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**Effect of ethrel postharvest applications on ripening of ‘Tron’ and ‘Hoi’ mangoes  
(*Mangifera indica* L.)**

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**Introduction**

Mango area and productivity increase rapidly in the north of Vietnam from 2001 to 2006: 5,801 to 11,300ha and 6,904 to 29,900 ton respectively. In which, main production regions locate in north-west with 10,500 ton fruit in 4,800 ha area and in north –east with a yield of 9,500 ton fruit in 4,100ha area in 2006 (Bui Quang Dang, 2008). Son La- a mountainous province in the north of Vietnam, originated two mango cultivars ‘Tron’ and ‘Hoi’, which were cultivated primarily at Yen Chau, Thuan Chau, and Truong Sai districts. However most of people prefer mango in Yen Chau due to their subper taste and aroma. Mango is a climatic fruit tree with the self life of its fruits is short. When mango fruits ripen, they become softly and deteriorate in short time. As the matter of this, it is difficult to deliver ripened mango to larger market in big cities and hence, reduces the chance for better profit to farmers. Meanwhile, green mature mango is firm enough and can maintain its apperance during transportation and Ethrel application can hasten fruit ripening. This brings more advantages to distribute to distant market places.

The role of ethylene in the regulation of fruit ripening in many kinds of fruits was investigated.

Miguel Mata et al. (2007) concluded that ripening reactions controlled by ethylene can be increased by exposure of the fruit to an atmosphere containing exogenous ethylene in order to produce homogeneous external color. Sergent et al. (1993) found when immersed ‘Keitt’ mangoes in hot water (52<sup>0</sup>C for 2 mins) and treated with 2-chloroethylphosphonic acid (Ethephons) at 1000, 2000 or 4000 mg l<sup>-1</sup> for 1 or 2 mins, the soluble solids content which correlated with improved their flavor and color and softer texture were increased.

Technical information is unknown yet concerning the effect of ethrel exposure on ripening of ‘Tron’ and ‘Hoi’ mango varieties while fruits have been stored in cool condition. The objective of this work was to evaluate the application of aqueous ethrel solution on cool storage ‘Tron’ and ‘Hoi’ mangoes.

**Material and Methods**

***Plant material and treatment***

In 2008 fruit of five ‘Tron’ and ‘Hoi’ trees from each of five orchards, respectively, were collected at commercial harvest and 10 days prior, in which ‘Hoi’ was harvested later than ‘Tron’ 10 days due to slower physiological growth. Fruits were trenched for 30 min in 0.4% and 0.8% Ethrel solution and water as control treatment, then dried at room temperature, kept in sealed

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plastic boxes and stored at 20°C and 12°C with a relative humidity of approximately 70%. At each removal date of 1, 3, 5, 7 and 9 days of storage time, fruit samples were kept over 24h at 20°C before fruit quality assessment commenced.

### Data collection

At each assessment date criteria were collected as following

Fruit weight (g) was recorded by conventional methods.

Skin disorders were evaluated based on a 1-5 score; 1 - no disorder, 2 - slightly affected (1-5% surface area), 3 - medium damage (5-15%), 4 - severe damage (>15%) and 5 - spoiled (black colour and sunken skin).

Total soluble solids (TSS) (%) were measured by a portable refractometer (E-line 90).

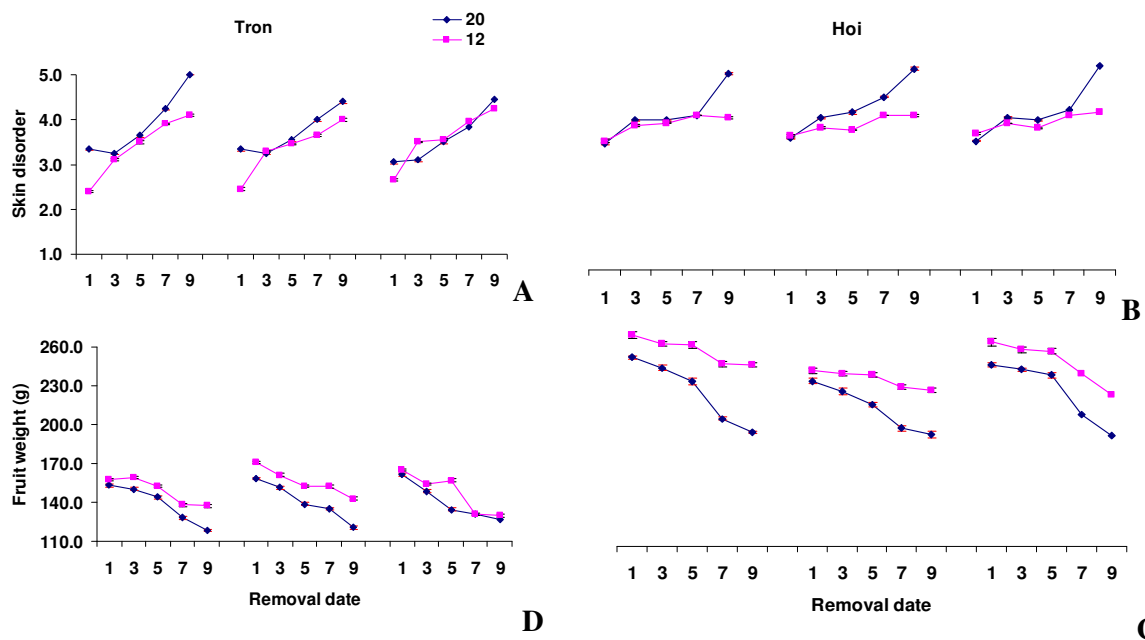
Firmness was determined with a handheld penetrometer (model FT 327, Italy). One determination each fruit, one cheek of mango fruit peeled and then penetrated. Results were reported in kg/cm<sup>2</sup>.

The colour of mangoes in terms of L\*, a\*, b\* values was determined using Nippon colorimeter (Nippon, Japan, Model NP-3000). Mango samples were cut longitudinally and the colour was measured in three places of each sample. Average values were recorded for the study. Before measuring, the colorimeter was standardized with black and white calibration tiles provided with the instrument. L\* denotes the lightness or darkness, a\*- green or red and b\*- blue or yellow colour of the samples. The nose cone was positioned in the surface of the skin and flesh mango such that the light thrown by the colorimeter is not leaked.

### Statistics

Data were analysed by ANOVA using the statistical package GenStat Discovery Edition 3. Mean comparison was made by the least significant difference (LSD). All tests of significance were at the 0.05 significance level.

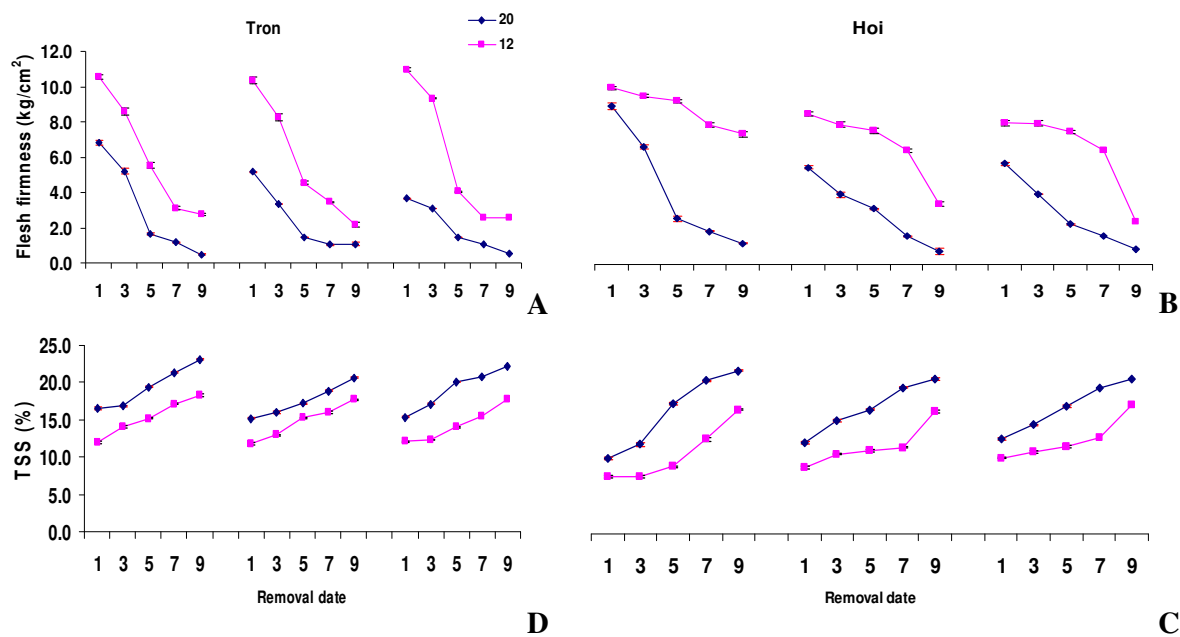
### Results and Discussion



**Fig 1.** Skin disorders (A, B) and fruit weight (C, D) of 'Tron' and 'Hoi' as mean value of 2 picks  $\pm$  SE

In general, ‘Hoi’ seemed more serious skin disorders than ‘Tron’, nevertheless at 12°C skin disorders was less development throughout storage phase and three treatments (Fig 1. A, B).

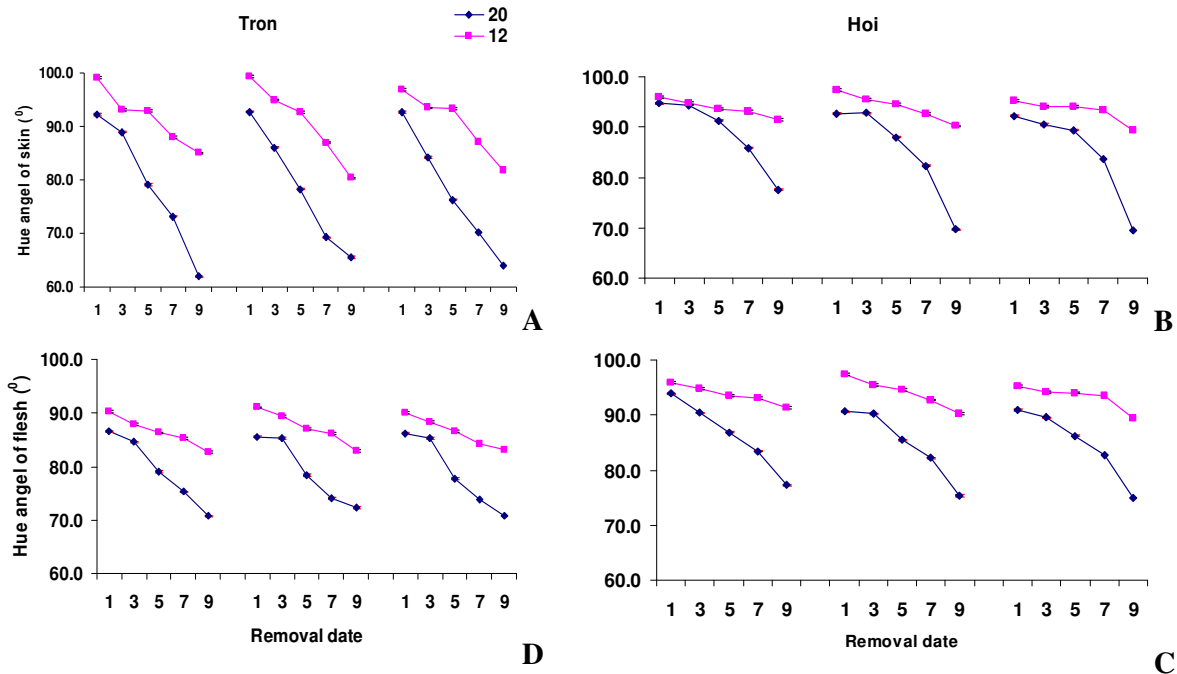
At 12°C, the fruit weight was significantly lost less than that at 20°C. An additional application at 12°C, fruit of both cultivars treated with 0.8% Ethrel had greater weight loss than other treatments at the same temperature (Fig 1. C, D). It may be due to higher respiration with higher concentration of ethrel treatment



**Fig 2.** Flesh firmness (A, B) and total soluble solid content (C, D) of ‘Tron’ and ‘Hoi’ as mean value of 2 picks  $\pm$  SE

Flesh firmness of ‘Hoi’ was maintained higher and longer compared to ‘Tron’ but was reduced more at higher concentrations of Ethrel in both temperature regimes (Fig. 2A, B). This indicated the important role of exogenous ethylene on texture change after applying. The same trend was reported previously for mango varieties ‘Ataulfo’ (Miguel Mata et al., 2007).

Refrigerated storage restricts ripening and limit effect of ethrel to ripening of ‘Tron’ and ‘Hoi’ fruits. Lower temperature storage and lower Ethrel concentrations stimulated slower rates of ripening, but increasing Ethrel concentration within five days at 12°C and three days at 20°C induced high soluble solids contents (Fig 2. C, D). In the beginning TSS of ‘Hoi’ is lower than ‘Tron’ at the same thermal regime. However, all of the treatments reached maximal soluble solids until the end of the storage period at each temperature level. These differences mean that ‘Hoi’ was more sensitive to ethrel than ‘Tron’. Higher soluble solids may be given explanation by activation of metabolism and further conversion of starch into sugars (Tucker, 1993). (Miguel Mata et al., 2007).



**Fig 3.** Hue angle of skin (A, B) and flesh (C, D) of 'Tron' and 'Hoi' as mean value of 2 picks  $\pm$  SE

Hue angle (h) values indicated the changes from green ( $120^{\circ}$ ) to yellow orange ( $60^{\circ}$ ) colours. At  $12^{\circ}\text{C}$  hue angles of skin and flesh were smaller than  $20^{\circ}\text{C}$ . Moreover, skin and flesh hue angle of 'Hoi' enhanced significantly at higher Ethrel concentration under both temperature regimes (Fig B, C). The results showed that 0.8% Ethrel accelerated ripening of both cultivars. Even mango fruits were delayed to ripen at lower temperature during storage but Ethrel could stimulate color of skin and flesh changing to yellow due to carotenoids synthesis increase. Carotenoids will increase in most mango varieties and is associated with the climacteric increase in respiration that is initiated by the action of ethylene (Saltveit, 1999). 'Ataulfo' fruit to be treated with ethylene were stored for 4 days at  $13\pm 1^{\circ}\text{C}$  and 90% RH, then at day 5, ethylene was applied at 100, 500 or  $1000\text{ ml l}^{-1}$  for either 6 or 12 h; then treated mangoes were stored at  $25\pm 2^{\circ}\text{C}$  and 85-90% RH until fully ripe shown that low ethylene concentrations produced faster carotene synthesis in the peel together with faster and homogenous yellow color development (Miguel Mata et al., 2007).

### Conclusions and Outlook

'Tron' and 'Hoi' were treated with 0.8% Ethrel accelerated ripening. Both cultivar fruit treated with 0.8% for 3 days at  $20^{\circ}\text{C}$  and 9 days at  $12^{\circ}\text{C}$  gave sound good fruit quality in terms of acceptable weight loss, flesh firmness, total soluble solid and hue angles.

Chemical composition change during storage is analysing for understanding more effect of ethrel to ripening of 'Tron' and 'Hoi' fruits.

### References

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