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Catfacing of Tomato Fruits as Influenced by Pruning[1]

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Abstract. **Catfacing on tomato fruit (*Lycopersicon esculentum* mill. cv. Manapal) was affected more by time of pruning than amount of pruning. Results indicated that a 2 stem, delayed pruning system produced a lower percentage of catfaced fruit than either 1 or 2 stem early pruning system. Catfacing rates in an unpruned system were equal to that of the delayed pruning system, but early marketable yields were depressed with the unpruned plants. Differences noted in vegetative characteristics, treatment response, and the nature of the deformity suggest that growth regulator balance may influence the formation of catfaced fruit.**

Catfacing is a deformity of tomato fruit usually expressed as an abnormally large scar or opening on the blossom end, but may also extend up the sides to cause deformity of the entire fruit. More catfaced fruits usually occur early in the season. This reduces profits to growers attempting to sell on an early market.

Tomato growers have most often associated catfacing with cool temp experienced during flowering and early fruit set in the spring. Many authorities believe that faulty pollination or fertilization due to the low temp may cause catfacing (1, 4). Most inferences concerning causes of catfacing have centered around the idea that either internal or external stress during some critical development phase may be responsible for increases in its occurrence.

Varying the time of N application would be expected to affect the plant in terms of early vigor and the time at which the plant would enter the reproductive stage. Internal stresses which could result from varying time and amount of pruning include nutrient balance in the plant, assimilation capacity for photosynthetic products, and endogenous growth regulator balance. The data presented here are preliminary results based on the first year of an extended study.

'Manapal' tomato, a cultivar with high incidence of catfacing, was seeded in the greenhouse on March 15 and transplanted to the field on April 25, 1974. A split plot experimental design with 4 replications was used. Time of N application comprised the main plots and pruning systems were subplots.

The 2 main plot treatments were 1) 135 kg/ha N applied as preplant ammonium nitrate and 2) 135 kg/ha N applied 22.5 kg/ha preplant with the remainder sidedressed as 22.5 + 45 + 45. Subplot treatments were a) unpruned, supported by stakes and weaved; b) early-pruned to 1 stem (not allowing suckers to exceed 5 cm length before removal) and staked; c) early-pruned to 2 stems and staked; and d) delay-pruned to 2 stems (with all pruning delayed until after initial fruit set) and staked.

Tissue samples were collected 6 times at 10 day intervals beginning 3 weeks after field transplant for laboratory analysis of total carbohydrates. The 4th leaf from the stem tip was collected from 10 plants per treatment on each occasion. Total carbohydrates were determined by Anthrone Method after Morris (5). Tomatoes were harvested twice weekly in the pink stage.

Laboratory analysis of tissue samples revealed no differences among treatments for total non-structural carbohydrates. Early and total marketable yields and % catfacing differed significantly among subplot treatments (Table 1). N had no effect on yield, fruit wt or catfacing.

The higher total market wt for the unpruned system was a reflection of the greater number of fruit harvested. Fruit size was significantly less in the unpruned than in the pruned systems.

The 1 and 2 stem early pruning systems resulted in a higher percentage of catfaced fruit than either the 2 stem delayed or the unpruned systems. This indicates that some factor which was critical for the normal development of fruit became a source of internal stress due to pruning during flower bud development. The results of this study, coupled with observations on the nature of the catfacing malady, suggest that proper levels of growth regulating substances may not have been maintained during this critical period.

One of two features is usually apparent on catfaced fruits. One involves an opening or scar at the blossom end, apparently a result of failure of the fruit wall in that region to grow and extend to encompass the entire fruit. This abnormality could be due to failure of cells to enlarge or divide normally which would imply the involvement of growth regulators. Knavel and Mohr (4) indicated that the failure of ovary walls to close completely near the base of the style may have been the result of inhibited synthesis or transport of important growth substances needed for normal cell division and growth in this region. Secondly, catfacing is very often accompanied by uneven seed distribution within the fruit (2). This phenomenon is especially pronounced when the catfacing scar extends up the side of the fruit as shown in Fig. 1. The carpels with higher seed concentration appear swelled compared to carpels with few or no seeds. Uneven growth of the fruit results, and the unequal distribution of growth may cause extension of the catface scar. Uneven seed distribution also implies the possible involvement of auxin since developing seeds are known to be a rich source of auxin in tomato fruit (6, 7).

If auxin supply is a stress factor which becomes critical in the development of catfaced fruit, the deficiency could be explained in terms of pruning. Since the chief source of endogenous auxin is in the meristematic region of the stem, pruning would constitute removal of additional sources of auxin to the developing ovary or fruit. The

Table 1. Early and total marketable yields and % catfacing of tomato fruit from pruning systems.

Pruning system	Marketable yield[z] (metric tons/ha) Early	Total	Fruits catfaced (%)	Avg wt (g) marketable fruit
1 stem	13.2a[y]	41.7a	59.1a	210.5a
2 stem	13.9a	57.7b	66.4a	199.1a
2 stem, delayed	13.5a	58.1b	47.8b	194.8a
Unpruned	7.8b	84.8c	45.9b	143.8b

[z]Yield for U.S. Standard grades 1 and 2.
[y]Means separation by Duncan's multiple range test, 5% level.

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Fig. 1. Catfaced tomato fruits revealing extended scar and unequal growth characteristics.

reduced no. of meristematic growing points could result in sub-optimal amounts of auxin reaching the fruiting structures at the proper developmental stage. Kazemi and Kefford (3) have shown that removal of the apical meristem produces a hyponastic leaf response due to auxin deficiency in tomatoes.

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Persistence of Ethephon to Induce Female Flowering in Cucumber[1]

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Abstract. **Reciprocal bud grafts were made over various time periods from 0 to 48 hours between (2 chloroethyl)phosphonic acid (ethephon)-treated and non-treated monoecious cucumbers (*Cucumis sativus* L.) to determine the persistence of ethephon to induce pistillate (female) flowering. Ethephon had no influence on sex expression in stocks if treated scions were grafted onto non-treated stocks. If rootstocks were treated with 250 ppm ethephon in the 2-leaf stage, femaleness was increased in plants grafted within 8 hours. After that, ethephon had essentially no effect on sex expression. The number of leaves (2, 4, 6, or 8) present at the time of application did not improve the effectiveness of ethphon in promoting femaleness when grafts were made 48 hours after application.**

The persistence of ethephon-induced femaleness in cucumber is dependent on factors such as temperature (8), concn of ethephon (6), stage of growth (4), and no. of applications (6). In the field environmental conditions such as low soil moisture, rainfall after spraying and high wind velocity can further reduce the persistence of ethephon's effect on femaleness.

Ethephon releases ethylene which promotes female flowering in cucurbits (2, 11). The speed and location with which ethephon converts to ethylene in cucumber is unknown. Hence, the length of time necessary to achieve the full effects of ethephon on cucumbers is unknown. Yamaguchi et al. (9) found that cucumber fruit harvested 22 days after treatment with ^{14}C labelled ethephon contained 0.1% of the applied ^{14}C. They did not identify the labelled compound. Lower et al. (4) observed that the greatest percentage of female flowers was produced on the main stem of cucumbers when the plants were sprayed twice in the 4th leaf stage with 120 ppm ethephon. The greatest total no. of female flowers were produced when the plants were treated in the 6th leaf stage. Our investigation was made to determine the length of time after ethephon treatment in which a response would be observed and to determine if the no. of leaves present at the time of application influenced the effect of ethephon on femaleness in cucumber.

The monoecious 'Wisconsin SMR 18' cucumber was grown in the greenhouse at 25°C (day), 21° (night) and 14-hr daylength. In the first experiment plants were sprayed to runoff with 250 ppm (about 1 mg ethephon/plant) of ethephon when 2 leaves were fully expanded. The apical tips (scion) of these plants were removed at intervals from 0 to 48 hr after treatment (Table 1). Non-treated scions were grafted onto these rootstocks. The treated scions were grafted onto untreated plants of the same age with 2 leaves. Each graft union was bound with a small piece of plastic drinking straw and a latex bandage. Grafted plants were placed in a shaded plastic tent with 100% relative humidity. After 4 days the humidity was gradually reduced to normal greenhouse humidity (about 60%). After 8 days the plants were replaced into ambient greenhouse conditions as described above. Non-grafted controls, 1 group treated, and another group non-treated, were left outside of the tent for comparison.

In a second experiment, plants in the 2-, 4-, 6- and 8-leaf stage were treated with 250 ppm (about 1, 2, 3 and 4 mg ethephon respectively/plant) ethephon. Tips of these plants were removed after 48 hr and non-treated tips from plants in the 2-leaf stage were then grafted as scions to these plants. The plants were

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