of KHINA -1 and PB-121 hybrids

Spathe's number	Average toddy production (litre/spathe)	
	KHINA - 1	PB-121
1	48.28	54.52
2	48.15	54.90
3	46.17	52.61
4	45.83	52.62
5	45.52	51.99
6	44.52	51.41
7	44.02	50.69
8	44.36	49.38
9	45.87	51.82
10	46.06	51.45
11	47.62	52.53
12	47.94	55.01
13	48.78	56.11
14	49.95	56.78
Average	46.65	52.99
CV(0/0)	3.89	4.06

Both KHINA-l and PB-121 hybrid coconut had same pattern of toddy production. It was high at the first spathe and then declined on the seventh or eight spathe and rose again on the fourteenth spathe. It was estimated that the fluctuation in production was influenced by climatic condition especially the rainfall. The lowest production at the seventh and eight spathe coincided with the dry season in August to September. Rumokoi et al (l991) stated that variety, climatic and soil condition, and tapping techniques are all factors that affect toddy yield.

The experiment with Nias Yellow Dwarf at Paniki Experimental Garden in North Sulawesi showed that the daily fluctuation of toddy yield depend on climatic condition especially the amount of rainfall and temperature on the day before tapping.

The model of toddy production of spathe of both KHINA-1 and PB-121 hybrid can be approached by quadratic equation as follows:

$$Yvol=(56.75)-(1.66)X\,l+(0.12\,)X1^2-(6.33)X2 \quad \text{.....(4)}$$

Yvol is the toddy volume of any spathe, XI is the spathe's number and X2 is the dummy variable to the coconut variety. If X2=it means KHINA- l and if X2=0 is PB-12 1.

By entering the dummy variable X2=1 into toddy production, the toddy production model for KHINA- l was as follows:

$$Yvol=(56.75)-(1.66)Xl+(0.12\,X1^2-(6.33)(1)$$

$$.=(56.75)-6.33)-(1.66)Xl+(0.12)\,X1^2$$

$$Yvol^1(5\ 0.41)-(1.66)X\,l+(0.12)\,X1^2 \quad \text{.....(5)}$$

While the coconut toddy production model of PB-121 could be obtained by substituting X2=0, that was:

$$Yvol^{\,2}=(56.75)-(1.66)X1+(0.\,12)\,X1^2-(6.33)(0)$$

$$Yvol^{\,2}=(56.75)-(1.66)XI+(0.\,12)\,X1^2 \quad \text{.....(6)}$$

There was significant statistical difference between the two models but the pattem was alike. Regression coefficient indicated that there was significant difference of toddy production among spathes. This difference as stated previously, was caused by climatic factors. In order to estimate coconut toddy production on each spathe from the two coconut hybrids the different regression models above can be apphed. These regression models can just be used for first year tapping or 14 tapping spathe. Coconut toddy production pattems of KHINA-l and PB-121 are presented in Figure 1.

Sucrose content

In average the sucrose content of every spathe did not differ significantly. Sucrose content of toddy of KHINA-1 and PB-121 was 16.35% and 16.39%, respectively (Table 2). Experimental results earlier on the sucrose content of KHINA-l hybrid coconut toddy was 12.49% (Joseph and Darwis, 1987) and no report on PB-121 hybrid coconut.

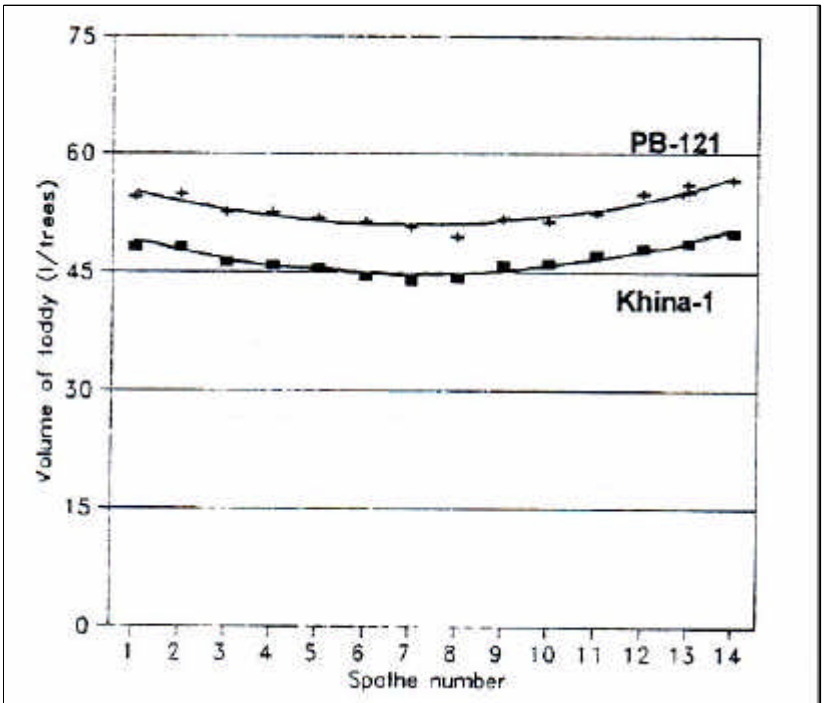

Figure 1. Toddy production of every spathe Khina-1 and PB-121 hybrid coconut

Table 2: Sucrose content of KHINA-l and PB-121 hybrid coconut toddy

Spathes number	Average sucrose content	
	KHINA - I	PB-121
1	16.22	16.30
2	16.07	16.22
3	16.29	16.40
4	16.45	16.40
5	16.39	16.32
6	16.57	16.47
7	16.48	16.45
8	16.53	16.56
9	16.73	16.29
10	16.69	16.48
11	16.39	16.34
12	16.42	16.27
13	16.22	16.14
14	16.07	16.27
Average	16.39	16.35
CV(%)	1.25	0.70

Sucrose content model of toddy differed from that of toddy production. In the first spathe, it was low but it increased in the eight to tenth spathe, then it declined succedingly to the fourteenth spathe. Fluctuation of sucrose content is assumed to be associated with climatic condition especially rainfall. Sucrose content of the coconut toddy coflected from the spathe in the dry season (April-October) was higher than of rainy season.

Sucrose content model of toddy could be approached by quadratic equation as follows:

$Ysuc.\ l = (l\ 6.0) + (0.13)X\ l - (0.009)\ X1^2 + (0.04)X^2$ ……..... (7)

Ysuc was sucrose content of every spathe coconut toddy, XI was the spathe's number and X2 dummy variable of varieties. If X2= l it means KHINA-l and if X2=0 it represents PB-121. By entering the dummy variable X2=1, model of sucrose content of toddy for KHINA-l hybrid is:

$Ysucl = (16.05) + (0.13)XI - (0.009)\ X1^2$ ..... (8)

Meanwhfle sucrose content model of toddy for PB-121 hybrid coconut can be obtained by substituting the dummy variable X2 equal to zero which results as follows:

$Ysuc2 = (l\ 6.004) + (0.13)X\ l - (0.009)\ X1^2$ …….. (9)

Sucrose content model of KHINA-l and PB-121 hybrid did not significantly differ. The regression coefficient of the models were significant at level 1%, it meant there were different sucrose content among spathe (Figure 2). In order to estimate the sucrose content of the coconut toddy from every spathe, one of those two regression equations (equation 8 or 9) can be used.

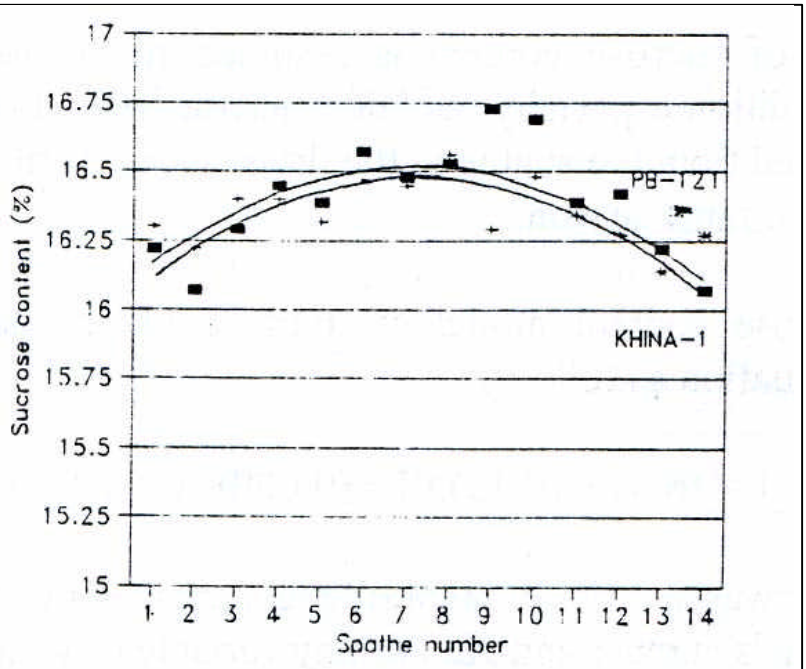

Figure 2. Sucrose content models of Khina-1 and PB-121

CONCLUSIONS

Coconut toddy production of PB-121 was higher than that of KHINA-l from each spathe. The average toddy production of PB-121 was 52.99 litres per spathe and KHINA-1 was 46.65 fitre per spathe. The sucrose content of KHINA-1 and PB-121 did not differ significantly. Model of the toddy production of KHINA- l and PB-121 differed, but there was no difference between the model of sucrose content of those two hybrid coconut varieties.

The result showed that PB-121 is feasible for tapping in order to increase farmers income and possibly reduce the risk of budrot and nut diseases incidence.

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