USE OF GIBBERELLIN FOR TIMING OF FRUIT MATURITY AND IMPROVED FIRMNESS IN >FRENCH= PRUNE

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Summary:

We used a commercial orchard of 'French'/Myro 29C prune trees that had been planted in 1980 at a spacing of 18' x 22'. The site location was North Placer County, just south of the Bear River (Farmland Management). The soil type was Kilaga loam and the orchard was flood-irrigated. We applied 40% ProGibb® at 24 and 32 grams a.i., at the rate of 200 gallons per acre as single treatments on July 2 and July 16, in single row treatment combinations (date of application/concentration). Fruit were sampled on August 2 and August 6. We evaluated fruit firmness as a function of treatment, and compared two firmness testing devices to determine the best method for measuring flesh firmness in prune. Improved firmness was found with application of ProGibb® at the lower concentration on both dates and a trend toward improved firmness was found with the higher concentration. The Imada pressure gauge and the standard penetrometer compared fruit similarly within each instrument's range of measurement, however, the penetrometer was the instrument chosen for best use.

Problem and its significance:

The ability to regulate the timing of maturity in prunes has been a goal for growers as extending the harvest period would allow more efficient utilization of dryer space, harvest equipment and labor. Use of gibberellin in stone fruits prior to harvest typically results in delayed maturation, which, in some cases, has been reported to increase both fruit size and firmness. These benefits of GA are routinely used in the cherry industry where growers can selectively delay maturation of a portion of their crop to coincide with market demand, packing house schedules and labor availability, while also increasing quality (fruit size and firmness). The effect of GA differs with type of GA, application timing and rate, and fruit species.

Changing the time of fruit maturation through advancement of physiological maturity is another possibility. Advancing maturity might be accomplished through the use of rest-breaking chemicals that can advance bloom. Dormex or CAN17 + surfactants (such as Entry or RNA85), as used in sweet cherries in California, or other options, such as ethephon or etheloleate (used for raisin production), might be used to manipulate prune harvest date.

In several years of studies begun in 1996 we found that application of gibberellin (Ralex®,GA_3, Valent U.S.A. Corp.) at 24 and 48 g a.i. per acre consistently increased fruit firmness when applied between 12 and 14% soluble solids, suggesting that GA can delay 'French' prune maturity.

Materials and methods:

Experimental location and plant material, sample procedures and experimental design:

We used a commercial orchard of 'French'/Myro 29C prune trees that had been planted in 1980 at a spacing of 18' x 22'. The site location was North Placer County, just south of the Bear River (Farmland Management). The soil type was Kilaga loam and the orchard was flood-irrigated. We applied 40% ProGibb® (Valent U.S.A. Corp.) at 24 and 32 grams a.i., at the rate of 200 gallons per acre on July 2 and July 16. Soluble solids at the first application were approximately 12%. The experimental design was nonrandomized and application of each spray date/GA concentration combination was made in a single row, from which 5

representative trees (those that were evenly-cropped, representative of the orchard overall and showing fruit drop that was not more or less than that of the orchard overall) were selected for evaluation at harvest.

An early harvest occurred on August 2, at which time we compared two firmness testing devices to determine the best method for measuring flesh firmness in prune. Five fruits were selected at random from each of five trees per treatment, sampling fruit from all sides of each tree in mid-canopy, rejecting 'blue fruit' and any other non-uniform fruit. A very thin slice of flesh with skin was removed from each cheek approximately 45E away from the suture on the equator of the fruit prior to instrument insertion. We used a standard penetrometer equipped with a 5/16" tip inserted approximately 3/16" into the fruit flesh on one cheek. An Imada DPS11-R digital force gauge equipped with a conical tip similar to that of the penetrometer. Pressure (firmness) measurements were read for each gauge in opposite cheeks for each fruit. Analysis of variance and mean comparison tests were used to compare treatments for effects on firmness.

Final harvest occurred on August 6. Ten fruit were sampled at random from all sides of the tree in mid-canopy, rejecting fruit that were obviously 'blue fruit' or otherwise 'cull fruit' for evaluation of fruit firmness as a function of treatment.

Results and Discussion:

Comparison of treatments (Table 1) suggests a trend toward improved firmness with 24 g ProGibb® on both dates of application, when fruit were harvested on August 2 and measured by either penetrometer or Imada gauge. Comparison of the two gauges show a reading for the Imada that was approximately half that of the penetrometer. This may be due to the fact that the conical tip on the Imada gauge is a sharp point, unlike that of the penetrometer, enabling easy penetration. We decided to use only the penetrometer for subsequent measurements, since the measurements for both instruments gave similar relative measures of firmness between treatments, within the ranges for each instrument, and because the penetrometer is the industry standard–and no improvement was felt to be achieved with the Imada gauge over the penetrometer in detecting firmness differences in this fruit.

When fruit harvested on August 6 were compared for firmness, we found that firmness was improved by treatment with ProGibb at 24 g a.i. per acre applied on both dates, at 3 and 5 weeks before harvest, (Table 2). Application date was highly significant and treatment level was significant in the analysis of variance. Treatment with 32 g ProGibb resulted in firmness that was numerically, but not statistically, better than that of the untreated fruit. These results suggest that fruit treated with 24 g ProGibb at 200 gallons per acre could be harvested later than untreated fruit, allowing a delayed harvest.

Table 1. Comparison of pressure gauges on >French= prune harvested August, 2, 2004. Measurement of firmness (lb) after treatment with gibberellin (ProGibb[7]) prior to harvest on date indicated.

Treatments (grams active ingredient per acre @ 200 gallons/acre)	Penetrometer (lb)	Imada (lb)
untreated	4.61 ab [x]	2.67 ab
24 g ProGibb[7] July 2	4.98 a	2.78 a
24 g ProGibb[7] July 16	5.10 a	2.70 ab
32 g ProGibb[7] July 2	4.29 b	2.30 b
32 g ProGibb[7] July 16	4.81 ab	2.54 ab

[x] Means separation within columns by Duncan=s Multiple Range Test, $P = 0.05$.

Table 2. Effect on firmness in >French= prune in 2004 by application of ProGibb[7].

ProGibb[7] (g a.i./acre)	Application date	Firmness (lb)
untreated		4.61 c [X]
24	Jul 2	5.16 a
24	Jul 16	4.94 ab
32	Jul 2	4.69 bc
32	Jul 16	4.70 bc

Source	df	Mean Squares III
Model	17	2.10***
Tree	4	4.07***
Fruit	9	0.73
Application date	2	4.04*
GA application level	1	4.93**
Date x GA level	1	0.28
Error	230	0.81

[X] Mean separation within columns by Duncan=s Multiple Range test, P = 0.05. Percentages transformed by arcsine transformation; actual means are shown.
***, **, * $P = 0.001, 0.01, 0.05$, respectively.

References:

Southwick, S.M., R.E. Moran, J.T Yeager and K. Glozer. 2000. Use of gibberellin to delay maturity and improve fruit quality of ‘French’ prune. *Journal of Horticultural Science & Biotechnology* 75(5): 591-597.

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