Cumulative effects of ethephon as a fruit thinner on French prune trees

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The market value of dried French prunes is determined largely by fruit size, which, in turn, is influenced primarily by crop load. Heavy cropping leads to small fruits low in soluble solids. Low soluble solids further influence prune size upon drying. Conversely, lightly cropped trees produce larger prunes that are higher in sugars, resulting in proportionately larger, more valuable dried fruit. Yield differences may be minimal with varying crop loads, however, because fruit size varies inversely with crop load.

Previous experiments have shown that (2-chloroethyl) phosphonic acid—ethephon—thins several fruit crops, including French prune. When a foliar spray was applied to heavily cropped French prune trees early in the season, ethephon reduced fruit set and improved fruit size. In past seasons, industry crop forecasts and subsequent pricing structures based on fruit size occurred too late in the growing season to allow growers to take advantage of this practice.

In 1981, the prune industry voted into the marketing order a minimum size standard that prunes must exceed to be salable in subsequent crop years. In addition to the minimum size, the industry can further establish a larger size prune as a minimum on an annual basis, depending on crop size and market condition. These changes make it illegal to sell prunes smaller than the minimum size established, and the pricing structure based on size makes it unprofitable to produce prunes near the minimum size.

With these incentives to produce larger prunes, annual applications of ethephon may become practice. The cumulative effect of ethephon treatment on prune trees should be known. The primary purpose of our experiment was to spray the same French prune trees for three consecutive years with ethephon at 50, 100, or 150 ppm and annually evaluate tree condition, fruit set, size, and yield.

Each year in April, trees in a 12-year-old French prune orchard in Tulare County, California, were foliar-sprayed with ethephon by handgun to the drip point as the fruits attained 8-mm seed length. A projected use rate of ethephon at 50 ppm was compared at double and triple concentrations on eight tree replicates with nontreated controls in a randomized complete block experiment.

Subjective evaluation of tree condition made each year during the growing season rated return bloom, vegetative growth, leaf color, premature senescence, and gummosis.

Bloom counts on three limbs per tree were followed by counting fruit on the same tagged limbs following ethephon application, after June drop. This provided the basis for calculating percent fruit set. At harvest the individual trees were compared for fresh and dry fruit yield, drying ratio, and number of dry fruit per pound. Soluble solids were measured on composite samples from replicates of each treatment.

Observations during the growing season suggested no impairment of return bloom, vegetative growth, or leaf color caused by ethephon treatment of these vigorous trees. We saw no obvious gummosis or other evidence of phytotoxicity at any ethephon rate applied. Tree condition the fourth year was vigorous, as judged by heavy return bloom and unabated vegetative growth. No treatment effect on premature fall leaf senescence was observed any year of the experiment.

Fruit set of untreated controls fluctuated widely from one year to the next—26 to 48 percent. Ethephon at 50 ppm resulted in more uniform set—from 16 to 20 percent. The double and triple rates of ethephon caused additional fruit removal each year (see table). Dry yield per tree was significantly reduced in two of the three test years by all ethephon treatments, and for all three years, fruit size was significantly improved at the 100 ppm and 150 ppm rate when compared with the control. In previous experiments, in which test trees were selected on the basis of maximum numbers of flowers, we found a definite advantage in fruit size improvement at 50 ppm. The latter would be true in years of more excessive fruit set.

Each year trees treated with ethephon produced fruit with higher soluble solids than controls. Soluble solids content dramatically influences dry fruit size by reducing fresh to dry ratio.

It is clear that ethephon will induce fruit thinning each year on the same tree when used at a 50-ppm concentration or higher. Further, these results support our previous experiments showing that, where poor fruit size and quality are a problem because of overcropping, ethephon can be used as a fruit thinner without harmful effects on healthy, vigorous French prune trees. In contrast, we have observed excessive gummosis on weak or stressed French prune trees treated with ethephon.

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Effect of repeated foliar applications of ethephon as a fruit thinner of French prune*

Year of application	Ethephon treatment	Fruit set	Fresh yield/ tree	Dry yield/ tree	Number of fruit/lb (fresh)	Number of fruit/lb (dry)	Dry ratio	Soluble solids†
	ppm	%	*lb*	*lb*				%
1973	0	26 a	411.4 a	123.2 a	29.1 a	97.3 a	3.34 a	23
	50	20 a	310.2 b	92.4 b	25 ab	84.1 ab	3.33 ab	24
	100	7 b	253 c	74.8 c	22.3 b	74.1 b	3.32 b	26
	150	6 b	140.8 d	41.8 d	21.8 b	73.2 b	3.32 b	26
1974	0	48 a	418 a	134.2 a	21.8 a	67.7 a	3.12 a	21
	50	20 b	330 b	110 b	21.8 a	65.5 ab	3.02 a	22
	100	11 c	231 c	81.4 c	20.9 ab	59.1 bc	2.83 b	23
	150	3 d	107.8 d	39.6 d	20.5 a	56.4 c	2.74 b	23
1975	0	26 a	446.6 a	134.2 a	27.3 a	90.5 a	3.32 a	19
	50	16 b	387.2 a	127.6 a	25.9 ab	83.6 ab	3.20 ab	21
	100	16 b	382.8 a	121 a	24.1 b	72.3 b	2.99 bc	21
	150	8 c	231 b	81.4 b	21.4 c	71.8 b	2.83 c	22

*Application by handgun at 8mm seed length. Mean separation within columns for each year, by Duncan's multiple range test at 5% level.
†Composite sample.