an angle so that, as the blade crossed the vertical cut, it tended to peel open one of the corners of the bark where the two incisions crossed (fig. 2). The high point of the knife blade (quill) was then used to peel open both corners (fig. 3). The trunk was now ready for the bud to be inserted (fig. 4).

With a bud stick about 1 cm (1/2 inch)in diameter, the budder made a cut angled downward into the stick, from about 2 cm (3/4 inch) above the bud to about 2 cm below the bud (fig. 5). A second angled cut made downward about 1 to 2 cm (1/2 to 3/4 inch) below the bud met the first cut and severed the bud from the stick (fig. 6). The second angled cut below the bud exposes more cambium surface (fig. 7) for better callusing, which first occurs at this point.

The bud was inserted under the open corners of bark, and the base of the bud shield was pushed well below the bottom of the vertical cut with the point of the knife blade (fig. 8). The bud was then covered with tightly pulled, overlapping wraps of white, 4-mil, plastic flagging tape. Since the understocks were about 5 cm (2 inches) in diameter, a 2.5-cm (1-inch) tape was used, starting below the bud (fig. 9) and wrapping up to about 2 to 3 cm (1 inch) above the horizontal cut (fig. 10).

The final few wraps were brought down to just above the bud and tied by tucking the end of the tape under the last wrap and pulling tightly to stretch the tape.

Tape wrapped in this way can be partially removed later if there is evidence of constriction or girdling of the shoot. Cutting across the tape up to the bud on the side of the vine relieves pressure below the bud. The tape will unravel below but not above the bud because of the overlapping last tie just above the bud. The tape should not be cut or removed above the bud until fall, unless there is evidence of girdling above the bud.

The tape held the buds tightly in place and prevented the shoots from breaking away. When the shoots were about 45 cm (18 inches) long, they were fastened to the bottom wire for support. To provide the more flexible established cordon needed for mechanical harvesting, each shoot was crossed over the top of the stock so that it was established on the side opposite the bud insertion.

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Lower ethephon rates effective in walnut harvest

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Previous research results have clearly demonstrated that early walnut harvest provides for the maximum quantity of light-colored kernels as well as the minimum amount of navel orangeworm damage.

Walnut kernels are mature, lightest in color, and of most value when the packing tissue surrounding the kernel halves has just turned brown (PTB). This usually occurs 2 to 3 weeks before sufficient hull splitting for harvest occurs. By applying the growth regulator ethephon at PTB, hull dehiscence is accelerated, and walnut harvest can be advanced by 5 to 10 days. Not only is harvest advanced, but in many cases, a complete harvest is obtained in one operation. Proper use of ethephon has made it possible to maintain kernel quality of harvested walnuts at a much higher level.

In spite of benefits provided through earlier harvest with ethephon, growers have been somewhat reluctant to use the growth regulator. Of particular concern has been the expense of applying ethephon at the registered rate of 5 pints per acre and uncertainty about the material's effectiveness in providing an early, single harvest.

Harvest trials

The purpose of these trials was to compare ethephon's effectiveness at 5 pints per acre with that at 3 and 4 pints per acre at dilute and semi-concentrate gallonage.

Replicated trials were established during 1975 in three areas of California with different climates: the San Joaquin Valley, the Sacramento Valley, and the coastal region. In each location a different walnut variety was used in the trial: Marchetti in the San Joaquin Valley, Ashley in the Sacramento Valley, and Payne in the coastal region.

Each trial was replicated three times with an average of 20 trees per replicate. Ethephon was applied at PTB (harvest commencing approximately 10 days later) at the following rates per acre:

- 3 pints in 100 gallons of water.
- 3 pints in 300 gallons.
- 4 pints in 100 gallons.
- 4 pints in 300 gallons.
- 5 pints in 100 gallons.
- 5 pints in 300 gallons.
- 0 pints (untreated check).

In each trial care was taken that ethephon-treated trees received thorough spray coverage. The walnut crop removed from each treatment during each harvest operation was accurately weighed to determine the percent of the crop removed with each harvest.

Harvest began for all treatments, including the untreated check, on the same date. In this way, date of harvest was eliminated as a factor governing completeness of harvest.

Results

Ethephon applications increased the percentage of removal in the first harvest in all locations (fig. 1). In the San Joaquin Valley, nut removal was increased by 15.8 to 21.8 percentage points, in the Sacramento Valley by 11.9 to 15.7 percentage points, and in the coastal region by 24.0 to 41.3 percentage points over the untreated check.

Although the Payne variety used in the coastal region resulted in the lowest percentage of nut removal in the first harvest, it also resulted in the greatest response in terms of percentage of removal over the untreated check. In no case was 100 percent nut removal obtained in the first harvest. However, in the Sacramento Valley trial, well over 90 percent of the nuts were removed with one harvest, leaving so few nuts that the cost of a second complete harvest operation would not normally be justified. In the San Joaquin Valley, on Marchetti walnuts, the use of ethephon increased the pounds of nuts removed in the first harvest by nearly 30 percent. This increase could improve quality significantly on this difficult-to-harvest variety.

In all trial locations, a significant difference ($p =\angle 0.05$) in percentage of nut removal was found between ethephon-treated plots and the untreated check. In the San Joaquin and Sacramento Valleys, there was no significant difference among any of the rates of ethephon or gallonage used per acre. In the coastal region, the 3-pint rate at 100 gallons per acre resulted in significantly fewer nuts being harvested in the first harvest than with any of the other ethephon rates or gallonages. However, even this 3-pint rate was significantly better than the untreated check.

In all locations, the ethephon-treated nuts were more hullable than the untreated check (fig. 2). In the San Joaquin Valley, the combined average hullability for all ethephon-treated plots was significantly greater ($p =\angle 0.05$) than the untreated check. In the Sacramento Valley, there was no significant difference in hullability among the ethephon-treated plots, but they were all significantly more hullable than the untreated check. In the coastal region, the ethephon-treated nuts were only slightly more hullable than the untreated check. This is probably because the cool coastal climate provides for more rapid hull dehiscence than does the warm interior valley.

No adverse effects, such as excessive leaf drop or poorer kernel quality, could be seen from the use of lower or more concentrated rates of ethephon.

Conclusions

The results of these trials have demonstrated that lower rates of ethephon may be used with results comparable to those at the 5-pint rate. The 3-pint rate, which worked well in the San Joaquin and Sacramento valleys at 100 and 300 gallons per acre and in the coastal region at 300 gallons per acre, could result in a 40 percent savings over the cost of the 5-pint rate. These trials also demonstrated that 100 gallons per acre worked as well as 300 gallons per acre. This can result in further savings, because the more acres that can be treated per tank load, the more efficient the operation.

Although a complete harvest (meaning 100 percent in one shake) may not be feasible, a far greater first harvest, and in some cases a near-complete harvest, is possible earlier than normal with the use of ethephon.

Even with the improved quality benefits obtained at a reasonable price, ethephon should not be used by all growers. The use of this material on orchards under stress has resulted in excessive defoliation, complicating harvest with an overabundance of leaves.

Growers who do not have their own harvest equipment or who, for some other reason, cannot harvest the crop promptly should not use this material. Once ethephon is applied, harvest must commence as soon as feasible to avoid accelerated loss in kernel quality.

Growers who have interplanted orchards of two or more varieties may find this material too difficult to use if only one variety is to be harvested at a time.

Finally, coverage is of utmost importance. If the trees are too large or the spray equipment inadequate to provide complete coverage, it would be unwise to use ethephon.

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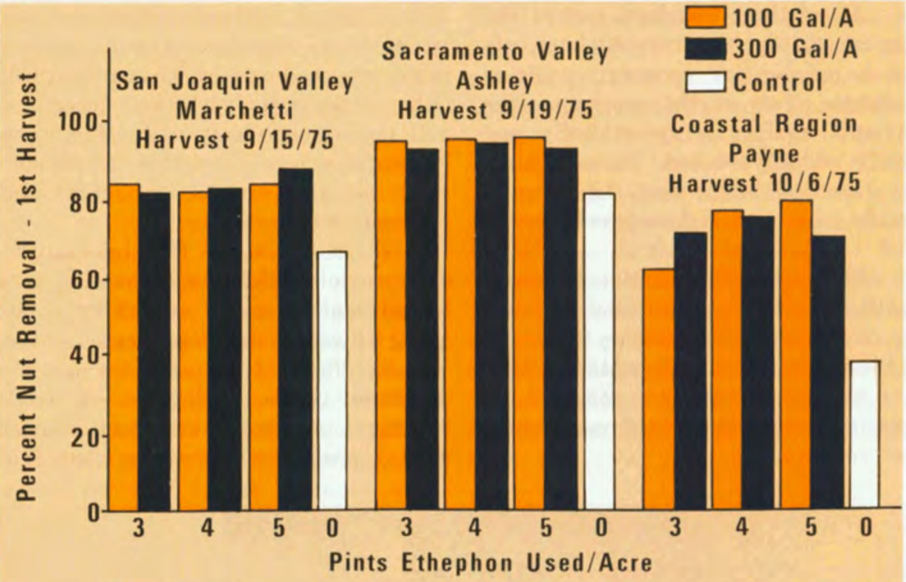

Fig. 1. Influence of ethephon rate and gallonage per acre on initial walnut harvest.

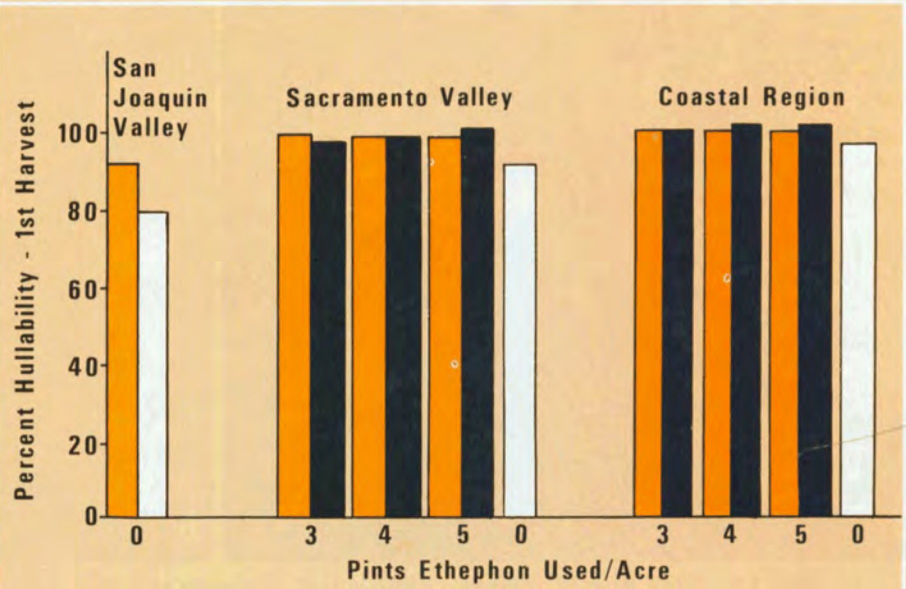

Fig. 2. Influence of ethephon rate and gallonage per acre on walnut hullability.