

## **Use of Dry Matter as Maturity Index in ‘Kradum’ Durians (*Durio Zibethinus Murr.*)**

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**Keywords** : postharvest technology, harvesting index, quality

### **Abstract**

**Durian is a fruit that has more maturity detection difficulties than any other fruit. Currently, most maturity indices used are subjective. However, in order to invent a tool to determine durian maturity, it must first be established just what is a mature durian. Studies during fruit growth and development in ‘Kradum’ durians revealed that the pulp accumulated as much as 2 % of dry matter per day during their food accumulation period, 3 to 4 weeks before maturity. Minimum dry matter content of about 28 % was needed for ‘Kradum’ durians to match the minimum eating quality. This level of dry matter was nearly identical to the 27 % official standard for this durian cultivar, recently announced in 2002. When examining the fruit destined for export, it was found that the exporters had adopted their maturity selection process to meet the official criteria, and had succeeded in the third season. However, the study also revealed that there was quite a high variability in the pulp dry matter among fruits from different orchards and seasons. Hence, further study on the influence of the environment and cultural practices are needed.**

### **INTRODUCTION**

Durian maturity is very difficult to determine from the external appearance. Several indices are used in combination including numbers of days from anthesis, color of the skin, color of the spine tip, the strength of the spine and the fruit stem, and the sound detected by knocking on the fruit (Nanthachai et al., 1994). Most of these indices are subjective and subject to bias. Until recently, there was no objective description of “mature” durian i.e. how much starch, sugar and fat should there be in durian pulp for it to be regarded as mature. Sangwanangkul and Siriphanich (2002) reported the growth and development of ‘Mongthong’ durian, and recommended that dry matter of the pulp was the best index to determine durian maturity. Data on sugar, starch, fat and carotenoid content, as well as pulp firmness and color, were inconsistent. Following this, a minimum pulp dry matter of 32 % was announced as the standard for ‘Mongthong’ durian maturity by the Ministry of Agriculture in Thailand. The dry matter of 27 % and 30 % were also declared as minimum dry matter for ‘Kradum’ and ‘Chanee’ cultivars, respectively. However, for these two cultivars, the figures were based on limited information and estimation by comparing growth in relation to ‘Monthong’ cultivar. This work accumulated data on dry matter of the pulp of ‘Kradum’ durian during the food accumulation period, as well as those intended for export by the exporter early in the season, in order to establish the justifiable minimum dry weight for ‘Kradum’ durian.

## **MATERIALS AND METHODS**

### **Dry matter during food accumulation period and its relation to eating quality.**

Three 12-14 year old 'Kradum' durian trees of similar size and health from Chantaburi province in the East coast of Thailand were selected from 3 orchards in 2002 and another 4 orchards in 2004. Young durian fruits were tagged  $10 \pm 3$  days after anthesis. Sixteen fruits were harvested from each tree at weekly interval, 3-5 weeks before normal harvesting time. Dry matter of the pulp at harvest was determined from 8 fruits by taking pulp sample from 3 locules of each fruit, chopped into small pieces, mixed well and sampled into a 20 gram sample for each fruit. The samples were oven dried at 70°C for 48 hours or until there was no further reduction in the weight. The other 8 fruits were allowed to ripen and tasted by 6 trained panelists for eating quality, based on sweetness, firmness, nuttiness, off-flavor, ripeness, maturity and overall preference.

All data was averaged to represent the information for each tree. Linear regression analysis was conducted between dry weight and each eating quality parameter, using taste score as the dependent variable, and dry weight as the independent variable. SPSS program was used for statistical analysis.

### **Dry matter of 'Kradum' durian intended for export**

Kradum durians intended for export were randomly purchased from exporters in the Eastern coastal area during the first 10 days of (the 2002-2004) durian season. Three boxes of Kradum durians, six fruits in each box, were randomly sampled per container from 8-12 exporters each year. Pulp dry weight of nine fruits were determined right after purchase and the others were allowed to ripen and checked for eating quality in the same manner as described above. The relation between pulp dry weight and the eating quality was determined using linear regression analysis as above.

## **RESULTS AND DISCUSSION**

Pulp dry matter of Kradum durian was determined during the last three weeks of fruit growth in 2002. The dry matter increased approximately 2 % per day between 83 to 90 days after anthesis, and leveled off during the last week. The difference between orchards was as high as 5 percent. (Fig. 1 A) In 2004, the pulp dry weight was approximately 6 % where the fruit size was still increasing during 69 and 76 days after anthesis (Fig 1 B). Later, when the fruit size became relatively stable, dry matter increased rapidly at approximately 1.5 % per day, reaching a maximum on day 97 after anthesis. The difference in dry matter between orchards was about 2 %.

It can be seen from this data that durian pulp dry matter varied between orchards as well as between season. When the relation ship between pulp dry matter and eating quality was analyzed using linear regression analysis, it was found that there was good correlation between dry matter and maturity, sweetness, nuttiness, off flavor and overall preference, but not with pulp firmness and ripeness (Fig 2). When considering a minimal acceptable eating score of 5, it was found that durian pulp had dry matter between 23.5 % to 33.5 % with an average of 28.6 %. The standard minimal dry weight of the pulp announced by the Ministry of Agriculture was 27 %.

When the Ministry of Agriculture first announced the use of pulp dry matter as the maturity standard for durian in 2002, the dry matter of the durian pulp from the durians destined for export was found to be rather low. (Fig 3) Four out of ten samples taken were below the official standard. On the other hand in 2003, all of the sample taken were above 30 %, far higher than the official standard. In 2004, all of the samples tested were above the standard, with the value being close to the official standard.

It can be determined from this data that in the past durian exported to foreign markets were rather low in quality, at least in terms of maturity. Many fruits were still too young to harvest. However, once the standard was enforced, the exporter adopted a better selection process for durian maturity. In 2003, their selection criteria was too high and this resulted in having most fruits fully mature, with a very high dry matter. Finally, in 2004, their selection processes were right on target.

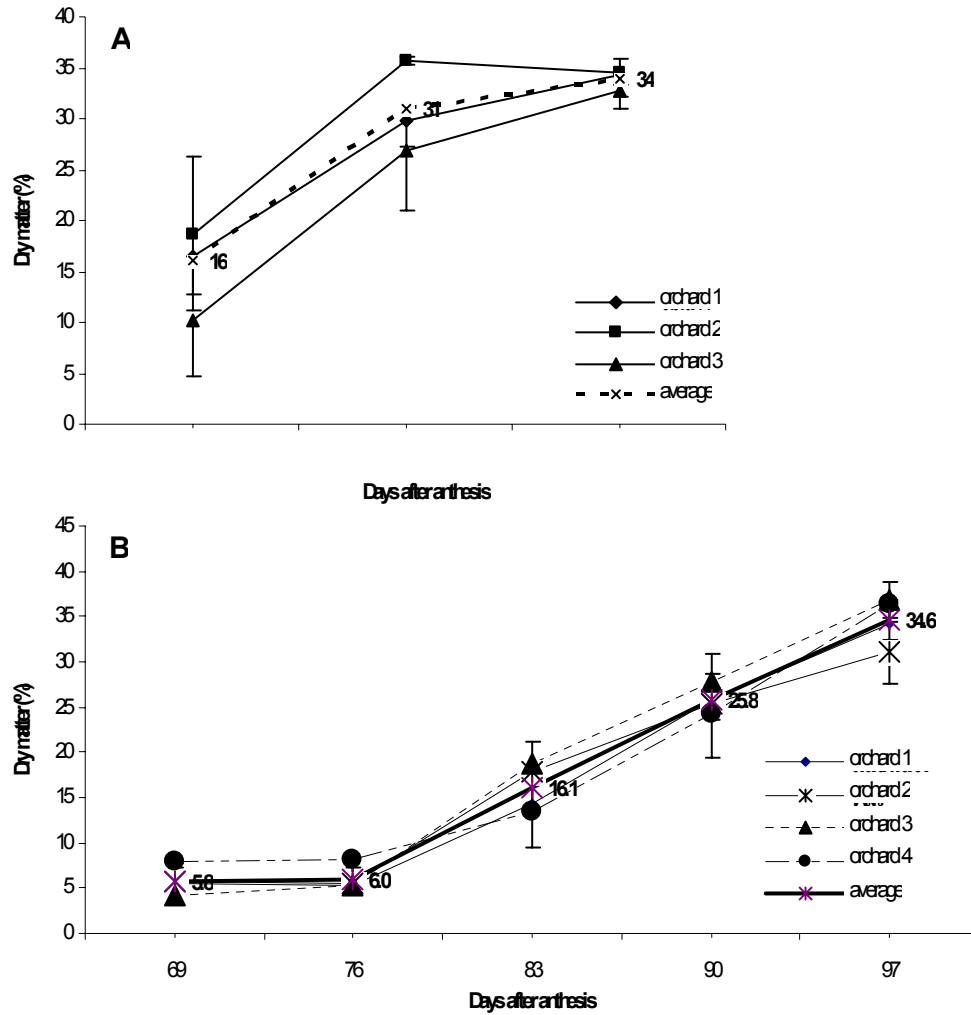
After analysing all the information gathered above, it is recommended that the standard value of twenty seven percent pulp dry matter should remain in effect for 'Kradum' durian. However, the data shown in this report also revealed that there were quite high variations in dry matter of the pulp between samples from different orchards, and different seasons. This means that the cultural practices and the environment has a significant influence on the accumulation of dry matter in durian pulp. In avocado where dry matter is also used as the maturity standard (Lee et al., 1994), it was reported that irrigation and the use of plant growth regulator could influence the dry matter (Lahav and Kalman, 1997, Vuthapanich et al., 1995). In addition, some exporters complained that some of their durian did not pass the maturity standard criteria due to rainfall during the harvesting period. Thus, studies on the influence of environmental conditions and cultural practices on durian pulp dry matter should be conducted.

From an scientific point of view, several attempts in the past to invent a tool or procedure to detect durian maturity were not successful. This was because most attempts tried to measure some parameters that had correlation with other aspects of maturity, but not the maturity of the pulp directly, eg. Terdwongworakul et al., (1998). The discovery that dry weight of the pulp is a good indicator of maturity should provide useful information for scientists, to devise a better tool or procedure.

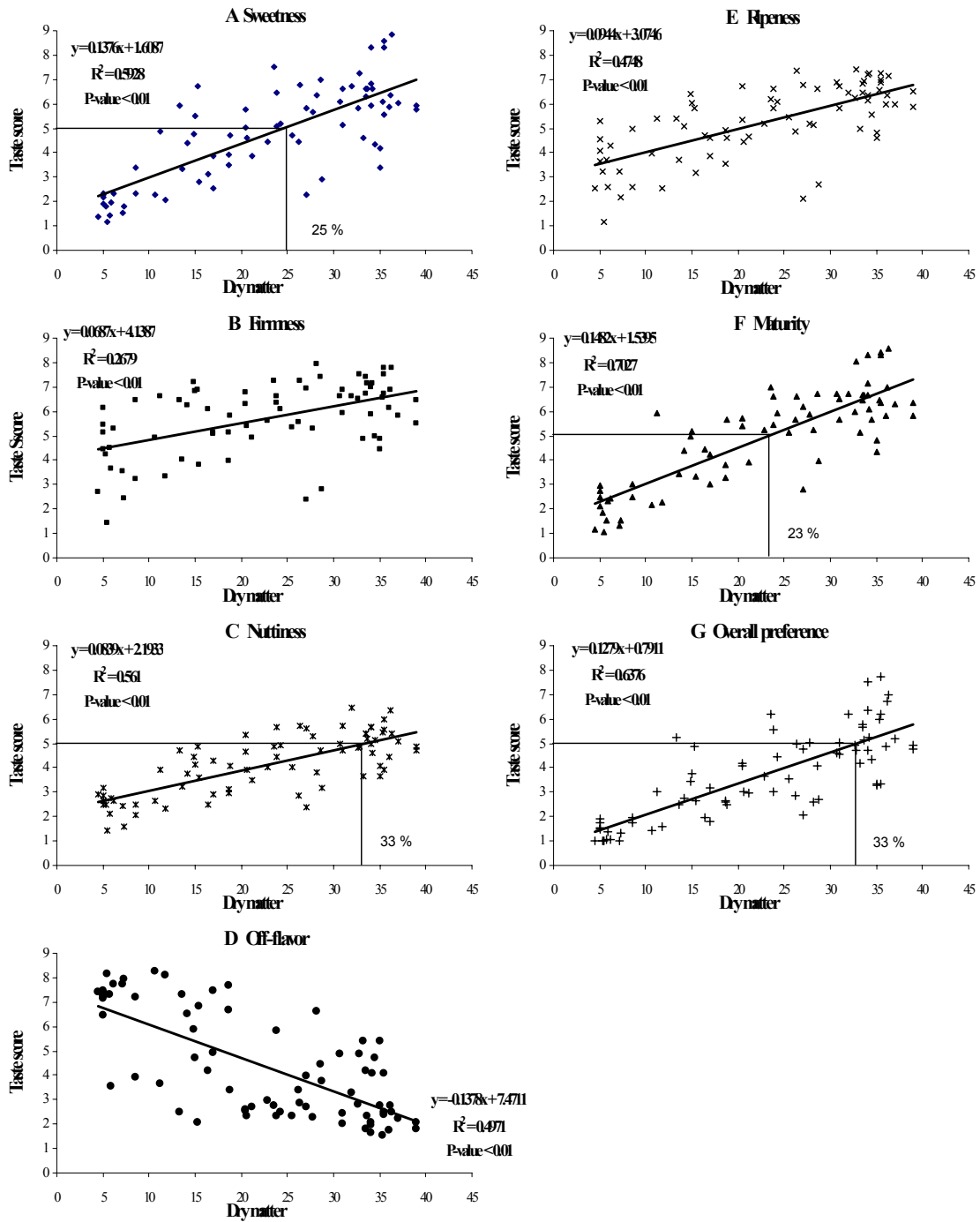
#### **Literature Cite**

- Lee, S.K., Young, R.E., Schiffman., P.M. Coggins Jr., C.W. 1983. Maturity Studies of avocado fruit based on picking dates and dry weight. *J.Am. Soc. Hort. Sci.* 108: 390-394.
- Lahav, E. and Kalman, D. 1977. Water requirement of avocado in Israel. II. Influence on yield, fruit growth and oil content. *Aust. J. Agri. Res.* 28: 869-877.
- Nanthachai, S., Siriphanich, J., Wahab, A. R. and Kosiyachinda, S. 1994. Harvesting indices and harvesting, p. 77-88. *In* Nanthachai, S. (ed.). *Durian: Fruit Development, Postharvest Physiology, Handling and Marketing in ASEAN.* ASEAN Food Handling Bureau, Kaula Lumpur.
- Sangwanangkul, P. and Siriphanich, J. 2000. Growth and development of durian fruit cv. Monthong. *Thai J. Agr. Sci.* 33: 75-82.
- Terdwongworakul, A., Srichonpet, N., Poniym, K. and Sukchareon, A. 1998. Frequency index as related to maturity stage of 'Montong' durian. *J. Natl. Res. Council of Thailand.* 30: 25-38. (In Thai)
- Vuthapanich and et al., 1995. Effect of irrigation and Foliar Cultar ® on fruit yield and quality of 'HASS' avocado fruit. *Proceeding of the world Avocado Congress III.* pp. 311-315.

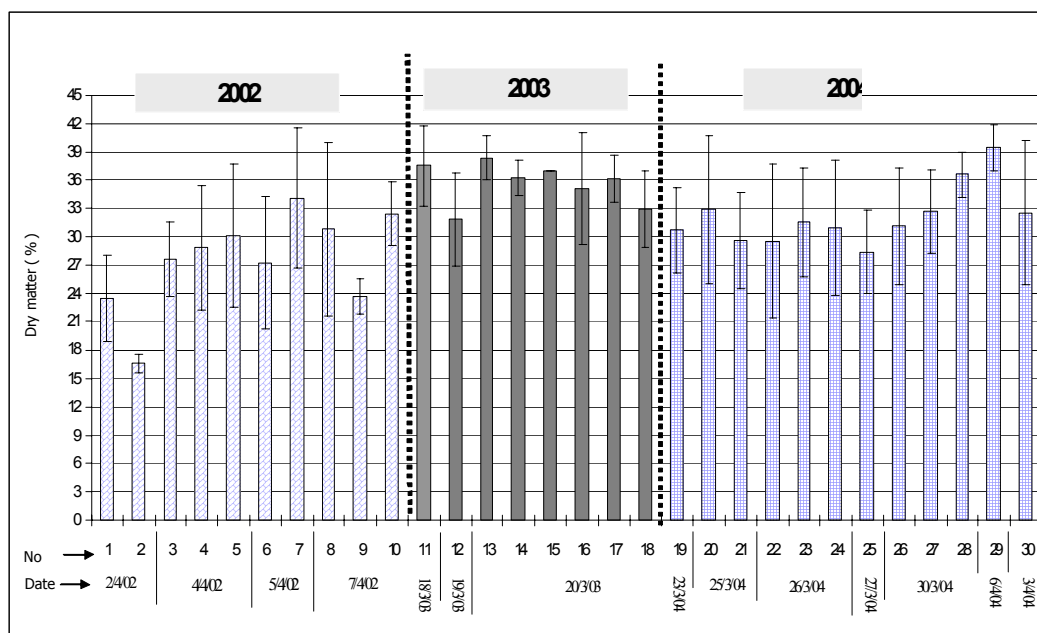
**Figures**



**Figure 1** Dry matter accumulation in the pulp of 'Kradum' durian from different orchards in 2002 (A) and 2004 (B) during their growth and development.



**Figure 2** Regression analysis between the pulp dry matter and various eating quality: sweetness (A), firmness (B), nuttiness (C), off-flavor (D), ripeness (E), maturity (F) and overall preference (G)



**Figure 3** Dry weight of the pulp of ‘Kradum’ durian purchased from exporters early in 2002-2004 durian seasons. Bars indicated standard deviation.

## ***Utilisation de la matière sèche comme index de maturité des durians “Kradun”***

**Mots clés :** *Technologie après la moisson, index de moisson, qualité*

### ***Résumé***

*Le durian est un fruit dont la maturité est difficile à détecter en comparaison avec d'autres fruits. Les indices de maturité couramment utilisés sont subjectifs. Cependant, afin d'inventer un outil pour la détermination de la maturité de ce fruit, il est nécessaire d'établir ce qu'est un durian mûr. Des études menées durant la croissance et le développement de durian de qualité « Kradum » ont révélé que la pulpe accumule plus de 2 % de matière sèche par jour. Cette accumulation se produit jusqu'à trois à quatre jours avant la maturité du fruit. Un minimum de 28% de matière sèche est cependant nécessaire pour que le fruit soit de qualité gustative suffisante. Ce niveau de matière sèche est proche du standard officiel de 27% annoncé en 2002 pour la culture de cette variété de durian. Lorsque l'on examine les fruits destinés à l'export, on constate que les exportateurs ont réussi en trois saisons à mettre au point un procédé de sélection de maturité permettant d'atteindre le critère officiel. Cependant, l'étude a également révélé qu'il existe une grande variabilité de la matière sèche de la pulpe pour des fruits en provenance de différents vergers et saisons. Ainsi, plusieurs études sont nécessaires pour appréhender l'influence de l'environnement et des pratiques de culture.*