Materials and Methods

1. Orchard location

Anna apple trees were selected at Doi Maehae Amphur Sanpatong Chaing Mai, elevation about 1,200 m.. The orchard was divided into 4 blocks. On February 19, 1986, the full bloom date, about 600 blossoming spurs were tagged (Fig.20). Fruit samples were picked every week, 5-fruit per block, total 20-fruit per week.

2. Growth observation

2.1 Fruit samples were weighed.

2.2 Width and lenght of fruit samples were measured at its widest and longest part by virnier caliper.

2.3 Volume of fruit samples were measured by water displacement method.

3. Determination of physical and chemical changes during growth

3.1 Flesh firmness

Flesh firmness was measured with an Effigi pressure tester with a 0.8 cm (5/16) diam plunger by averaging 2 readings taken on oposite sides of the fruit after removing the peel about 2 cm^2 near the equator.

3.2 Chlorophyll content of the peel

Each fruit was carefully peeled with a hand peeler. The peel was weighed 1 gram then ground with purified sand and 2-3 ml 80 % acetone and added about 10 ml 80 % acetone then filtered through No.1 Whatman paper, washed the ground peel with 2-3 ml 80 % acetone 1-2 times. The fitrate was added 80 % acetone to 20 ml and determined the optical density with spectrophotometer SP 8-100 at 645 and 663 nm wave lenghts. Then calculated the total chlorophyll content on the basis of milligrams of chlorophyll per gram peel according to the following equations (Whitham et al., 1971).

mg total chlorophyll/g peel

$$= 20.2\,(D_{645}) + 8.02\,(D_{663}) \times \frac{V}{1000 \times W}$$

V = the final volume of the 80 % acetone-chlorophyll extract

W = the fresh weight in grams of the peel extracted

3.3 Starch-iodine test

The distribution of starch within individual fruits was determine by immersing a transverse equatorial slice in an aqueous IKI solution (dissolved 2.5 gm of I_2 in 10 gm KI dilute with 1000 ml H_2O) and allowing color to develop about 2 min. Relative starch content was determined by

rating the distribution pattern of starch in the fruit with score 0 to 6 similar to starch-iodine scores for Gramy Smith apples by the Department of Scientific and Industrial Research Auckland (1979). see Fig.8.

3.4 Titratable acidity

The flesh of apples within each blocks were weighed to 40 grams. The fleh was blended 15 seconds with electric blender then juiced through the cloth. The volume of juice was measured. Tritratable acidity was determined by titrating 2 ml of juice in 25 ml of distilled water with 0.1 N NaOH using phenolphthalein as indicator and calculated as percentage of malic acid by fruit juice volume according to the following equation (adapted from Ruck, 1963).

% total acid

$$= \frac{1}{10} \times \frac{\text{equiv.wt. of acid x normality of NaOH x titer (ml)}}{\text{volume of sample (ml)}}$$

Equivalent weight of malic acid = 67.05 gm

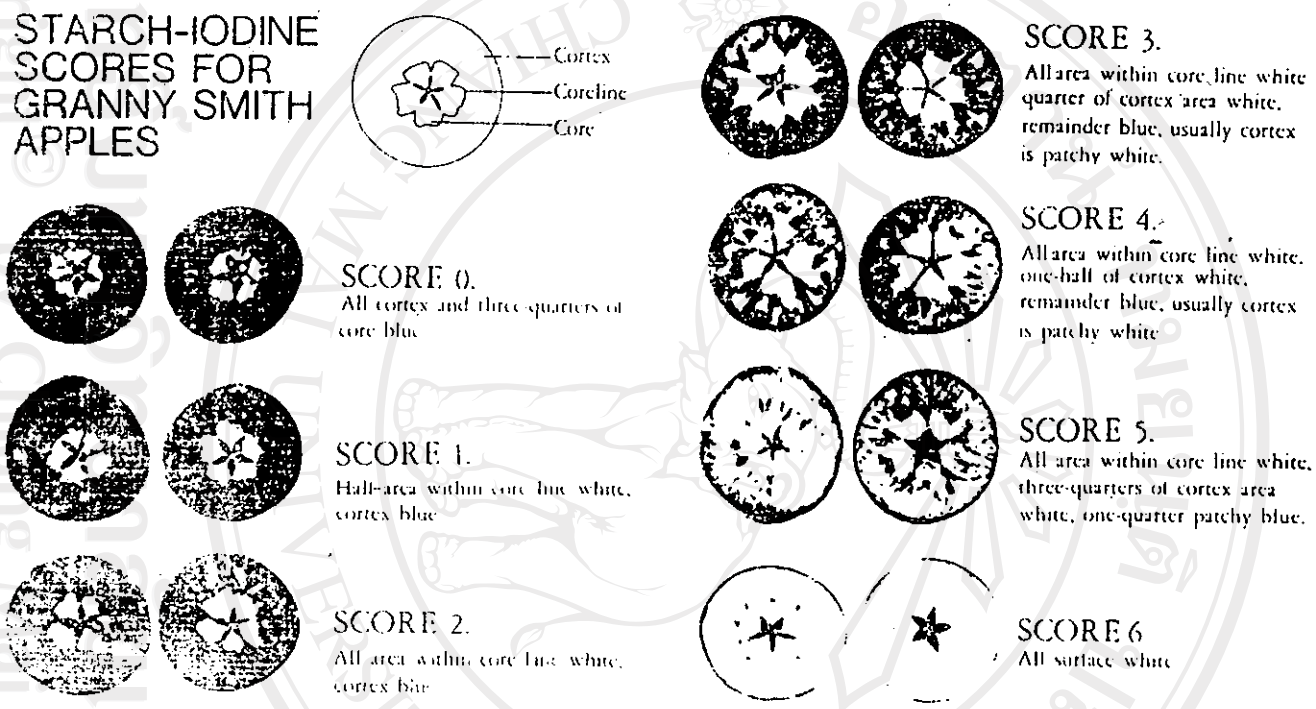

Fig.8 Showing the starch-iodine scores for Granny Smith apples. (From the department of scientific and Indrustrial Research Auckland, 1979)

3.5 Vitamin C content

This method applied from titration method for Vitamin C by Collins (1979).

The procedure was as follows :

a) Prepared the starch indicator solution by boiling 100 ml of distilled water and adding slowly 5 gm of soluble starch and stirring until the suspension was fairly clear. Allowed to cool before using.

b) Prepared the aqueous IKI solution by dissolving 2.5 gm I_2 in a solution of 10 gm KI in 100 ml of distilled water and diluted to 1 liter.

c) Prepared the ascorbic acid solution by dissolving 100 gm ascorbic acid in 100 ml of distilled water. So 1 ml of this solution contained 1 mg of vitamin C.

d) Titrated 10 ml ascorbic acid solution with IKI solution, 5 times using starch solution as indicator. The titration end point was signaled by the formation of the starch-iodine blue complex. Then calculated the equivalent of IKI solution to a certain number of milligrams vitamin C per milliliters.

Vitamin C content was determined by titrating 2 ml juice in 25 ml of distilled water with IKI solution using starch solution as indicator. The Vitamin C content was calculated by a number of IKI solution volume.

3.6 Total soluble solids content

Total soluble solids were determinal by a hand refractometer and expressed as % Brix.

4. Qualities change after harvest

The fruit sample harvested at 13, 14, 15 and 16 weeks after full bloom, 3 fruits per block total 12 fruits on each harvest date, were placed in the plastic basket and held in the air-conditioning room to allow ripening. After 7 and 14 days the physical and chemical changes were determined by the same method of the determination during growth.

5. Sensory evaluation

Desert quality was evaluated by 5 members taste panel. Each harvested date, the 4 fruit samples were evaluated and ratings were made on taste (sweetness and acidity), aroma, firmness and acceptability. Sensory scores ranged from 1 to 5 for taste(sweetness and acidity), aroma and firmness and from 1 to 9 for acceptability.

Taste panel assesments

Name : _____

Date : _____

Sample code					
Taste (sweetness and acidity)					
aroma					
textures					
acceptability					
comments					

taste
(sweetness and acidity)

1 very sour
2 moderate sour
3 less sour
4 sweet sour
5 sweet

aroma

1 fresh aroma
2 slightly ripe
3 moderate ripe
4 very ripe
5 over ripe
(almost fermenting)

firmness

1 very soft
2 slightly soft
3 less crispy
4 moderate crispy
5 very crispy

acceptability

1. dislike extremely
2. dislike very much
3. dislike moderately
4. dislike slightly
5. neither like nor dislike
6. like slightly
7. like moderately
8. like very much
9. like extremely