# STABILITY OF THE NUT CHARACTERS OF DIFFERENT COCONUT CULTIVARS

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## ABSTRACT

Nut size, weight of nut components, meat thickness, copra yield per nut and oil content of eleven coconut cultivars were observed to be stable during the five-year evaluation period. Except for the more variable weights of water and husk, coefficient of variation of their yearly means were most often below 10%.

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KEY WORDS: Coconut. Copra yield. Nut components. Oil content.

## INTRODUCTION

Among the characters of coconut, those of the fruit or nut are of prime importance. The characteristics of the nuts determine their uses as they largely influence farmers' and consumers' biases. In the Philippines, farmers prefer big-sized nuts as processing of small nuts into copra entails more labor cost considering the handling and dehusking operations despite the fact that smaller nuts could give more meat per unit of bulk than big nuts with the same meat thickness (Banzon and Velasco, 1982). Among Thai farmers, nut size is considered as a determinant factor in the saleability of their coconut in the fresh market where big nuts are more acceptable than small ones (Rattanapruk, *et al.*, 1985). Since a fresh market enterprise is more popular in Thailand than copra production, the small size of the high yielding MAWA was therefore considered a constraint in its adoption.

Nut characters such as size, proportion of meat and percentage of oil in copra are among the most important factors influencing commercially important oil yield (Banzon and Velasco, 1982). In addition, coconut varieties/types are visually identified by the characteristics of their nuts, *i.e.*, size, color, shape, *etc.* because they are easy to recognize. Nut component characteristics or fruit composition is also among the most stable characteristics of coconut and possibly the most diagnostic. Thus, nut characteristics serve as bases for distinguishing populations and selection criteria in coconut genetic improvement activities (Gruezo, 1990 and Harries, 1981 and 1982).

The RCRC at ViSCA has been characterizing a number of its coconut accessions. Part of its characterization work is on nuts, the results of which are herein described.

## METHODOLOGY

Thirty trees of each fully bearing dwarf accession namely: Albuera (ALD), Camotes (CAM), Catigan (CAT), Coconiño (CÑO), Lingkuranay (LKY), Malayan Red (MRD), Malayan Yellow (MYD) and Tacunan (TAC) were randomly chosen as samples. Of the Baybay tall (BAY), 50 trees were sampled while all available trees of the other talls with smaller stand, *i.e.* Agta (AGT) and Puringkitan (PUR), were used for the study. Fifty brown mature nuts were obtained from each population every sampling period for data gathering. Sampling was done twice a year.

Nut size was measured in terms of the polar and equatorial diameters of each nut using a measuring box patterned after the Philippine Coconut Authority's (PCA) measuring device. Polar diameter was the longitudinal measurement of a nut at its longest side while the equatorial diameter was obtained by getting the mean of the three side measurements, each side measured at its widest portion.

The nut components were accounted by weighing each whole nut, then the dehusked nut, the split nut, the meat and the shell.

Fresh meat thickness was determined after nut splitting using a dial caliper. Measurements were made at the stigmatic, polar and equatorial portions of the horizontally split nut. After weighing the different nut components, the extracted meat was oven-dried at 80°C until weights were stable to determine copra yield per nut.

For oil determination, fresh meat from a different set of sample nuts was shredded and oven-dried at 80°C until weights were stable. Oil content was determined from the resulting dried shredded sample through Soxhlet extraction method (Cagampang and Rodriguez, 1980). It was expressed as percentage of dry meat sample adjusted to 6% moisture.

Data gathering period for the above characters was five years (1989-1993).

## RESULTS AND DISCUSSION

*Nut size and shape*

Accumulated data showed considerable variability in the nut size and shape of RCRC coconut accessions but not within each population. The tall BAY had bigger nuts than the dwarfs but AGT and PUR had smaller nuts than the other dwarfs such as CAM, CAT, MRD and TAC (Table 1). ALD nuts were as big as those of AGT while CÑO, LKY and MYD had the smallest nuts.

CAM, CAT and BAY had almost round nuts while the rest were elongated. ALD, CÑO, LKY and AGT were oblong; MRD, MYD and PUR were angled while TAC was ovoid. The observed differences in size and shape were almost consistent from year to year. Variability within a population from one year to another was very little with coefficient of variation ranging only from 0.8% (CAT) to 5.7% (PUR) in polar diameter and 1.3% (CAT) to 5.5% (AGT) in equatorial diameter. Standard error of the mean was generally smaller than 1 cm except that of the equatorial diameter of AGT and the polar diameter of PUR. This finding was similar to the results of an experiment where polar diameter was seen to be less variable than equatorial diameter (Nuñez, 1992). Moreover, little variability observed in polar and equatorial diameters from year to year proved that nut size is a stable character of coconut.

Table 1. Mean nut size (cm) of RCRC coconut accessions.

| Cultivar | Range of Annual Means (1989-1993) | | General Mean | | C. V. (%) | |
|---|---|---|---|---|---|---|
| | Polar Diameter | Equatorial Diameter | Polar Diameter | Equatorial Diameter | Polar Diameter | Equatorial Diameter |
| Dwarfs | | | | | | |
| ALD | 18.2-19.4 | 15.3-16.2 | 18.5 ± 0.22d | 15.5 ± 0.17c | 2.4 | 2.2 |
| CAM | 19.2-20.3 | 16.4-17.2 | 19.6 ± 0.17bc | 16.8 ± 0.15b | 1.7 | 1.7 |
| CAT | 19.2-19.7 | 17.1-17.8 | 19.5 ± 0.08bc | 17.5 ± 0.11b | 0.8 | 1.3 |
| CÑO | 15.8-18.1 | 11.1-12.7 | 16.4 ± 0.22e | 11.9 ± 0.26e | 2.6 | 4.4 |
| LKY | 16.7-17.8 | 12.9-13.8 | 17.2 ± 0.18e | 13.4 ± 0.14d | 2.1 | 2.1 |
| MRD | 20.1-22.0 | 14.1-15.1 | 21.0 ± 0.32a | 14.6 ± 0.22c | 3.1 | 2.9 |
| MYD | 16.3-18.0 | 12.7-14.7 | 17.0 ± 0.32e | 13.6 ± 0.32d | 3.8 | 4.6 |
| TAC | 20.4-22.9 | 16.6-17.4 | 21.6 ± 0.42a | 17.0 ± 0.16b | 3.8 | 1.9 |
| Talls | | | | | | |
| AGT | 17.6-19.9 | 14.3-16.8 | 19.0 ± 0.38cd | 15.6 ± 0.44c | 3.9 | 5.5 |
| BAY | 19.7-21.7 | 18.2-19.0 | 20.3 ± 0.27ab | 18.5 ± 0.14a | 2.6 | 1.5 |
| PUR | 17.6-20.2 | 16.2-17.3 | 19.1 ± 1.55cd | 16.8 ± 0.21b | 5.7 | 2.4 |

*Nut components*

The weight of the different components of a nut is generally given more importance than the weight of the whole nut. The former serves as a measure of how efficient a genotype divides its accumulated dry matter with special regard to the meat which is the more economically important part. Further, nut or fruit composition has been recognized as a very useful criterion for distinguishing coconut populations/varieties due to their apparent stability indicating the major influence of genetic factors.

Among the parameters studied, less variability in shell and fresh meat data was observed compared with the husk and water data. Coefficient of variation of shell and fresh meat data ranged from 3.6-14.2% and 2.7-21.0%, respectively, while those of the husk and water ranged from 3.8-22.6% and 7.2-42.0%, respectively (Table 2). The highest standard error of the mean was 29.5 g (TAC) in husk weight, 27.9 g (CAM) in weight of water, 10.3 g (AGT) in shell weight, and 24.8 g (AGT) in fresh meat weight. The least was 2.6 g (CÑO) in husk weight, 3.5 g (LKY) in weight of water, 1.6 g (CÑO) in shell weight, and 6.1 g (MRD) in fresh meat weight.

*Copra yield*

Except for AGT, data on mean copra yield per nut of the other cultivars during the five-year period also exhibited very little variability, with their coefficient of variation not exceeding 10% (Table 2). CÑO, which had the second highest coefficient of variation of 9.1%, is a fragile cultivar which tends to be susceptible to alternate bearing. It is possible that meat production and consequently copra production per nut was affected by drastic changes in nut production of each palm. The more variable AGT has not yet been observed for alternate bearing phenomenon but the data were obtained when the palms were at initial bearing stage. In coconut, this stage could still be abnormal.

Copra yield per nut is highly heritable (Meunier,*et al.*, 1984) indicating that the character is largely influenced by genetic factors. The heritability for copra/nut was estimated to be 0.95 and correlation between parent and progenies of $r=\pm0.7186$ for copra/nut was recorded (Chan, 1983). This could explain the apparent stability of the copra yield characters of coconut.

*Meat thickness*

Meat thickness, although influenced by other factors such as fertilization (Oguis, 1984), was likewise seen to be a very stable character. Coefficient

Table 2. Mean weight (g) of nut components and copra yield per nut of RCRC coconut accessions (1989-1993).

| Cultivar | Husk | | Water | | Shell | | Fresh Meat | | Copra | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Weight | C.V. (%) | Weight | C.V. (%) | Weight | C.V. (%) | Weight | C.V. (%) | Weight | C.V. (%) |
| Dwarfs | | | | | | | | | | |
| ALD | 296.4 ± 20.3bc | 13.5 | 190.5 ± 19.6c | 20.4 | 131.8 ± 3.2d | 4.8 | 353.4 ± 22.7c | 12.7 | 183.2 ± 7.4c | 8.0 |
| CAM | 316.0 ± 23.5bc | 14.7 | 200.7 ± 27.9c | 27.5 | 174.2 ± 6.0c | 6.8 | 428.7 ± 8.3b | 3.8 | 210.2 ± 5.2b | 4.8 |
| CAT | 371.9 ± 11.1a | 5.9 | 234.0 ± 19.2bc | 16.3 | 168.3 ± 5.6c | 6.6 | 405.2 ± 9.3b | 4.6 | 205.5 ± 5.1bc | 4.9 |
| CÑO | 136.2 ± 2.6e | 3.8 | 83.4 ± 17.7d | 42.0 | 91.8 ± 1.6e | 3.6 | 177.4 ± 18.8f | 21.0 | 100.5 ± 4.6e | 9.1 |
| LKY | 207.2 ± 5.3d | 5.1 | 97.1 ± 3.5d | 7.2 | 88.7 ± 1.9e | 4.3 | 227.4 ± 17.5e | 15.3 | 114.6 ± 4.7e | 8.2 |
| MRD | 266.6 ± 12.1c | 9.0 | 189.9 ± 15.5c | 16.9 | 140.1 ± 10.1d | 14.2 | 295.2 ± 6.1d | 4.1 | 142.2 ± 5.5d | 7.7 |
| MYD | 176.3 ± 20.1de | 22.6 | 130.6 ± 19.8d | 30.0 | 98.2 ± 5.5e | 11.1 | 278.1 ± 8.7d | 6.2 | 119.7 ± 3.7de | 6.1 |
| TAC | 369.8 ± 29.5a | 15.8 | 253.8 ± 15.4b | 12.1 | 175.9 ± 5.8c | 6.5 | 423.6 ± 10.3b | 4.8 | 221.8 ± 5.3b | 4.7 |
| Talls | | | | | | | | | | |
| AGT | 346.5 ± 24.2ab | 13.8 | 213.6 ± 24.2ab | 22.5 | 166.1 ± 10.3c | 12.3 | 386.8 ± 24.8bc | 12.7 | 227.7 ± 17.5b | 15.2 |
| BAY | 380.1 ± 20.4a | 10.6 | 348.6 ± 24.0a | 13.6 | 239.0 ± 4.4a | 3.6 | 539.5 ± 7.3a | 2.7 | 288.4 ± 9.4a | 6.4 |
| PUR | 291.5 ± 23.1c | 15.7 | 259.0 ± 17.1b | 13.0 | 204.7 ± 9.6b | 9.6 | 418.5 ± 15.7b | 7.4 | 224.1 ± 5.2b | 4.6 |

Table 3. Meat thickness (mm) of RCRC coconut accessions.

| Cultivar | Range of Annual Means (1989-1993) | General Mean | C.V.(%) |
|---|---|---|---|
| Dwarfs | | | |
| ALD | 10.3-10.9 | 10.6 ± 0.12cd | 2.2 |
| CAM | 11.1-11.8 | 11.6 ± 0.14ab | 2.4 |
| CAT | 11.0-12.6 | 12.0 ± 0.28a | 4.6 |
| CÑO | 8.9-10.3 | 9.5 ± 0.23e | 5.0 |
| LKY | 9.2 - 9.8 | 9.6 ± 0.12e | 2.4 |
| MRD | 10.6-11.8 | 11.0 ± 0.25bc | 4.5 |
| MYD | 9.0-10.9 | 10.2 ± 0.36d | 6.9 |
| TAC | 10.8-12.0 | 11.4 ± 0.21ab | 3.7 |
| Talls | | | |
| AGT | 11.0-12.1 | 11.4 ± 0.20ab | 3.5 |
| BAY | 11.7-12.5 | 12.0 ± 0.14a | 2.3 |
| PUR | 10.5-12.2 | 11.2 ± 0.29b | 5.2 |

Table 4. Oil content (%) of RCRC coconut accessions.

| Cultivar | Range of Annual Means (1989-1993) | General Mean | C.V.(%) |
|---|---|---|---|
| Dwarfs | | | |
| ALD | 59.0-63.9 | 62.8 ± 0.95 | 3.02 |
| CAM | 61.1-63.4 | 62.8 ± 0.44 | 1.39 |
| CAT | 54.8-61.5 | 59.5 ± 1.27 | 4.22 |
| CÑO | 64.1-66.5 | 65.2 ± 0.47 | 1.42 |
| LKY | 64.2-69.1 | 66.2 ± 1.12 | 2.49 |
| MRD | 53.3-61.2 | 57.6 ± 1.54 | 5.28 |
| MYD | 51.4-60.7 | 57.2 ± 1.58 | 5.48 |
| TAC | 61.6-67.4 | 64.5 ± 1.20 | 3.70 |
| Talls | | | |
| AGT | 56.0-63.8 | 60.4 ± 1.79 | 5.37 |
| BAY | 48.6-63.0 | 58.8 ± 2.41 | 8.99 |
| PUR | 54.0-62.6 | 59.8 ± 2.17 | 6.56 |

of variation of yearly means of five year data ranged from 2.2-6.9% only (Table 3). Standard error of the mean varied from 0.12 mm (ALD and LKY) to 0.36 mm (MYD) only. ALD had the least variation and MYD, another dwarf, had the highest.

Moreover, it is interesting to note that the thickest meat was found both in the tall (BAY and AGT) and dwarf (CAT, CAM and TAC) cultivars.

*Oil content*

There was very little variation in mean oil content among the different accessions ranging only from 57.2% (MYD) to 66.2% (LKY) which was similar to the report of Chan (1983) (Table 4). Variability among the five-year data was likewise very low, ranging from 1.39% (CAM) to 8.99% (BAY). Standard error of the mean was as low as 0.44% in CAM and as high as 2.41% in BAY.

Unlike the observation of Gascon and De Nuce de Lamothe (1978) who reported the oil content in dwarfs to be generally lower than in the talls by about 5%, some dwarf cultivars, *i.e.*, LKY, CÑO, TAC, ALD and CAM, had higher oil content than the talls.

## CONCLUSION

The apparent stability of the nut characters studied indicated that data gathering for the purpose of characterization could be shorter than five years.

## LITERATURE CITED

BANZON, J.A. and VELASCO, J.R. 1982. Coconut Production and Utilization. Philippine Coconut Research and Development Foundation, Inc. (PCRDF). Amber Avenue, Pasig, Metro Manila, Philippines. p. 42.

CAGAMPANG, G.B. and RODRIGUEZ, F.M. 1980. Methods of Analysis for Screening Crops of Appropriate Qualities. Institute of Plant Breeding, University of the Philippines, Los Baños (UPLB), Laguna. p. 18.

CHAN, E. 1983. Progress in coconut breeding in United Plantations, Berhad, Malaysia. Oleagineux 38:371-379.

GASCON, J.P. and DE NUCE DE LAMOTHE, M. 1978. Genetic improvement of the coconut, results and prospect. Proc. Intl. Conf. on Cocoa and Coconut, Kuala Lumpur. p. 489-499.

GRUEZO, W.Sm. 1990. Fruit component analysis of eight "wild" coconut populations in the Philippines. Philipp. J. Coco. Studies XV:6-15.

HARRIES, H.C. 1981. Germination and taxonomy of the coconut. Ann. Bot. 48:873-883.

HARRIES, H.C. 1982. Coconut varieties. Indian Coco. J. 34:33-39.

MEUNIER, J., SANGARE, A., LE SAINT, J.P. and BONNOT, F. 1984. Genetic analysis of yield characters in some hybrids of coconut (*Cocos nucifera* L.). Oleagineux 39:581-586.

NUÑEZ, T.C. 1992. Breeding for improved varieties in coconut. Study 1. Evaluation of seven local dwarf coconut cultivars under four fertilizer levels. Terminal Report. Regional Coconut Research Center. Visayas State College of Agriculture, Baybay, Leyte, Philippines. pp. 99.

OGUIS, L.G. 1984. Chlorine fertilization of coconut. Paper presented during the 2nd National Coconut Research and Development Symposium, June 20-22, 1984, PCARRD, Los Baños, Laguna, Philippines. pp. 26.

RATTANAPRUK, M., HOWL, J.C., THIRAKUL, A., PETCHPIROON, C. and DOOTRON, J. 1985. Comparison of precocity and yield of hybrid coconut varieties in Thailand. Oleagineux 40:125-131.