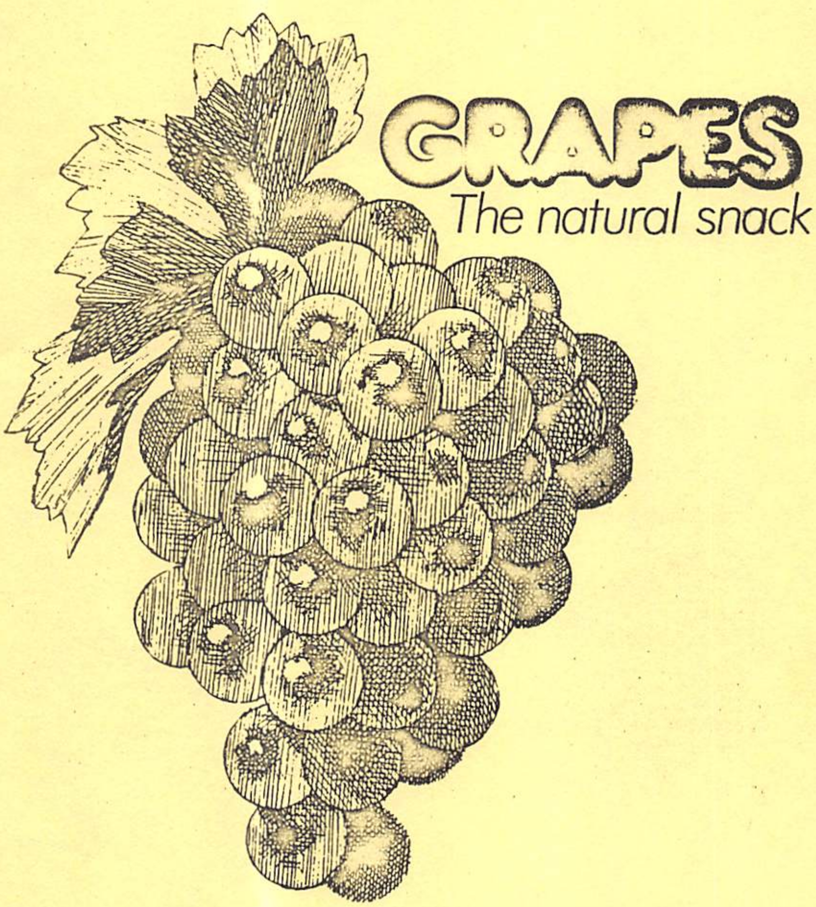
1982 PROCEEDINGS

COACHELLA VALLEY TABLE GRAPE SEMINAR



FORBES AUDITORIUM

COACHELLA VALLEY, CALIFORNIA

U. C. COOPERATIVE EXTENSION AND CALIFORNIA TABLE GRAPE COMMISSION

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GIRDLING & GIBBERELLIN EFFECTS ON TABLE THOMPSON SEEDLESS

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Girdling is the removal of a strip of phloem tissue on either the trunk or canes of a grapevine. The phloem is the live outer bark whose function is the transport of the materials produced in the shoots including sugars and hormones. These metabolites are then concentrated in the parts of the plants above the girdle until the girdle heals and the phloem tissues reunits.

If Thompsons are girdled at fruit set, when the berries are about 3/16" in diameter (4-5 mm), the berries become much larger and the berries also shatter less.

Winkler in the book, General Viticulture, states that "It is essential that a ring of bark be <u>completely</u> removed." Surveys in commercial vineyards showed that very few girdles were complete. Most were 90-95% complete. With trunk girdling, an area between the trunk & the stake was apt to be missed. Other area might not be cut deeply enough.

Trials were established to determine how much the effects of girdling were diminished if 5 per cent or more of the phloem at the circumferance of the trunk were left intact. The results showed that if 5% of the trunk were not girdled, only about half the normal response was secured.[1] If 10% or more were left, there was essentially no response.

Trials to determine the difference in response between 1/8, 3/16, and 1/4 inch trunk girdling widths showed that all were equal. In the San Joaquin Valley, girdles heal in about 3 1/2 weeks. The difference in time of healing

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1/ With Ribiers girdled at the beginning of color for earlier maturity, there was no benefit if even 5% were left.

was only 3 or 4 days between 1/8 and 1/4 inch wide girdles. This difference came after three weeks when there was no longer any response to girdling. The only benefit of a wider girdle is the probability that it will be more nearly complete.

Before gibberellin, vines that were girdled produced berries 30-40% larger than those produced on vines not girdled. With gibberellin, girdling still increases berry size about 20%. It is not possible to produce berries as large with gibberellin alone as with gibberellin and girdling. Girdling is also necessary to reduce shatter and to produce more uniform sized fruit.

Gibberellin will increase berry weight 60-80% above that produced by girdling alone. The greatest benefit is produced by 40-60 ppm of gibberellin (assuming a rate of 200 gallons per acre). Using higher concentrations or repeated applications does increase the size a little but the benefit per unit of gibberellin is small.

The greatest size benefit is secured from application at fruit set when the berries are about 3/16". The response drops off with time.

Trial with adjuvants (spreader-stickers, wetting agents, ph adjustment, etc.) showed no benefit above that obtained from gibberellin alone. Mixing gibberellin with many other pesticides showed no decrease in response. This does not mean that all mixtures are safe under all conditions since scarring does occur at times.

PLANT TISSUE ANALYSIS AS A GUIDE TO VINEYARD FERTILIZATION

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WHY TISSUE ANALYSIS IN VINEYARDS?

Chemical analysis of the plant tissues is becoming an increasingly important tool in furthering knowledge of vine nutrition. Long continuing research by personnel of the University of California and other research institutions has established critical levels of essential nutritional elements in the tissues of important grape varieties.

With this information and the expanding services of commercial laboratories, growers can effectively use tissue analysis to diagnose their own vineyard nutritional problems and needs. Many growers have already taken guesswork out of the vine fertilization by more accurately basing their fertilization program on tissue nutrient levels.

Tissue analysis in vineyard nutrition is much more effective and reliable than soil analysis. Soil analysis does not accurately represent the quantities of nutrients the vine is actually able to remove from the soil. Our many types of vineyard soils and vines' potentially deep and far-ranging root system are largely responsible for this difference.

Soil analysis is <u>only</u> of value in <u>vineyards</u> when determining problems directly related to the soil such as alkalinity, high salts, or merely supplementing tissue analysis findings.

The following guidelines can be used for proper sample taking and interpretation in vine tissue analysis.

HOW TO SAMPLE A VINEYARD

The method of sampling is dependent on the objective: (1) Determination of nitrogen status and general nutritional levels, or (2) Trouble shooting and diagnosing vine disorders.

1. Nitrogen Status and General Nutritional Levels of Vineyards

This approach is used when surveying a vineyard for fertilizer needs and when evaluating a fertilizer program.

Time to Sample. **Timing is extremely important. Samples must be taken during bloomtime,** the nearer to full bloom the better ("full bloom" is when approximately two-thirds of the caps have fallen from the flowers). This normally occurs during mid-May in Fresno County, but can vary between May 1-30, depending on the season, location, and grape variety.

Plant Part to Sample. The petioles (leaf stems) are normally used--those from leaves opposite the clusters toward the base of shoot. Immediately remove and discard the blades, leaving only the petioles for analysis.

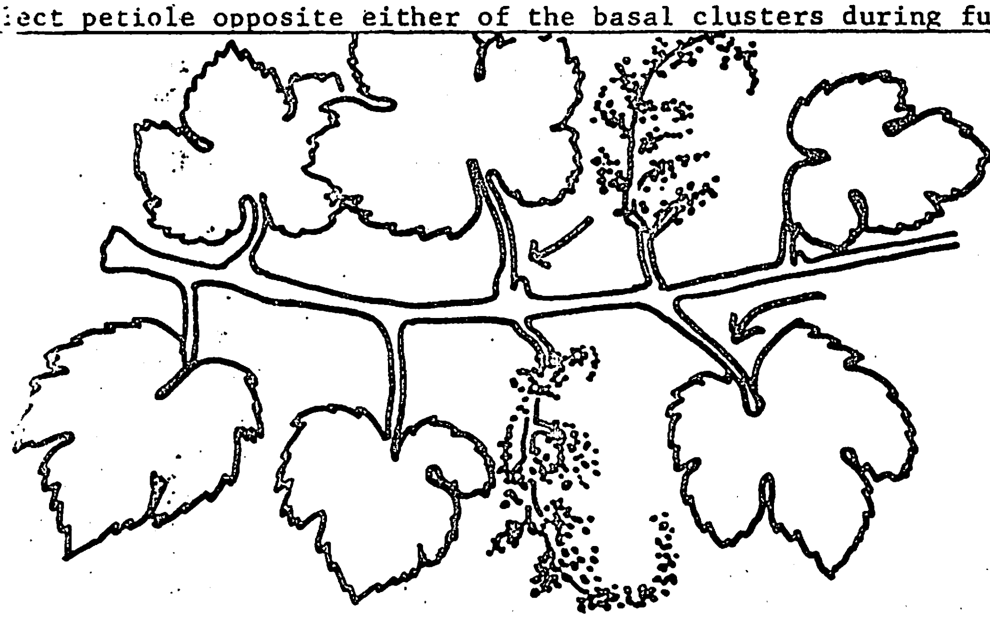
Taking a Representative Sample. Each sample should represent not more than 10 acres, even in uniform vineyards. Areas of different soil types and weak or strong vine areas should be sampled separately.

Each sample should consist of 75-100 petioles collected from separate vines uniformly dis buted over each area.

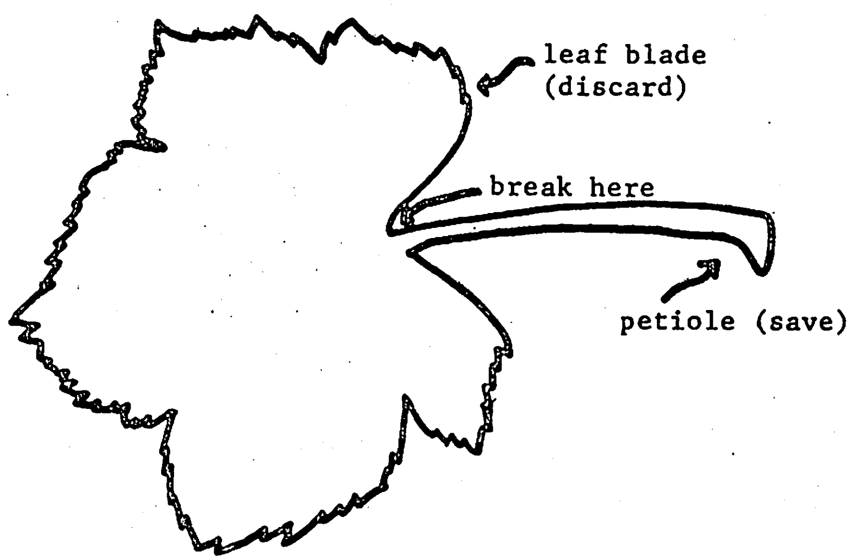
Ca Samples. Put each sample in a new, clean paper bag. A No. 2 bag is a co ient size. Do not use a plastic bag because of moisture condensation and p e molding. Label and keep a record of the pertinent information--name, date, va y, location, condition of vineyard, and foliar sprays used. Deliver the pe les immediately. If there is a delay, keep the bags open in a warm, dry, well-ventilated place. This will begin the drying process and prevent molding and decay.

Fo age contamination from a nutrient spray can give erroneous laboratory results. Do sample after a nutrient spray unless you (1) are not considering analysis of a tritional element contained in the spray, (2) have made arrangements with the la tory for sample washing, or (3) are sampling uncontaminated tissue later in the season.

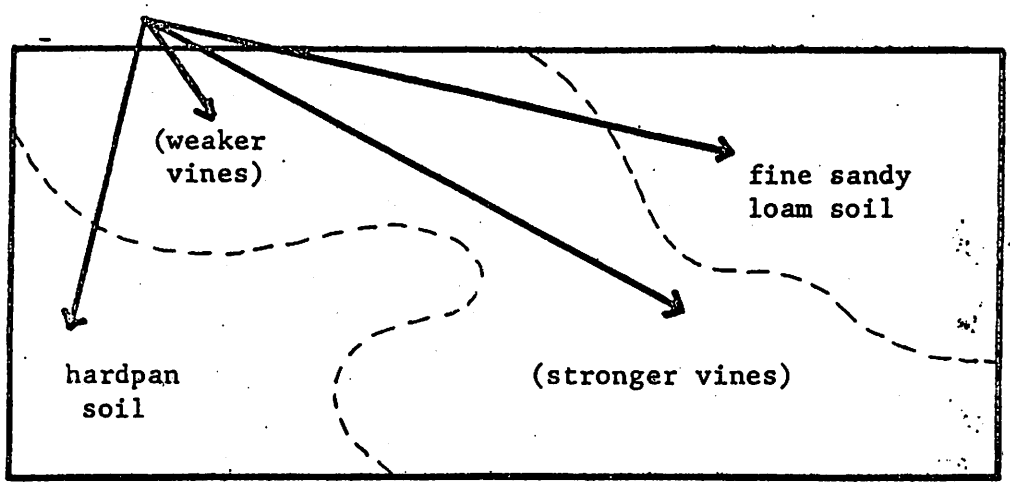
A Select petiole opposite either of the basal clusters during full bloom.



B. Save the petiole and discard the blade.



C. Sample each vineyard area separately.



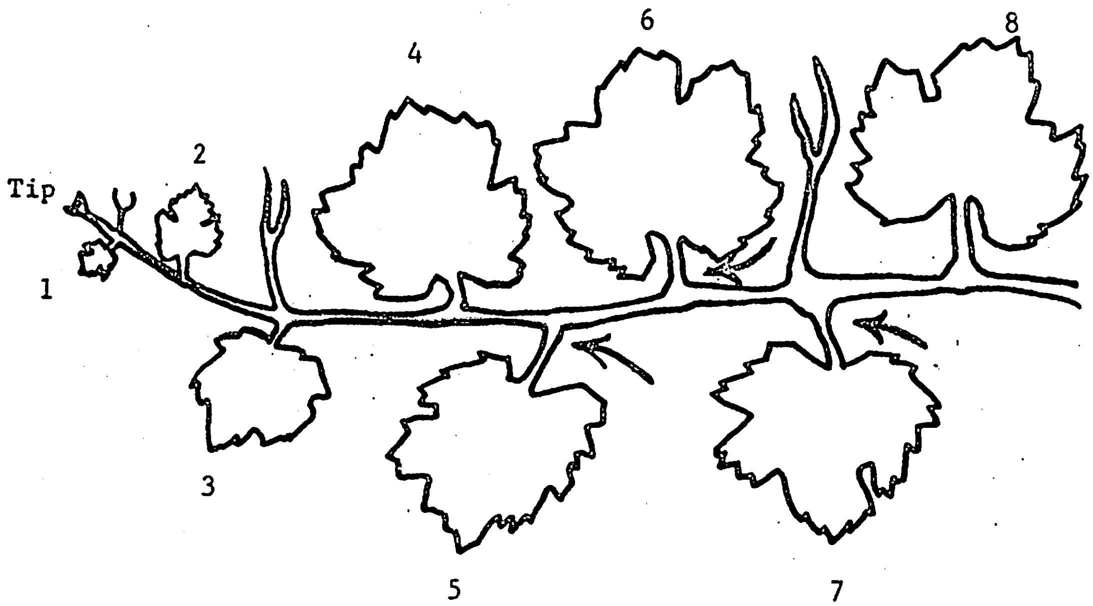
2. Trouble Shooting, Diagnosing Visual Vine Disorders, and Follow-up Sampling

The bloom period offers the advantage of easy, uniform sampling during a definite stage of vine growth. However, both deficiency and toxicity symptoms most commonly appear in mid-season or harvest time. Thus, sampling at this time is useful in diagnosing vine disorders and as a follow-up of questionable bloomtime levels.

Time to Sample. Samples can be collected at any time when abnormal appearance is noted. However, for midsummer resampling of an area with a questionable bloomtime potassium level, it is best to sample in mid-July at berry softening.

Plant Part to Sample. Take the petiole from the most recently matured leaf on a shoot after the bloom period. This would be the first fully expanded leaf, usually the 5th to 7th leaf from the tip of an actively growing shoot.

Collect petioles taken from the most recently developed, full sized leaf.



Where toxicities are involved, it is desirable to collect both the leaf blades and the petioles, since toxic elements, such as boron, may show greater accumulation in the blade itself.

Taking a Representative Sample. Uniformly sample the area in question. In cases where leaf symptoms are showing, be sure to sample the affected leaves. For comparison, take a second sample from healthy shoots in an unaffected area.

Care of the Samples. Same as bloomtime samples.

WHAT ANALYSES SHOULD BE MADE?

For general nutritional surveying have the laboratory analyze bloomtime samples for nitrate-nitrogen (NO_3-N), total phosphorus (P), total potassium (K), zinc (Zn), and boron (B).

An analysis of other elements, such as magnesium (Mg) and manganese (Mn), which are rarely deficient is only necessary for more background information or for leaf symptom diagnosis.

For trouble shooting, especially in mid to late summer, the samples can be analyzed for possible toxicities of chloride (cl), boron (B), and sodium (Na), or for possible potassium (K) deficiency.

SHOULD THIS BE DONE EVERY YEAR?

Check the bloomtime nitrate-nitrogen levels for a few successive years so that any necessary adjustments can be made in the nitrogen fertilization program to establish correct vine nitrogen levels.

If levels of the other nutrients are adequate, you need only rerun them every few years to maintain a check.

INTERPRETATION OF LABORATORY ANALYSIS

The following interpretations give critical values for important grape vine nutritional elements. They are approximate levels based on the available information to date, and are subject to change as more information becomes available.

Critical levels are not yet developed for all grape varieties, and the levels reported are based mostly on experience with a few of the more important ones. Known important variety differences are mentioned under each element.

These data are based on leaf petioles taken from opposite clusters at full bloom, except where stated otherwise.

MACRONUTRIENTS

NITROGEN

The following nitrate-nitrogen levels were established with the Thompson Seedless variety. Although other varieties, such as Carignane, appear to fit into these ranges, they should be considered general guidelines to catagorize a vineyard as relatively low, medium, or high in nitrogen, and to evaluate nitrogen fertilizer programs from year to year. Yield and fruit quality effects of nitrate-nitrogen levels in other varieties have not yet been established.

Nitrate-nitrogen levels are typically highest 5-10 days before bloom, decline through the bloom period, and reach a relatively stable lower level by 2-3 weeks after bloom. Nitrate-nitrogen levels are similar for a given variety during bloomtime if they are taken within several nodes in either direction from the cluster positions. There are wide differences among grape varieties, rootstocks, and year to year fluctuations in the same vineyard.

	NO_3-N ppm
Deficient	less than 350
Questionable	350 - 500
Adequate	500 - 1200
More than necessary	over 1200
Excess	over 2000
Possibly toxic	over 3000

Levels over 1200 ppm can produce excess growth, but may be justified where heavy foliage is desired. Levels over 2000 ppm have been associated with various detrimental effects--excessive growth, reduced bud fruitfulness in Thompson Seedless, poorer cane maturity and reduced fruit set.

Levels over 3000 ppm are sometimes associated with toxic effects, such as leaf burn. This most commonly begins between 3500 and 4500 ppm in Thompson Seedless, but can be higher in some varieties and growing conditions.

The leaf burn symptoms are actually caused by an excessive ammonium-nitrogen buildup in the blades due to inadequate nitrogen assimilation. However, petiole nitrate levels may still provide an indication of the problem but with a recognized wide range in nitrate-N levels above 3000 ppm associated with a wide range of symptoms.

PHOSPHORUS

	% Total Phosphorus
Possibly deficient*	less than 0.1
Questionable	0.1 - 0.15
Adequate	over 0.15

*Deficiency symptoms have not been identified in California vineyards, nor have there been measurable responses in yield and fruit quality in University of California trials--thus, the lack of a critical deficient level.

By mid-summer, these critical levels can drop: possibly deficient—less than .08%; questionable—.08% - .12%; adequate—more than .12 %.

Petiole phosphorus levels tend to decline through the bloom period and level off through mid-summer. Differences among mature leaf petioles among the shoot are minor.

There are wide differences among grape varieties and between year to year levels in the same vineyard.

POTASSIUM

	% Potassium
Deficient	less than 1.0
Questionable	1.0 - 1.5
Adequate	over 1.5

Vines in the questionable range should be resampled 6-8 weeks after bloom (about mid-July) by the collection of petioles from most recently matured leaves. Levels below 0.5% K would be deficient, whereas a safe level would be above 0.8% at this time.

Opposite cluster petiole levels usually decline most rapidly from before bloom until 2 to 4 weeks afterwards. Thereafter they decline gradually or level off through mid-summer. Potassium levels are highest in the youngest mature leaf petioles where they peak at bloomtime and they decline with time and with leaf age. Potassium levels can vary widely (30-50%) from year to year in the same vineyard.

Varietal differences also exist for potassium, although not as great as for nitrate-nitrogen. Certain varieties, such as Emperor, French Colombard, and Rubired, tend to be high in potassium whereas Salvador tends to be low. Thompson Seedless, Carignane, and Barbera are among the intermediate varieties.

MAGNESIUM

	% Total Magnesium
Probably deficient	less than 0.2
Questionable	0.2 - 0.3
Adequate	over 0.3

Petiole levels in California vineyards almost always increase as the season progresses and tend to be higher in older petioles. Critical petiole levels are probably higher later in the season, but they have not been established.

MICRONUTRIENTS

ZINC

	Total Zinc ppm
Deficient	less than 15
Questionable	15 - 26
Adequate	over 26

Differences in petiole levels along the shoot and changes during the season are minor. Bloomtime levels are more critical because of possible berry-set effects.

MANGANESE

	Total Manganese ppm
Deficient	less than 20
Questionable	20 - 25
Adequate	over 25

Differences among the mature leaf petioles along the shoot are minor. No conclusions on variety differences and seasonal changes can be made because of limited data.

BORON

	Total Boron ppm
Deficient	less than 25
Questionable	26 - 30
Adequate	over 30
Possibly Toxicity	100 - 150 and above (can be confirmed with blade analysis, presence of symptoms and/or soil analysis)
Toxicity	over 300 in blades

Petiole levels normally do not vary markedly along the shoot or during the growing season. However, in soils with high or excess boron the petiole levels increase gradually through the season.

Boron accumulates more in the blades. Thus, in high boron areas the levels increase markedly during the season and are higher in the older leaves.

IRON

Critical levels are not established because there is no correlation between iron deficiency and tissue levels. Deficiencies are related more to iron immobility within the grapevine than to total iron levels. Petiole levels range widely, from 50 to 300 ppm, but most typically from 70 to 200 ppm.

SALINITY PROBLEMS

CHLORIDE (salt injury)

	% Total Chloride
Possible toxicity	over 0.5 at bloomtime
Toxicity	1.0 - 1.5 and above chloride in mid summer to late summer*
	over 0.5 in blades

*Leaf injury from chloride injury sometimes occurs at petiole levels down to .8% in sensitive varieties and under conditions of high sodium. Blade analysis may be needed to confirm a toxicity.

Varieties and rootstocks differ widely in tolerance. Chloride continues to accumulate during the growing season and does so predominately in the petiole even though the symptoms of excess appear in the blades.

SODIUM

	% Total Sodium
Possible problem	over 0.5
	over 0.25 in blades

Effects of sodium have not been clearly defined because they are usually associated with high chlorides. Sodium may aggravate a chloride problem.

The Effect of Gibberellin, Bloom and Post-Bloom Treatment, Girdling and Ethephon on Flame Seedless, 1981

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SUMMARY

An application of 5 ppm gibberellin in bloom significantly reduced the set compared to untreated vines. Further reductions in set were secured with 10 and 15 ppm but these also tended to increase the numbers of shot berries. Applications of two gibberellin thinning sprays in a vigorous vineyard resulted in excessive thinning and increased shot berry production.

Gibberellin sizing sprays produced their maximum benefit at 40 ppm. No additional benefit was secured with 80 or 120 ppm whether the vines were girdled or not. Girdling for size resulted in an average 0.6 gram increase in berry weight. If vines were not girdled, the use of high rates of gibberellin would not compensate for its absence.

Ethephon applied at color break increased the percentage of harvestable fruit regardless of girdling treatment. However, the best color development was secured with a combination of ethephon and a maturity girdle. Ethephon and the maturity girdle both resulted in reduced titratable acidity. The girdle also affected the firmness or crispness of the Flame Seedless berry. The least firm was the non-girdled fruit and the maturity girdled the firmest.

In 1981 trials were established in four Flame Seedless vineyards which had produced at least three crops. Sufficient vines were available at all locations for replicated tests. Unfortunately two out of the three plots were lost at one location due to color girdling of all check vines. Results presented are from three vineyard locations.

Objectives of tests:

(1) To evaluate the concentration of bloom time gibberellin on thinning and shot berry production.

(2) To evaluate the effect of girdling and gibberellin concentration on the berry weight.

(3) To evaluate the effect of girdling for fruit size increase or maturity (color break) with and without the application of ethephon at color break on the color development.

Methods

a. Gibberellin Applied During Bloom.

Trial No. 1 was established in the Wheeler Ridge District of Kern County. Spray was applied on May 7, 1981 with a single over the row inverted "U" boom sprayer at 250 gallons per acre. Bloom was estimated to be between 50-70 percent at the time of application. Bloom sequence was: no bloom, April 30, 1981; 30 percent bloom, May 4, 1981; 50-70 percent bloom, May 7, 1981. Grower applied two gibberellin sizing sprays of 30-35 ppm each and normal cultural cultural practices were followed. At harvest 15 top laterals were randomly selected from each treated plot and evaluated.

Trial No. 2 was established in the Delano District. After the trial was marked, but prior to the experimental application, the grower applied a single bloom spray of 6.0 ppm at 20-30 percent bloom. It was decided to evaluate a second set of sprays so the plot was re-sprayed on May 12, 1981.

The concentrations and method used was the same as for trial No. 1 at harvest 10 shoulders were selected for data collection.

b. Gibberellin and Girdling for Berry Size Increase

Trial No. 1 was established in Wheeler Ridge District on six year old vines. Single sizing sprays were applied at 0, 40, 80, and 120 ppm and 250 GPA, utilizing a single row, inverted "U" boom sprayer. Sprays were applied when the average berry size was 7.22 mm. The range was:

15.1 percent, 4-4.5 mm; 72.3 percent, 5.5-8.5 mm; 12.6 percent was 8.5-10 mm in diameter. Sizing sprays were applied on May 25, 1981 and the vines were girdled by one man using a ¼ inch girdling knife on May 26, 1981. Girdles were checked for completeness the next day. Berry samples were collected from each plot on July 7, 1981 for data analysis. All other cultural practices were normal for the variety.

c. Ethephon and Girdling on Color Development

Trial No. 1 was established in the Wheeler Ridge district on six year old vines. Bloom and sizing sprays were applied by the grower.

Vines were girdled for fruit size increase on May 26, 1981 with a ¼ inch girdling knife. Ethephon was applied at less than 1 percent color development at the rate of one pint per acre at 250 GPA with a single row inverted "U" boom sprayer and girdled for color with a ¼ inch girdling knife on June 20, 1981. Berry samples were collected on July 6 and July 14, 1981. Estimates of color development were also made on the same dates. Actual harvest data was collected between July 21 and August 7, 1981.

Trial No. 2 was established in the Terra Bella District of Tulare County. The vines were size girdled on May 27, 1981. Ethephon was applied on June 26, 1981 and the color girdle was applied on the same date. Color development was approximately 30 percent at the time of ethephon application and color break girdle. Estimate of percent harvestable fruit was made on July 9, 1981. Berry samples, 75 berries/plot, were taken at harvest on July 9, 1981 for determination of berry weight, °Brix and titratable acidity.

Trial No. 3 was established at the Kearney Horticultural Field Station (KHFS). The vines were shoot thinned to two shoots per spur position. On May 13, at 70% bloom, the vines were sprayed with 5 ppm gibberellin. Sixty ppm gibberellin was applied on May 28 and the girdling was done on May 29. The vines were thinned to 18 - 25 clusters per vine and tipped on June 1. Ethephon was applied on June 29 at about 30% color break in a dilute spray. Range of clusters were 0-90% color development.

Results

a. Gibberellin Applied During Bloom

Even though all berries were larger when gibberellin was applied at bloom, the difference was not statistically significant, Table 1. There was no effect on °Brix, or titratable acidity due to the amount of gibberellin applied as bloom spray. The 5 and 7½ ppm sprays statistically reduced the number of berries per centimeter of shoulder length from the check while the 7½, 10, and 15 ppm sprays further reduced the number of berries per centimeter of shoulder length from the check. There was little improvement in reducing the number of berries per centimeter of shoulder length when more than 5 ppm gibberellin was applied at bloom. Similar results were obtained when the weight of berries per centimeter of shoulder length was evaluated. Percent shot berries were statistically increased over the check at 7½, 10, and 15 ppm. It appears as though 5 ppm gibberellin adequately thins the clusters, therefore, there is no advantage in increasing the concentration of bloom spray to 7½, 10, or 15 ppm.

In test No. 2, Table 2, the vineyard had been sprayed one time by the grower with a second experimental application. There was no effect on the berry weight, however, the number of berries per centimeter of shoulder length were statistically reduced at both the 7½ and 15 ppm spray over the single spray check. In this case, these clusters were actually overthinned. There was no statistical difference in the length of the shoulder, but there was again a statistical reduction in the average number of berries per shoulder when comparing a single 7½ ppm spray in the early part of bloom to two 7½ ppm spray or a 7½ ppm and a 15 ppm spray. Also, of importance was the fact that shot berries increased from 6 percent in the single application to 16 and 12 percent in the double 7½ ppm treatment and the 7½ and 15 ppm sprays. This would indicate that two bloom sprays are not advisable on Flame Seedless since overthinning could result. This is also compounded by an increase in the percentage of shot berries.

b. Gibberellin and Girdling for Berry Size Increase

Single applications of gibberellin at 40, 80, and 120 ppm Tables 3, 4, and 5 were compared on girdled and ungirdled vines. The berry weight did not increase above 40 ppm so there was no advantage in utilizing 80 or 120 ppm of gibberellin. In all cases girdling further increased the berry size, however, higher rates of gibberellin did not replace the size increase obtained through the girdle. Girdling generally averaged about 0.6 of a gram increase in berry weight over similarly treated non-girdled berries. Both girdling and increasing gibberellin concentrations tended to decrease the maturity of the Flame Seedless. In this particular test, both girdling and gibberellin tended to reduce the acid content and titratable acidity.

c. Ethephon and Girdling on Color Development of Flame Seedless

Ethephon had no effect on increasing the size of Flame Seedless (Table 6). The no girdle treatment and maturity girdle did not affect berry size, however, the size girdle resulted in a significant increase in berry size. The no girdle treatment and a size girdle had no effect on the °Brix, however, the maturity girdle resulted in a significant increase in °Brix (Table 7).

The no girdle treatment and size girdle had no effect on the titraratable acidity, however, the maturity girdle and ethephon both significantly reduced the level of titratable acidity (Table 8). The no girdle treatment and size girdle had no effect upon the °Brix to acid ratio of the fruit, Table 9, whether ethephon was used or not. However, ethephon and maturity girdle resulted in significant increase of °Brix/acid ratio on the first harvest date. As the grapes matured, the acid level of both treated and untreated fruit tends to equalize.

Estimates were made on two dates, July 6 and July 14, on the percentage of harvestable fruit, Table 10. The fruit was picked to determine the percent harvested on July 21.

There was no statistical increase on the percentage of harvestable fruit between the no girdle treatment and size girdle on any of the harvest dates. However, the maturity girdle significantly increased the percentages of harvestable fruit on all dates. Ethephon produced no difference between the percentages of harvestable fruit from the no girdle and the size girdle treatment. Approximately 50 percent of the fruit was harvestable from the maturity girdle + ethephon treatment regardless of the date of estimation (July 6, 14, 21), whereas only 16 percent could have been harvested on July 6 with a maturity girdle and no ethephon and less than 1/2 percent without ethephon where no girdle or size girdle was applied. The ethephon improved the percentage of harvestabable fruit regardless of girdling treatment. A higher percentage of harvestable fruit was obtained with a combination of maturity girdling and ethephon.

Table 11 presents the effects of girdling and ethephon treatment on the berry firmness. Ethephon did not significantly decrease berry firmness. However, both the girdling treatments improved the berry firmness. The nongirdled fruit was the least firm, sized girdled fruit was intermediate, and the maturity girdled fruit was the most firm. The differences in the crispness and the firmness was readily detected during fruit evaluations.

Tables 12, through 15 present the results of experiment 2 in the Terra Bella District.

The size girdle significantly increased the berry weight of Flame Seedless (Table 12). Girdling and ethephon had no effect on °Brix (Table 13). Girdling reduced the titratable acidity below that of nongirdled fruit in Test 2 (Table 14). In contrast only the maturity girdled reduced the titratable acidity in Test 1 (Table 8). Ethephon significantly reduced the titratable acidity of Flame Seedless in both Tests 1 and 2 (Tables 8 and 14). In Test 2 (Table 15) the maturity girdle had no effect on increasing the percentage harvestable fruit probably due to the short period between the application of the girdle and harvest evaluation. Ethephon at one pint per acre significantly increased the percentage harvestable fruit (Table 15).

Tests at KHFS again demonstrated that ethephon increased the percentage of harvestable fruit (Table 16).

The fruit-set girdled vines began coloring before the check vines. They could easily be recognized because of their large berry size. The response to ethephon was marked. Fruit-set girdled vines, without ethephon, colored just a bit slower than check vines and developed less intense color.

At the time ethephon was applied, individual clusters ranged from 0 - 90% color. All developed normal color although the more colored clusters matured first.

The fruit was allowed to hang on the vines until late fall. It remained in good condition until late September. The color remained bright with berries maintaining their firmness. The shatter potential increased with increasing maturity.

Table 1. The effects of gibberellin bloom sprays on fruit characteristics of Flame Seedless, Trial 1 - Wheeler Ridge

Gibberellin ppm	Berry wt. gms.	°Brix	Titratable acidity	No. berries/cm. of shoulder length	Wt. of berries/cm. of shoulder length gms.	Percent shot berries
0	4.14a[1]	16.7a	.61a	3.67a	15.3a	1.4a
5	4.77b	17.1a	.60a	2.91b	13.7b	1.9ab
7½	4.56b	17.0a	.61a	2.78bc	12.6bc	3.1b
10	4.76b	17.0a	.59a	2.63c	12.5bc	3.1b
15	4.74b	17.2a	.59a	2.61c	12.4c	3.2b

[1] Mean separation in columns by Duncan's multiple range test 5% level.

Table 2. The effects of gibberellin bloom sprays on fruit characteristics of Flame Seedless, Trial 2 - Delano District

Fruit Characteristics ppm	Berry Wt. grams	No. of berries/cm. shoulder length	Average length shoulder cm.	Average No. berries/shoulder	Percent shot berries
1 spray early bloom 7½ ppm	4.77a[1]	1.98a	12.4a	24.3a	6.3a
7½ ppm early bloom & 7½ ppm full bloom	4.74a	1.15b	14.6a	16.8b	16.0b
7½ ppm early bloom & 7½ ppm full bloom	4.78a	1.20b	13.7a	16.7b	12.5ab

[1] Mean separation in columns by Duncan's multiple range test, 5% level.

Table 3. The effects of fruit set girdling and gibberellin concentration on berry weight (grams) of Flame Seedless

	Girdling Treatment		
Gibberellin ppm	Not Girdled	Girdled	Average Effect of gibberellin
0	3.17	3.92	3.54
40	4.82	5.24	5.03
80	4.68	5.19	4.94
120	4.71	5.50	5.11
Average effect of girdling	4.35	4.96	

LSD .05 Girdling = .26, Gibberellin = .22, Interaction = NS

Table 4. The effects of fruit set girdling and gibberellin concentration on soluble solids, °Brix, of Flame Seedless

Gibberellin ppm	Girdling Treatment: Not Girdled	Girdled	Average effect of gibberellin
0	18.6	18.0	18.3
40	18.0	17.6	17.8
80	17.2	17.3	17.2
120	17.1	17.0	17.0
Average effect of girdling	17.7	17.4	

LSD .05 Girdling = 0.3, Gibberellin = 0.5, Interaction = NS

Table 5. The effects of fruit set girdling and gibberellin concentration on titratable acidity of Flame Seedless

Gibberellin ppm	Not Girdled	Girdled	Average effect of gibberellin
0	.66	.69	.68
40	.64	.65	.64
80	.62	.63	.63
120	.61	.62	.61
Average effect of girdling	.63	.65	

LSD .05 Girdling = .01, Gibberellin = .03, Interaction = NS

Table 6. The effects of girdling & ethephon treatment of Flame Seedless on berry weight (grams).*

Ethephon Treat.	7/6/81 Harvest: No Girdle	Size Girdle	Maturity Girdle	7/14/81 Harvest: No Girdle	Size Girdle	Maturity Girdle	Ave. effect of Ethethon 7/6	7/14
None	4.62	5.77	4.77	4.96	6.04	4.87	5.05	5.29
1 pt/A.	4.73	5.74	4.80	4.99	6.07	5.00	5.09	5.39
Ave. effect of girdling	4.68	5.76	4.79	4.98	6.06	4.94		

LSD .05
7/6/81 Harvest: Girdle = 0.15; Ethephon = N.S.; Interaction = N.S.
7/14/81 Harvest: Girdle = 0.15; Ethephon = N.S.; Interaction = N.S.

* Ethrel ® brand of ethephon was used in Tables 6 through 16 inclusive

Table 7. The effects of girdling & ethephon treatment of Flame Seedless on °Brix

Ethephon Treatment	7/6/81 Harvest No Girdle	Size Girdle	Maturity Girdle	7/14/81 Harvest No Girdle	Size Girdle	Maturity Girdle	Ave. Effect of Ethephon 7/6/81	7/14/81
None	15.6	15.6	17.7	17.3	16.9	19.9	16.3	18.0
1 pt/A.	15.7	15.7	17.5	17.5	17.0	19.1	16.3	17.9
Ave. effect of girdling	15.6	15.6	17.6	17.4	16.9	19.5		
LSD .05	Girdle = 0.5 Ethephon = N.S. Interaction = N.S.			Girdle = 0.6 Ethephon = N.S. Interaction = N.S.				

Table 8. The effects of girdling & ethephon treatment of Flame Seedless on titratable acidity

Ethephon Treatment	7/6/81 Harvest No Girdle	Size Girdle	Maturity Girdle	7/14/81 Harvest No Girdle	Size Girdle	Maturity Girdle	Ave. Effect of Ethephon 7/6/81	7/14/81
None	.66	.66	.60	.56	.55	.53	.64	.55
1 pt/A.	.60	.60	.56	.52	.52	.51	.59	.52
Ave. effect of girdling	.63	.63	.58	.54	.54	.52		
LSD .05	Girdle = 0.02 Ethephon = 0.03 Interaction = N.S.			Girdle = 0.03 Ethephon = 0.03 Interaction = N.S.				

Table 9. The effects of girdling & ethephon treatment of Flame Seedless on °Brix/acid ratio

Ethephon Treatment	7/6/81 Harvest No Girdle	Size Girdle	Maturity Girdle	7/14/81 Harvest No Girdle	Size Girdle	Maturity Girdle	Ave. Effect of Ethephon 7/6/81	7/14/81
None	23.8	23.6	29.9	30.9	30.8	37.5	25.8	33.1
1 pt/A.	26.3	26.2	31.3	33.7	32.9	37.8	27.9	34.8
Ave. effect of girdling	25.1	24.9	30.6	32.3	31.9	37.7		
LSD .05	Girdle = 1.6 Ethephon = 1.9 Interaction = N.S.			Girdle = 1.7 Ethephon = N.S. Interaction = N.S.				

Table 10. The effects of girdling & ethephon treatment of Flame Seedless on percentage of harvestable fruit

Ethephon Treat.	7/6 Harvest No Girdle	Size Girdle	Maturity Girdle	7/14 Harvest No Girdle	Size Girdle	Maturity Girdle	7/21 Harvest No Girdle	Size Girdle	Maturity Girdle	Ave. Effect of Ethephon None	Size	Mat.
None	0.5	0.0	16.5	2.0	0.5	19.5	19.0	15.0	54.4	5.7	7.2	29.5
1 pt/A.	16.2	17.0	46.5	16.5	14.4	54.5	51.3	48.6	57.5	26.6	28.4	52.5
Ave. effect of girdlg.	8.1	8.5	31.5	9.3	7.2	37.0	35.2	31.8	56.0			

LSD .05 Girdling = 9.3
Ethephon = 7.6
Interaction = N.S.

Girdling = 8.2
Ethephon = 10.1
Interaction = N.S.

Girdling = .12
Ethephon = .17
Interaction = Sig.

Table 11. The effects of girdling & ethephon treatment of Flame Seedless on berry firmness (grams)

Ethephon Treatment	No Girdle	Size Girdle	Maturity Girdle	Ave. Effect of Ethephon
None	533	575	607	572
1 pt/A.	479	524	575	526
Ave. effect of girdling	506	550	591	

LSD .05 Girdle = 40 Ethephon = N.S. Interaction = N.S.

Table 12. The effects of girdling & ethephon treatment of Flame Seedless on berry weight (grams)

Ethephon Treatment	No Girdle	Size Girdle	Maturity Girdle	Ave. Effect of Ethephon
None	3.62	3.86	3.70	3.73
1 pt/A.	3.61	3.96	3.62	3.73
Ave. effect of girdling	3.61	3.96	3.66	

LSD .05 Girdle = 0.24 Ethephon = N.S. Interaction = N.S.

Table 13. The effects of girdling & ethephon treatment of Flame Seedless on Soluble Solids, °Brix

Ethephon Treatment	No Girdle	Size Girdle	Maturity Girdle	Ave. Effect of Ethephon
None	16.0	16.4	16.4	16.3
1 pt/A.	15.7	16.0	16.1	15.9
Ave. effect of girdling	15.8	16.2	16.3	
LSD .05	Girdle = N.S.	Ethephon = N.S.	Interaction = N.S.	

Table 14. The effects of girdling & ethephon treatment of Flame Seedless on titratable acidity

Ethephon Treatment	No Girdle	Size Girdle	Maturity Girdle	Ave. Effect of Ethephon
None	.62	.57	.56	.58
1 pt/A.	.58	.54	.55	.56
Ave. effect of girdling	.60	.56	.56	
LSD .05	Girdle = .02	Ethephon = .02	Interaction = N.S.	

Table 15. The effects of girdling & ethephon treatment of Flame Seedless on percentage fruit harvestable

Ethephon Treatment	No Girdle	Size Girdle	Maturity Girdle	Ave. Effect of Ethephon
None	13	16	18	16
1 pt/A.	32	33	18	28
Ave. effect of girdling	22	24	18	
LSD .05	Girdle = N.S.	Ethephon = 9	Interaction = N.S.	

Table 16. The effects of fruit set girdling & ethephon treatment on fruit characteristics of Flame Seedless (KHFS)

Treatment		July 17			% Fruit Harvestable based on color	
Girdle	Ethephon	Berry Wt. grams	°Brix	Titratable acidity	July 17	July 24
None	None	4.18a[1]	18.1a	.54a	12a	55a
Fruit set	None	5.25b	16.8b	.58a	15a	48a
Fruit set	1 pt/A. at color break	5.72b	16.9b	.54a	55b	88b

[1] Mean separation with Duncan's multiple range test, 5% level