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Gibberellin and Flame Seedless Grapes

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The gibberellins were discovered back in 1926 by a Japanese plant pathologist studying the symptoms of a disease of rice called "foolish seedling." It was observed that the causal pathogen was a soilborne fungus, Gibberella fujikuroi (a fusarium type fungus), which caused infected rice seedlings to grow much taller than healthy ones. When a pure culture filtrate was sprayed onto rice seedlings, it produced the same excessive growth characteristics as the disease. This growth regulating substance secreted by a fungus was eventually isolated and called gibberellin. These discoveries attracted little attention outside Japan until the 1950's when interest in this substance exploded. Scientists around the world began to study the biological activity of gibberellin on commercially important plants. Gibberellin was hailed as a mysterious wonder worker of the plant world.

Today we know that gibberellins are chemicals naturally found in plants including grapes and they primarily affect growth by controlling cell elongation and division. Many different gibberellins have been isolated from plants and fully characterized. The different gibberellins possess close structural similarity and are identified as GA1, GA2, GA3, and so on. The gibberellin used on grapes is GA3 and is commercially produced by mass cultures of selected fungus strains and with fermentation and purification, similar to the way penicillin is produced.

University of California scientists led the world with research on table, raisin, and wine grapes. In 1957, Robert J. Weaver, a viticulture professor at the University of California, Davis, was first to report that gibberellin had potential in the production of grapes, particularly Thompson Seedless table grapes. Field research by UC specialists and farm advisors determined how to most effectively use gibberellin, and by 1962, only five years after the first testing was done at Davis, nearly all Thompson Seedless for table fruit in California were being sprayed at berry set with gibberellin to increase berry size. Further research discovered that clusters could be thinned with a bloom time application, and by 1967 this became a standard practice. Consumers were excited about these new seedless grapes with large berries and attractive clusters. Today, per capita consumption of table grapes has soared thanks to Thompson Seedless, Flame Seedless, Perlette and other seedless grapes and of course gibberellin, the wonder worker of seedless grapes.

Since Robert Weaver's initial discovery at Davis in 1957, many University of California researchers have made major contributions to our knowledge of gibberellin use on table, raisin, and wine grapes. Information was developed on the effects gibberellin has on bunch lengthening, berry thinning, berry enlargement, maturity hastening, maturity delay, berry shatter, physiological and phytotoxic responses. Research information on table, raisin, and wine grapes is the basis for the present day use of gibberellin, and research continues as new cultivars are released.

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The response to gibberellin will vary depending on when it is applied (phenological stage) and how much is used. The research by Fred Jensen, Nick Dokoozlian, Mary Bianchi, and Don Luvisi (UC viticulture specialists and farm advisors) provided the following information on Flame Seedless.

The response of Flame Seedless to gibberellin:

1. Bud break to bloom. The hope or objective of applying gibberellin two to three weeks prior bloom is to elongate clusters and reduce cluster compactness-often called the stretch spray. Unfortunately, gibberellin applied at this time does not loosen clusters when measured at harvest. It does accelerate the growth of the clusters, which is obvious soon after application, but untreated clusters soon catch up. A stretch spray may advance bloom a day or two but does not advance the harvest date.

2. Bloom. Gibberellin reduces the berry set of Flame Seedless when applied during bloom. Response is temperature dependent, and the greatest reduction in berry set occurs when temperatures are in the 90's. In young, vigorous vineyards, excessive shatter can occur when warm temperatures and a rapid bloom occur and lower rates should be used. Bloom sprays to Flame Seedless increase berry weight but have little effect on berry shape. Ideally, application should be applied at 40 to 80 percent bloom. Effectiveness drops rather rapidly if sprays are applied much earlier or later than the optimal stage. Shot berries are more likely to occur when sprays are applied early in bloom or before bloom.

3. Completion of bloom to berry set. In the southern San Joaquin Valley there are normally 12 to 14 days between the completion of bloom (100% bloom) and berry set (berry drop completed). Applying gibberellin to Thompson Seedless during this period between bloom and berry set increases berry size and elongates the berry. However, Flame Seedless does not respond to gibberellin applied at this time - there is no increase in berry size or change in berry shape.

4. Berry set and growth. Gibberellin applied to Flame Seedless at fruit set (berry diameter 5 to 6mm) and up to two weeks later (berry diameter 9 to 10mm) will result in about the same increase in berry size. This is a long response period compared to Thompson Seedless or Perlette. Sizing response rapidly diminishes when applied later than two weeks after berry set. Unfortunately, gibberellin applied after berry set also reduces color development, especially when high rates are used or a late application is made (two weeks after berry set or later). The effect on berry size and color must both be considered when deciding how much gibberellin to apply to Flame Seedless. Growers experiencing poor color development with Flame Seedless (not contributed to overcropping, light management, virus, etc.) should reevaluate their gibberellin program, both timing and rate. The application of ethephon only partially overcomes the color problem created by excessive or poorly timed gibberellin applications.