

Growth regulators affect apple maturity

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Reports from other apple producing states have shown that two chemical growth regulators, Alar and ethephon, could have a distinct effect on apple maturity. Alar has been reported to increase firmness of fruit, delay maturity, increase red surface color of red varieties, reduce incidence of scald, and reduce preharvest drop. Ethephon has been shown to hasten fruit maturity, improve the soluble solids content of fruit, and improve red surface color of red varieties.

In California, several red apple varieties, especially various strains of Red Delicious, frequently do not have well-colored fruit when they meet minimum maturity standards. Therefore, if Alar or ethephon applied alone or in sequence enhanced fruit color, these materials would be a valuable aid to the California apple industry. If they also improved soluble solids (sugar) content and reduced storage scald on fruit, the grower and the consumer would both benefit.

Four-year trial

A trial using these materials separately and in sequence was begun in 1972 in a 'Richared Delicious' apple orchard in Santa Cruz County. Alar was applied at 1,000 ppm (1 pound per 100 gallons water) approximately two months before harvest and ethephon at 300 ppm (1 pint per 100 gallons water) 10 to 14 days before anticipated harvest. Naphthalene-acetic acid (NAA) at 10 ppm also was applied 10 to 14 days before harvest to prevent preharvest fruit drop. Dilute handgun applications of all materials were made at about 8 gallons of spray mix per tree. Treatments were applied to the same trees during the four consecutive years of this trial (1972-75).

Samples of 20 fruit per tree were collected at the beginning of the harvest season (Release Date for Red Delicious in Santa Cruz County) and evaluated for surface red color, soluble solids, flesh firmness, and weight.

Results

In three of the four years of this trial, ethephon significantly improved sur-

TABLE 1. EFFECT OF GROWTH REGULATORS ON 'RICHARED DELICIOUS' APPLES. SUMMARY OF FOUR YEARS' DATA (1972-75)

Treatment	Color index*	Soluble solids (percent)	Flesh firmness (pounds)	Weight per fruit (grams)
Untreated control	3.7	11.2	18.0	138
Alar 1,000 ppm (summer)	3.2	10.7	19.8	121
Ethephon 300 ppm (preharvest)	2.7	12.2	17.9	140
Alar 1,000 ppm (summer) plus ethephon 300 ppm (preharvest)	2.3	12.6	19.6	134

* Color rated on a 1 to 5 scale: 1 — surface fully red; 2 — 90 percent of surface red; 3 — 75 percent red; 4 — 50 percent red; 5 — less than half of surface red.

TABLE 2. EFFECT OF GROWTH REGULATORS ON SCALD DEVELOPMENT IN 'RICHARED DELICIOUS' APPLES*

Treatment	Percent fruit showing scald†	
	1972	1973
Untreated control	47 c	42 b
Alar 1,000 ppm (summer)	10 ab	19 a
Ethephon 300 ppm (preharvest)	22 b	55 c
Alar 1,000 ppm (summer) plus ethephon 300 ppm (preharvest)	2 a	22 a

* Fruit stored four to five months in regular cold storage before evaluation.
† Mean separation within columns by Duncan's Multiple Range Test, 5 percent level.

face red color of the fruit (table 1). Alar significantly enhanced red coloration only in 1975. The combination treatment frequently improved color more than ethephon alone, but the differences were not significant.

Ethephon alone and in combination with Alar increased soluble solids content of the fruit in all four years; Alar alone decreased soluble solids in two of the four years. Alar alone increased flesh firmness in three of the four years and, in combination with ethephon, produced firmer flesh in 1973 and 1974. Ethephon alone had no effect on fruit flesh firmness.

Alar tended to reduce fruit size as measured by weight. Ethephon had no effect on fruit weight.

In 1972 and 1973, an additional 20 fruit sample was taken from each tree and held for four to five months in regular cold storage. After storage, percent scald was determined. Alar and the combination treatment markedly reduced storage scald in both years (table 2). Ethephon alone had a variable effect, decreasing scald in 1972 but increasing it in 1973.

Discussion

The year following Alar applica-

tion, there have been reports of excessive fruit set, fruit size reduction, short thickened stems, and misshapen fruit. At the rate and timing discussed here, these effects have generally not been noted to any great extent on Red Delicious apples in California. Also, some of these growth regulator treatments may affect the time or amount of bloom or both. Therefore, trees should be carefully observed after such treatments.

It appears that ethephon is most advantageous in California on early shipping blocks of Red Delicious. Ethephon may cause green apples, such as the 'Newtown Pippin,' to turn yellow. Color response of striped strains of Red Delicious, such as 'Starking,' to this material may take place slowly, while internal maturity can be enhanced more rapidly. Regardless of color response, treated fruit must be harvested when mature so that it does not become overripe. Ethephon works well in a programmed harvest situation where only as much acreage is sprayed at any one time as can be managed at harvest.

Drift of these growth regulators onto adjoining crops must be prevented, because undesirable side effects on other crops might result. Only one application per year of each material should be made to apple trees. Weak or stressed trees should not be sprayed.

In addition to its effect on color and maturity, ethephon loosens the fruit, thereby increasing preharvest drop. Therefore, a "stop-drop" material should be used. Although Alar has "stop-drop" capability, it is usually not adequate to prevent drop of fruit subsequently treated with ethephon. For other precautions and application information, read and follow the labels.

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