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Screening Fresh-market Tomatoes for Susceptibility to Catfacing with GA_3 Foliar Sprays

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Abstract. **The blossom-end scarring of tomato fruit caused by exposure of the plant to cool weather during ovary formation, commonly termed catfacing, can also be induced by GA_3 foliar sprays. To determine if GA_3 treatment could serve as a cultivar screening tool to identify lines susceptible to the disorder, we compared the catfacing incidence in 14 fresh-market tomato cultivars after GAS sprays and in nontreated controls in two field experiments. In 1 year, removal of the plant's apex was also imposed. GA_3 sprays (22 µM twice, applied 1 week apart to tomato seedlings ≈5 weeks old) increased catfacing incidence in both years and accentuated cultivar differences in the disorder. Topping did not increase catfacing significantly. The cultivars Valerie, Sunrise, and Basketvee were least affected by catfacing in the experiments, while 'Starfire', 'New Yorker', and 'Olympic' had the highest percentage of catfaced fruit. The GA_3 screening method shows promise for identifying cultivar differences in susceptibility to blossom-end scarring. Chemical name used: gibberellic acid (GA_3).**

The formation of irregularly shaped fruit with enlarged blossom-end scars, termed catfacing, occurs more frequently in some cultivars than in others (Knavel and Mohr, 1969; Saito and Ito, 1971; Sawhney and Greyson, 197 1). Since the disorder can cause significant reductions in marketable yield (Wien and Zhang, 1991), there has been interest in selecting for genotypes less subject to catfacing. Commonly, selection is practiced after the disorder has been induced by exposure to relatively low temperatures in the field (Barten et al., 1992; Elkind et al., 1990) or in a growth chamber.However, the unreliability of weather conditions in the field and space limitations in controlled environments limit the usefulness of these techniques. The discovery that GA_3 foliar sprays at transplanting can induce catfacing in known susceptible cultivars suggests that this technique might be used as an economical and convenient alternative screening tool (Wien and Zhang, 1991). The present work is a test of this hypothesis.

Materials and Methods

Seeds of 14 fresh-market tomato cultivars were sown 7 May 1990 and 1991 in Todd Planter trays (Speedling, Sun City, Fla.) of 36-ml individual cell volume filled with peat–vermiculite artificial soil mix. After 36 days of growth in 1990 and 29 days in 1991, the seedlings were transplanted into a Howard gravelly loam soil (loamy-skeletal, mixed mesic, Glossoboric Hapludalf) at Freeville, N.Y. Plant spacing was 137 × 30 cm, with 10 plants m single-row subplots. Treatments in both years consisted of a water-treated control and foliar sprays of 22 µM GAS at 2 and 9 days after transplanting (DAT). In 1990 only, a third treatment consisted of topping plants at transplanting by manually pinching off the plant apex and leaves smaller than 1 cm long. This treatment was based on the preliminary finding that apex removal increases catfacing in early clusters. The statistical design was a split plot, with above treatments as main plots and cultivars as subplots. There were four replications.

Catfacing was evaluated 84 DAT on six plants per subplot by harvesting main stem cluster 3, the first cluster on the branch arising just below the first main stem cluster and on two basal branches on each plant in the control and GA_3 treatment. For the topping treatment, the first two clusters on two basal branches were harvested, since main stem and primary branch clusters had been removed in topping. For each treatment, the clusters sampled represent those most affected by catfacing in the GA_3 treatment (Wien and Turner, 1994). Catfacing incidence was measured by expressing the number of fruits with blossom-end scars longer than 1 cm as a percentage of the total fruits per sample. The data were tested by analysis of variance for each year. Standard errors provided a variation estimate for the cultivar × treatment interaction means.

Results and Discussion

Catfacing incidence was significantly *($P <$* 0.001) increased by GA_3 treatment in both years (Table 1). Differences among cultivars across treatments were significant at $P \leq 0.001$. GA_3 treatment magnified the cultivar differences and contributed to a significant treatment × cultivar interaction. The cultivar Market Pride did not respond to GA_3 treatment. 'Valerie' was least affected by the disorder in the treated and nontreated plots, confirming the results of previous work (Wien and Zhang, 1991). 'Sunrise' and 'Basketvee' were moderately susceptible, but were significantly different from only the most severely affected, i.e., 'Starfke' and 'New Yorker'. GA_3 foliar sprays thus are not suited for exposing slight differences in catfacing susceptibility.

There was a higher incidence of the disor-

Table 1. Catfacing incidence (mean ± standard error) in 14 fresh-market tomato cultivars grown in 1990 and 1991 as influenced by foliar sprays of 22 µM GA_3 at transplanting or by apex removal (topping).

	Catfacing (%)[z]					
	Nontreated		GA_3		Topped	
Cultivar	1990	1991	1990	1991	1990	Avg
Starfire	32 ± 3	62 ± 4	76 ± 4	88 ± 3	39 ± 5	59
New Yorker	28 ± 5	43 ± 2	46 ± 5	73 ± 8	41 ± 9	46
Olympic	21 ± 4	35 ± 2	53 ± 6	56 ± 5	27 ± 4	38
Pik Rite	25 ± 6	33 ± 1	46 ± 6	47 ± 7	27 ± 3	36
Ultrasweet	15 ± 4	29 ± 2	46 ± 5	39 ± 5	30 ± 10	32
Colonial	23 ± 6	27 ± 4	36 ± 4	38 ± 1	33 ± 2	31
Market Pride	21 ± 5	40 ± 5	22 ± 8	44 ± 8	22 ± 2	30
Mountain Spring	26 ± 7	20 ± 4	35 ± 4	46 ± 2	24 ± 2	30
Pik Red	12 ± 4	27 ± 3	34 ± 4	43 ± 7	20 ± 5	27
Pilgrim	13 ± 1	25 ± 4	31 ± 6	43 ± 9	11 ± 1	25
Sunbeam	13 ± 3	30 ± 4	24 ± 5	36 ± 8	16 ± 4	24
Basketvee	8 ± 4	12 ± 4	29 ± 4	49 ± 5	14 ± 1	22
Sunrise	9 ± 4	11 ± 2	34 ± 10	36 ± 8	9 ± 1	20
Valerie	4 ± 0.5	3 ± 1	18 ± 2	28 ± 2	5 ± 0.6	12
Mean	18 a[y]	28	38 b	48	23 a	
$HSD_{0.05}$[x]	NS	36	32	36	32	

[z]Percentage of fruit on designated clusters with blossom scar length ≥1 cm.
[y]1990 treatment mean separation by Duncan's multiple range test, $P \leq 0.05$. Means for 1991 treatments differ at $P \leq 0.001$.
[x]Honestly significant difference values to compare means within columns.
[NS]Nonsignificant.

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der in 1991 than in 1990. The minimum temperatures during the first 2 weeks after transplanting were closer to the optimum temperatures for catfacing of 8C (Saito and Ito, 197 1) in 1991 than in 1990 (10 vs. 14C, respectively). Maximum temperatures were nearly identical in both years and 8C above the optimum of 17C. Catfacing incidence in control plots ranged from 3% to 62% in 1991, compared to 4% to 32% in 1990. With the wider range of responses among cultivars in 1991, the correlation coefficient between treated and controls was also higher in that year (r= 0.81, compared to $\boldsymbol{r}$ = 0.70 in 1990). The results confirm the value of using a GA_3 treatment to accentuate catfacing symptoms when temperatures cannot be relied on to induce the disorder.

The moderate increase in blossom-end scarring brought about by topping compared to the controls was not statistically significant (Table 1). The technique therefore has little potential as a screen for catfacing.

The results of these experiments indicate that GA_3 foliar sprays can serve as a convenient screening tool to identify genotypes strongly susceptible or resistant to catfacing. The method did not discriminate clearly among lines of intermediate susceptibility, however, and should not be relied on for detecting small differences.

Literature Cited

Barten,J.H.M.,J.W. Scott, N. Kedar, and Y. Elkind. 1992.Lowtemperaturesinducerough blossomed scarring of tomato fruit during early flower development.J.Amer. Soc. Hort. Sci. 117:298–303.

Elkind, Y., O.B.O. Galper, S. Vidavski, J.W. Scott, and N. Kedar. 1990. Genetic variation and heritability of blossom-end scar size in tomato. Euphytica 50:241-248.

Knavel, D. and H.C. Mohr. 1969. Some abnormalities in tomato fruits as influenced by cold treatment of seedlings. J. Amer. Soc. Hort. Sci. 94:411413.

Saito, T. and H.Ito. 1971. Studies on the growth and fruiting in the tomato.XI.Effect of temperature on the development of flower,especially that of the ovary and its locule (in Japanese, with English summary). J. Jpn. Soc. Hort. Sci. 40:128-138.

Sawhney, V.K. and R.I. Greyson. 1971. Induction of multilocular ovary in tomato by gibberellic acid. J. Amer. Soc. Hort. Sci. 96:196198.

Wien, H.C. and A.D. Turner. 1994. Severity of tomatofruitblossom-endscarringisdetermined by plant age at induction. J. Amer. Soc. Hort. Sci.119:32–35.

Wien, H.C. and Y. Zhang. 1991. Glbberellic acid foliar spraysshowpromise as screening tool for tomato fruitcatfacing.HortScience6:583–585.