

Research Article

Harvesting indices of Chi-fah Yai pepper (*Capsicum annuum* L.) fruit

Sompoch Noichinda^{1*}, Kitti Bodhipadma¹, Daranee MOUNGJOMPRANG¹,
Nutjaree Thongnurang¹ and Hattachai Kasiolarn²

¹Division of Agro-Industrial Technology, Faculty of Applied Science, King Mongkut' University of Technology
North Bangkok, Bangsue, Bangkok 10800 Thailand

²Department of Plant Production Technology, Faculty of Agricultural Technology, King Mongkut's Institute of
Technology Ladkrabang, Bangkok, 10520 Thailand

*E-mail: snd@kmutnb.ac.th

Abstract

Maturity of chili and pepper fruits can be predicted from the peel color. The mature green stage of Chi-fah Yai pepper fruit contained highest amount of chlorophyll (0.42 g/gFW) and the chlorophyll declined in red stage (0.1 g/gFW). Conversely, chlorophyllase activity increased when pepper fruit turned from green (0.18 unit/min/mg protein) to reddish-green (0.61 unit/min/mg protein). For anthocyanin accumulation, synthesis of this pigment began at the mature green stage and elevated until fully red stage. Similar to fruit ripening pattern, total sugar content raised from mature green to reddish-green stages and slightly declined in fully red stage. In case of ascorbic acid, this antioxidant content increased throughout fruit developmental stage. For capsaicin, the hot or pungency taste, it was found in both of inner wall pericarp and placenta and this compound slightly increased during fruit ripening on plant. Thus, we suggested that Chi-fah Yai pepper fruit should be harvested from stage 3 because it riches of nutritional value such as total sugar, ascorbic acid and capsaicin.

Keywords: chilli, fruit ripening, maturity index

Introduction

There are so many kinds of chili and pepper grown in Thailand but Chi-fah Yai was classified as a "pepper" (*Capsicum annuum*) due to its fruit having a moderate hot taste which contained 13 and 15 mg/gFW capsaicin in the pulp and placenta, respectively, (Noichinda et al., 2012) that suitable for cooking Thai curry. Recent research showed that the different fruit maturity stages of Chi-fah Yai pepper fruit had antioxidant substances and free radical scavenging ability (Naisupab et al., 2015).

Normally in immature stage of *Capsicum* fruit, the peel color stays green which contains high content of chlorophyll and then this photosynthetic pigment declines in accompany with the synthesis of carotene (orange-red pigment) or xanthophyll (yellow pigment) during fruit ripening. However, anthocyanin which showing the color character from red to purple was also discovered as the main pigment in chili fruit (Lightbourn et al., 2007; Lightbourn et al., 2008; Aza-Gonzalez et al., 2012).

Hence, in this research, we investigated the nutritional value of different color stages of pepper fruit to establish the "maturity index" of Chi-fah Yai pepper fruit.

Materials and methods

The different stages (green, 25% red, 50% red, 75% red and fully red as shown in figure 1A) of Chi-fah Yai pepper fruits were harvested from a commercial pepper grower garden in Nakorn Pathom province. Quality of each maturation fruit group was investigated as the following:

(1) Chlorophyll content in acetone extraction solution was measured with a spectrophotometer method at 652 nm (Witham et al., 1971).

(2) Chlorophyllase was extracted and assayed according to the method of Shimokawa et al. (1978).

(3) Anthocyanin content in ethanol extraction (95% ethanol + conc. HCl + H₂O in the ratio of 85:2:13) of fruit pulp was measured with a spectrophotometer at 540 nm (Weaver and Pool, 1971).

(4) Sugar content in the extraction solution of 80% phenol plus conc. H₂SO₄ was measured with a spectrophotometer at 490 nm (Dubois et al., 1956).

(5) Ascorbic acid was analyzed by AOAC (1984) method.

(6) Capsaicin content was measured by thin layer chromatography according to Spanyol and Blazovich (1969) which slightly modified by using Kiesel G layers model F254 silica gel coating 0.25 mm chromatography.

Results and discussion

The fully mature of pepper fruits are differ among its peel color, green or dark-green. Normally the harvesting index of pepper depends on the utilizing purpose, particularly for salad, stir fry or curry paste. Most of pepper fruits are classified as a non-climacteric respiration since they do not undergo ripening after harvested from the pepper plant. The fruit peel color simply changes from green to red (Lockwood and Vines, 1972). This phenomenon is well occurred when fruit still stays on plant. For the beneficial of fruit color improvement, we must spay ethylene releasing solution (ethephon) during fruit maturation on tree (Krajayklang et al., 1999).

Mature green stage of Chi-fah Yai pepper fruit contained chlorophyll (0.42 g/gFW) and slightly declined in more mature stage fruit until nearly stable (0.1 g/gFW) at fully red (Fig. 1A and 1B) which was correlated to the increasing chlorophyllase (chlorophyll degradation enzyme) activity that reached to the peak (0.61 unit/min/ug protein) at red stage (Fig. 1B).

For red color in Chi-fah Yai pepper fruit, it was the combination two red pigments such as carotene a kind of carotenoid that represent orange-red color and anthocyanin (red-purple color). In our experiment, anthocyanin was investigated as a red color. At mature green stage, anthocyanin already appeared in pepper fruit pulp but it was dominated by chlorophyll until it dramatically increased at stage 3 (Fig. 1C). As we known, pepper fruit is a good source of ascorbic acid. It held high content of ascorbic acid about 0.5-0.8 g/100ml of fruit juice (Fig. 1D). Our result indicates that the more maturity stage the higher ascorbic acid content. Besides, we also found that the total sugar content rose during red pad developing on fruit peel (Fig. 1E), then declined when peel color completely red which means that sugar was utilized in the respiratory process.

Capsaicin is a hot taste substance in *Capsicum* fruits. The degree of pungency is depending on species and variety. Most of *C. frutescence* fruits are hotter than *C. annum* (Noichinda et al., 2012). In different parts of *Capsicum* fruit, it holds different contents of capsaicin. Red stage of pepper fruit which contained high amount of capsaicin was hotter than green stage (Fig. 1F). Interestingly, the parcenta contained high amount of capsaicin than those of fruit pulp. Since capsaicin is a subclass of phenolics that almost located in the seed and parcenta of *Capsicum* fruit (Noichinda et al., 2012). Therefore, capsaicin might be more synthesized in seed and parcenta than fruit pulp.

Because of the different in many compounds from various stages of fruit, we can conclude from our experiment that Chi-fah Yai pepper fruit should be started to be harvested from stage 3 since it contained high nutritional values such as total sugar, ascorbic acid and capsaicin content.

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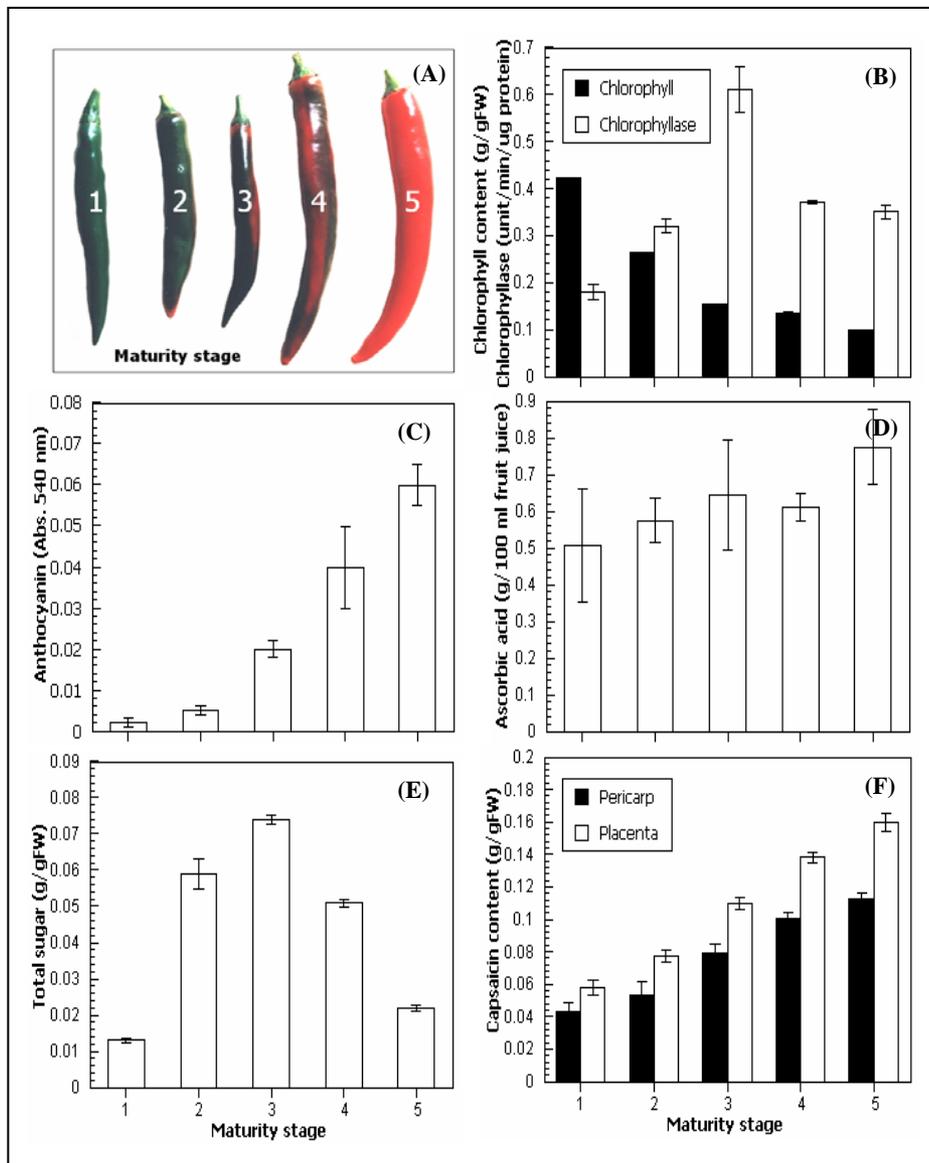


Figure 1. Maturity stage of Chi-fah Yai pepper fruit (A) and its compounds in each stage (B-F)