Reducing pesticide treatments in celery may be justified

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Lower insecticide usage in the first half of the season did not reduce marketable fall-crop celery in this test.

The California celery crop, valued at $100 million, accounted for over 65 percent of total U.S. production in 1979. Despite the crop's economic importance, little information is available on insect injury to celery.

The major insect pests of celery in California are lepidopterous larvae, including the beet armyworm, cabbage looper, variegated cutworm, black cutworm, celery leaftier, and omnivorous leafroller; beet armyworm and cabbage looper are the predominant species. Because of insecticide applications to control these pests, an agromyzid leafminer, *Liriomyza trifolii*, has become an increasing problem. This leafminer is a recent invader to California, presumably from Florida, and is resistant to many insecticides. In some instances, it has become a serious pest of celery, even in the absence of insecticide applications.

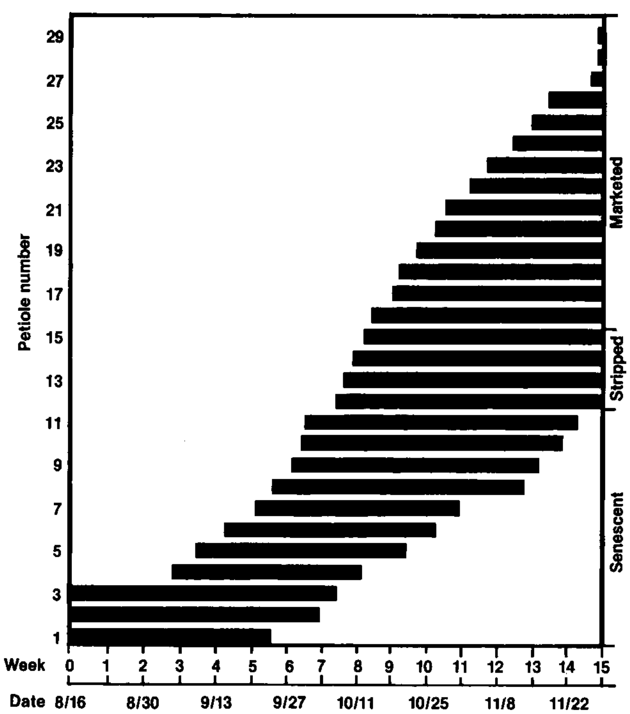
We conducted studies from 1978 to 1980 to establish a treatment level for lepidopterous pests in relation to celery growth. The goal was to reduce the number of insecticide applications on the crop and help alleviate the leafminer problem.

Plant growth

Celery (Tall Utah 5270R) was transplanted into field plots on August 16, 1978, at the University of California South Coast Field Station, Santa Ana. Ten celery plants randomly selected from the field were examined weekly from two weeks after transplanting until one week before harvest. All petioles longer than 5 centimeters were numbered. The date that each petiole began to turn yellow was recorded. At harvest (December 6), the plants were stripped and trimmed to commercial standards, and the number of stripped petioles recorded.

An average of 8.5 (7 to 11) petioles died before harvest and 3.5 (3 to 4) additional petioles were stripped from the plants at harvest (see graph). An average of 14.2 (13 to 15) marketable petioles was obtained after stripping and trimming. Similar results have been reported from research in Florida.

In our study, petioles destined to become marketable appeared approximately halfway through the growing season. All petioles produced before then either died or were stripped from the plants at harvest. These results are valid for only fall-crop celery grown in southern California. Different growth characteristics may occur with different planting dates and in other areas of the state.



Graph of mean dates for petiole (stalk) initiation, longevity, and disposition of fall-crop celery in southern California shows that up to 11 stalks died before harvest; 3 to 4 more were lost at harvest, leaving 13 to 15 marketable.

Treatment levels, 1978-1979

In the test field, treatment levels of 0.05, 0.25, 0.5, and 1.0 larva per plant and an untreated control were replicated four times in a randomized complete block design. Each replicate was four double-bed rows wide by 15.2 meters long with a 3-meter buffer between replicates.

Twenty-five celery plants per replicate were inspected weekly, from two weeks after transplanting until one week before harvest. Lepidopterous larvae found on the plants were categorized as to species and size (small, first and second stage; medium, third and fourth stage; and large, fifth or later stages). When the total number of larvae equaled or exceeded the treatment levels, acephate was applied at 1 pound active ingredient per acre with 100 gallons water per acre. Nine applications were made at the 0.05 level, five at the 0.25 level, four at the 0.5 level, and two at the 1.0 level. At harvest, all plants were trimmed and stripped to commercial standards, graded to size, and inspected for lepidopterous damage.

In 1979, celery was transplanted on August 1 at the South Coast Field Station. Treatment levels were 0.01, 0.05, 0.25, and 0.5 larva per plant, and an untreated control. Experimental design and plot size were the same as in 1978.

Twenty-five plants per replicate were inspected for lepidopterous larvae weekly, from three weeks after transplanting until one week before harvest (November 14). Larvae were categorized in the same manner as in 1978. When the total number of larvae equaled or exceeded the treatment levels, methomyl was applied at 0.9 pound active ingredient per acre with 100 gallons water per acre. Nine applications were made at the 0.01 level, six at the 0.05 level, three at the 0.25 level, and none at the 0.5 level. At harvest, all plants were trimmed and stripped to commercial standards, graded to size, and inspected for lepidopterous damage.

The mean number of third or later stage beet armyworm and cabbage looper larvae per plant per week at the various treatment levels was calculated for the last half of the season for both years (tables 1 and 2). (We used the second half of the growing season, since we had found that the marketable celery petioles are produced during that period.) In 1978, the last nine weeks of the season were used to calculate the mean population levels, and in 1979, the last eight weeks. We used third or later stage larvae, because we found that the small larvae of both species feed primarily on the leaf tissue that is trimmed at harvest. The mean number of third or later stage cabbage looper and beet armyworm larvae for the last half of the season for the various treatment levels was then regressed against the mean percent damaged celery plants.

The lepidopterous larval population at the various treatment levels consisted primarily of beet armyworm and cabbage looper. In 1978, the total lepidopterous larvae found in all treatment levels, including the check, were 46.3 percent beet armyworm, 51.7 percent cabbage looper, and 2 percent other larvae. In 1979, 29.9 percent were beet armyworm, 64.1 percent cabbage looper, and 6 percent other larvae. The "other" larvae were usually found late in the growing season, in low numbers, and were not included in the data analysis.

A strong relationship was shown when the mean number of third or later stage larvae in the second half of the season was regressed against the mean percentage of damaged celery plants. However, the relationship was weaker when the mean number of such larvae for the entire season was regressed against the mean percentage of damaged celery plants. This indicates that insect pest control in celery changes with growth of the plant. Early in the season, before petioles destined to become marketable have appeared, pest control can be reduced considerably. After marketable petioles appear, the number of lepidopterous larvae should be maintained below two or three per 100 plants to avoid economic injury.

Implementation study

To test the idea that insect control can vary with the growth stage of the celery plants, we conducted a study in 1980 at South Coast Field Station, basing insecticide applications for lepidopterous larval control on appearance of the first marketable celery petiole. The field was transplanted on August 13.

Treatment levels were 0.05 larva per plant for the entire season; untreated for the first half of the season, then 0.05 larva per plant for the second half; 0.25 larva per plant for the first half of the season, then 0.05 for the second half; and an untreated control. The first half of the growing season was seven weeks long, from August 13 to October 3. Each treatment level was replicated three times and each replicate was eight rows wide by 50 feet long.

The field was inspected once a week by counting 100 plants per treatment. When the total number of larvae (all species and all stages) equaled or exceeded the treatment levels, methomyl was applied at 0.9 pound active ingredient per acre with 100 gallons water per acre. The field was harvested on December 9, and all celery plants in the center four rows were trimmed and stripped to commercial standards, graded to size, and inspected for lepidopterous damage.

There was no significant difference in the percentage of damaged plants when insecticide treatments were applied at 0.05 larva for the entire season, untreated for the first half of the season and 0.05 larva for the second half of the season, or 0.25 larva for the first half of the season and 0.05 larva for the second half of the season (mean percentages were 7.1, 10.9, and 11.7, respectively). Only when no insecticides were applied to the celery crop did significant yield loss occur (62.5 percent damage).

The small amount of damage in the treated plots was caused primarily by beet armyworm, the key pest of celery in southern California. Insecticide applications to suppress the larval population ranged from four at 0.05 larva per plant for the entire season to two at 0.25 larva per plant for the first half of the season and 0.05 for the second half. The latter treatment level saved two insecticide applications. However, the larval population was much lower in the 1980 growing season than in previous years. A higher pest population might have resulted in greater savings in insecticide usage, while still maintaining commercially acceptable celery.

The lower insecticide usage, especially during the first half of the growing season, probably would reduce the leafminer problem because of increased activity of beneficial insects.

TABLE 1. Mean number of larvae per plant per week for last half of growing season and percent damaged celery plants at various treatment levels, Santa Ana, California, 1978

		Treatment levels (larvae/plant)*				
Species	**Stage**	**0.05**	**0.25**	**0.5**	**1.0**	**Check**
		larvae/plant/week				
Cabbage looper	Medium	0.004	0.011	0.058	0.098	0.157
	Large	0.000	0.056	0.019	0.056	0.117
Beet armyworm	Medium	0.020	0.043	0.064	0.091	0.094
	Large	0.001	0.020	0.022	0.050	0.078
		% damaged celery plants				
		2.8	11.0	20.5	53.4	82.8

*Third or later stage (medium and large) lepidopterous larvae.

TABLE 2. Mean number of larvae per plant per week for last half of growing season and percent damaged celery plants at various treatment levels, Santa Ana, California, 1979

		Treatment levels (larvae/plant)*				
Species	**Stage**	**0.01**	**0.05**	**0.025**	**0.5**	**Check**
		larvae/plant/week				
Cabbage looper	Medium	0.008	0.006	0.048	0.060	0.061
	Large	0.001	0.006	0.020	0.041	0.040
Beet armyworm	Medium	0.000	0.003	0.015	0.044	0.040
	Large	0.003	0.001	0.013	0.026	0.019
		% damaged celery plants				
		2.8	3.0	16.0	25.5	21.2

*Third or later stage (medium and large) lepidopterous larvae.

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