

Control of Shoot Growth in 'French' Prune by Apogee in 2003

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Summary:

We used vigorously growing 'French' prune trees growing on marianna 2624 rootstock that had been planted in 1991 and utilized in our continuing Apogee trials. We applied Apogee as a single treatment of 250 mg $\square\text{L}^{-1}$ (ppm, applied at 200 gallons per acre) on April 8, approximately 2 weeks after full bloom (average current season shoot length ~4 inches). We also applied Apogee as multiple treatments of 250 mg $\square\text{L}^{-1}$ (per application) on April 8 and April 29, on April 8 and May 20, or on April 8, April 29 and May 20 at 200 gallons per acre spray volume. All Apogee treatments reduced shoot growth at the last date of measure, 65 days after full bloom (March 25). The single application on April 8 reduced shoot growth overall by 19% and all split applications reduced growth approximately 25%. Return bloom in 2003 after treatments made in 2002 was not affected by Apogee. Unfortunately, it does not appear that BASF will label Apogee for use on prunes and plums in California, so we will discontinue this work.

Problem and its significance:

Shoot growth of prune trees can be highly variable and sometimes excessive in prune orchards throughout California. To remedy excessive shoot growth, pruning is often necessary, but pruning is one of the highest costs in prune production. Apogee™, a shoot growth inhibitor (prohexadione calcium; BASF Corp., Research Triangle Park, NC), has been shown to reduce shoot growth of apples, pears, and sweet cherry. Apogee works as a gibberellin biosynthesis inhibitor. Apogee sprays have been reported to reduce secondary growth by as much as 50% in apples (Yoder et al., 1995), and shoot growth reduction appears to be concentration- and species-dependent. Apogee may have a relatively short active period in the plant after application (BASF estimates approximately 10 to 14 days with repeat applications at 3 to 5 weekly intervals.), therefore timing of application and the possibility that a repeated treatment would be efficacious was investigated. Our preliminary work with back pack mist blower sprayers indicated that Apogee may have promise for shoot growth reduction in 'French' prune. Consequently, our more extensive 2002 and 2003 orchard sprayer trials were initiated.

Materials and methods

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

Experiments were conducted at UC Davis' Wolfskill Experimental Orchard (Masson addition) in Winters, CA. We used a complete randomized design of four replicates with four-tree plots x six treatments and treated trees blocked by treatment along three rows per replicate. Treated trees were 'French' prune trees planted in 1991 on M2624 rootstock at 183 trees per acre density. These trees had been used in 2002 trials and the control treatment and early single treatment (Apogee at 250 ppm, April 8) were applied to the same trees that had received these treatments in 2002. Treated trees were fully guarded against spray drift. Application of Apogee™ (prohexadione calcium, BASF Corp., Research Triangle Park, North Carolina), a growth retardant, was at 200 gallons per acre (936 L $\square\text{ha}^{-1}$) using a speed sprayer; 0.1% Regulaid

was added as an adjuvant. Ten shoots per tree, from approximately 1 m above ground level to approximately 2.5 m above ground on all sides of the tree, were tagged on April 8, prior to treatment. On this date shoots averaged ~4 inches (10.2 cm) in length. Apogee was applied either as a single application on April 8 (approximately 14 days after full bloom), or as split treatments of 250 mg $\square\text{L}^{-1}$ (per application) on April 8 and April 29, on April 8 and May 20, or on April 8, April 29 and May 20. Shoot growth was measured April 8, May 5 and May 30. Return bloom measurements for comparison of 2002 treatment effects was measured on March 25. Statistical Analysis Systems software (SAS Institute, Cary, NC) was used to perform the analysis of variance (PROC GLM). Mean separation was by Duncan's Multiple Range Test, 5% level of significance.

Results:

Return bloom measured on March 25 (full bloom) did not vary among Apogee treatments applied in 2002 (Table 1).

Shoot growth responses to Apogee had shown from year to year that application timing and concentration affected the amount of shoot growth measured in 'French' prune (Figures 1-3). Results in 2003 were consistent with previous years' work in that total shoot growth was found to be reduced approximately 19% by the first treatment with 250 mg $\square\text{L}^{-1}$ Apogee, applied on April 8, and by 25% by all split applications when measured on May 30 (Figure 4); a split application of 125 mg $\square\text{L}^{-1}$ Apogee had reduced shoot growth in 2002 compared to most single treatments and the untreated control (Figure 3). In all years of this trial, we found that a large number of treated shoots set terminal buds within one month of treatment, when Apogee was applied shortly after bloom.

Summary Remarks:

Apogee has a federal registration and is labeled in California for use on apples (we expect a label on pears in 2004). Apogee is normally applied with multiple sprays at either 125 or 250 mg $\square\text{L}^{-1}$ from 100 to 200 gallons per acre. Results with 'French' prune suggest Apogee may be an effective plant growth regulator for reducing shoot growth under California conditions.

Pertinent literature:

Costa, G., C. Andreotti, F. Bucchi, E. Sabatini, C. Bazzi, S. Malaguti and W. Rademacher. 2001. Prohexadione-Ca (Apogee[®]): Growth regulation and reduced fire blight incidence in pear. Hortscience 36:931-933.

Yoder, K.S., S.S. Miller and R.E. Byers. 1995. Suppression of fireblight shoot blight by prohexadione calcium under experimental and natural inoculation conditions. Proprietary publication, BASF.

Table 1. Effect of Apogee[®] on return bloom of 'French' prune. Applications made in 2002 (full bloom was on March 28, 2002; March 25, 2003).

Apogee (ppm, mg l ⁻¹ ; 100 gal/A); date of application ^y in 2002	No. of flowers per cm shoot length
250, April 8	0.52 ^x
125, April 8	0.47
250, April 22	0.49
125, April 22	0.55
125 + 125 April 8 & April 22	0.47
Control	0.64 ns

^xMean separation by Duncan's Multiple Range, $P=0.05$, ns = non significant.

^yAll applications made with 0.1% Regulaid.

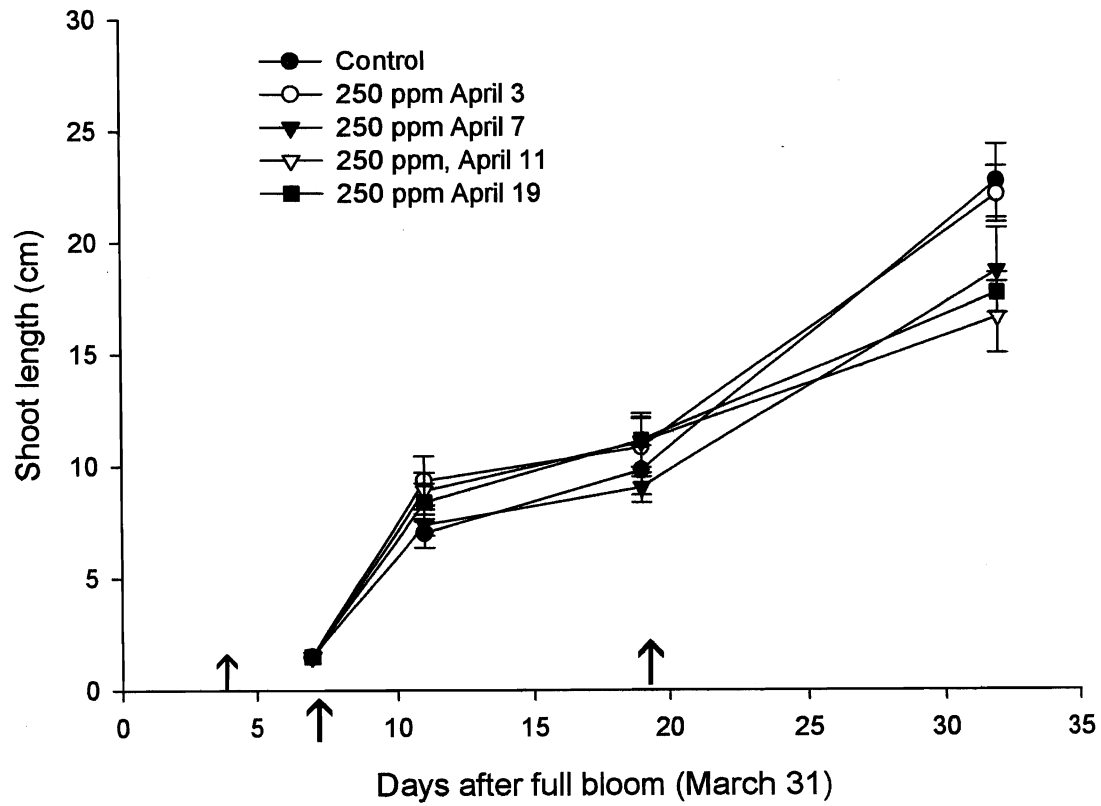


Figure 1. Effect of Apogee[®] on mean lateral shoot growth (\pm s.e.) of 'French' prune in 2000. Arrows indicate dates of application of Apogee.

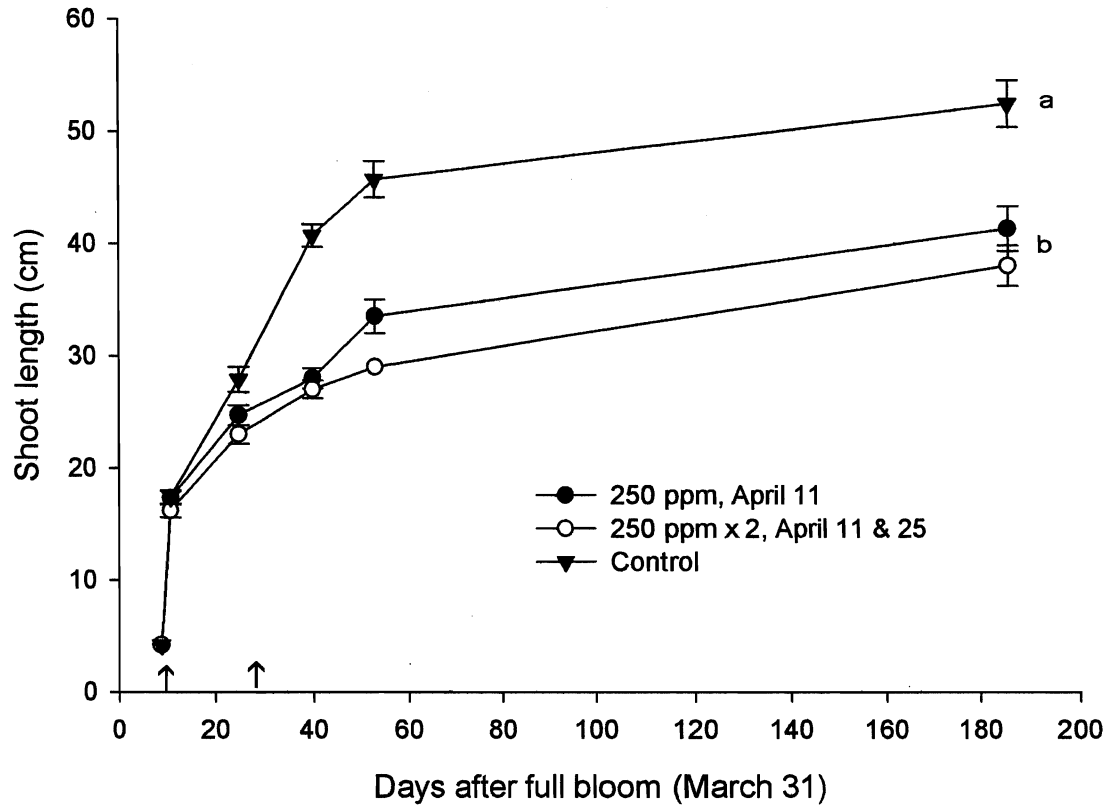


Figure 2. Effect of Apogee[®] on mean lateral shoot growth (\pm s.e.) of 'French' prune in 2001. Arrows indicate dates of application of Apogee.

Figure 3. Shoot growth with Apogee treatment of 'French' prune in 2002

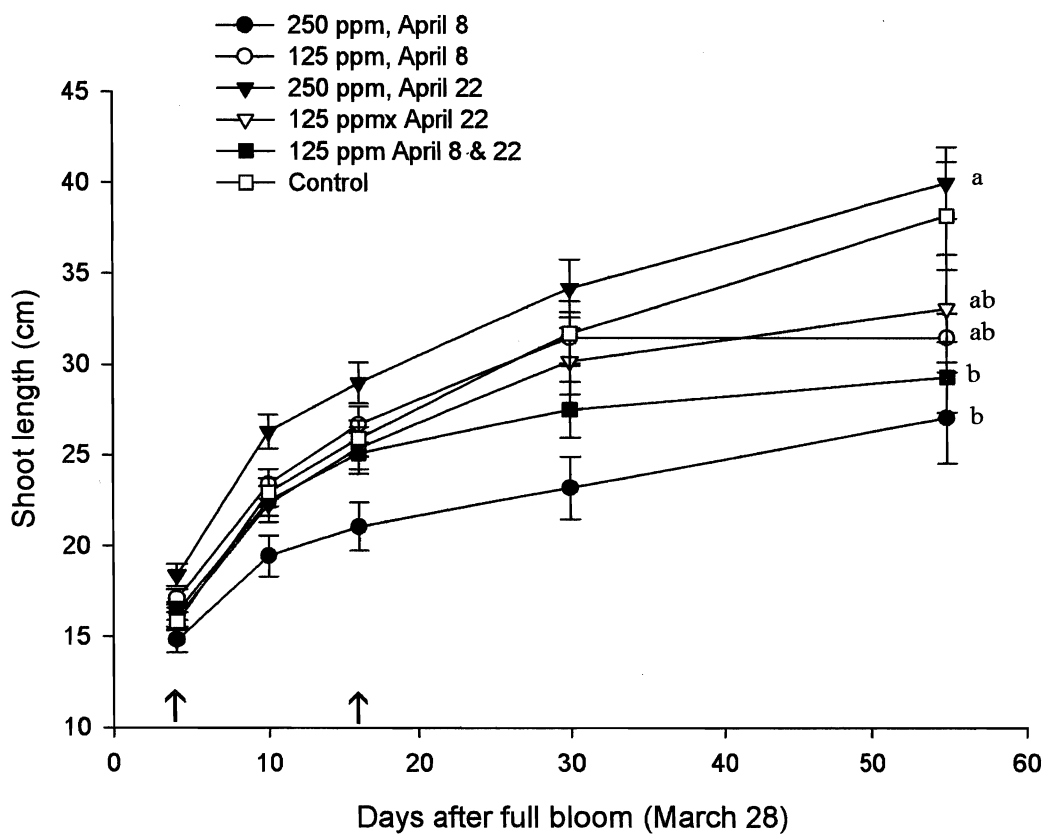


Figure 3. Effect of Apogee® on mean lateral shoot growth (\pm s.e.) of 'French' prune in 2002. Arrows indicate dates of application of Apogee.

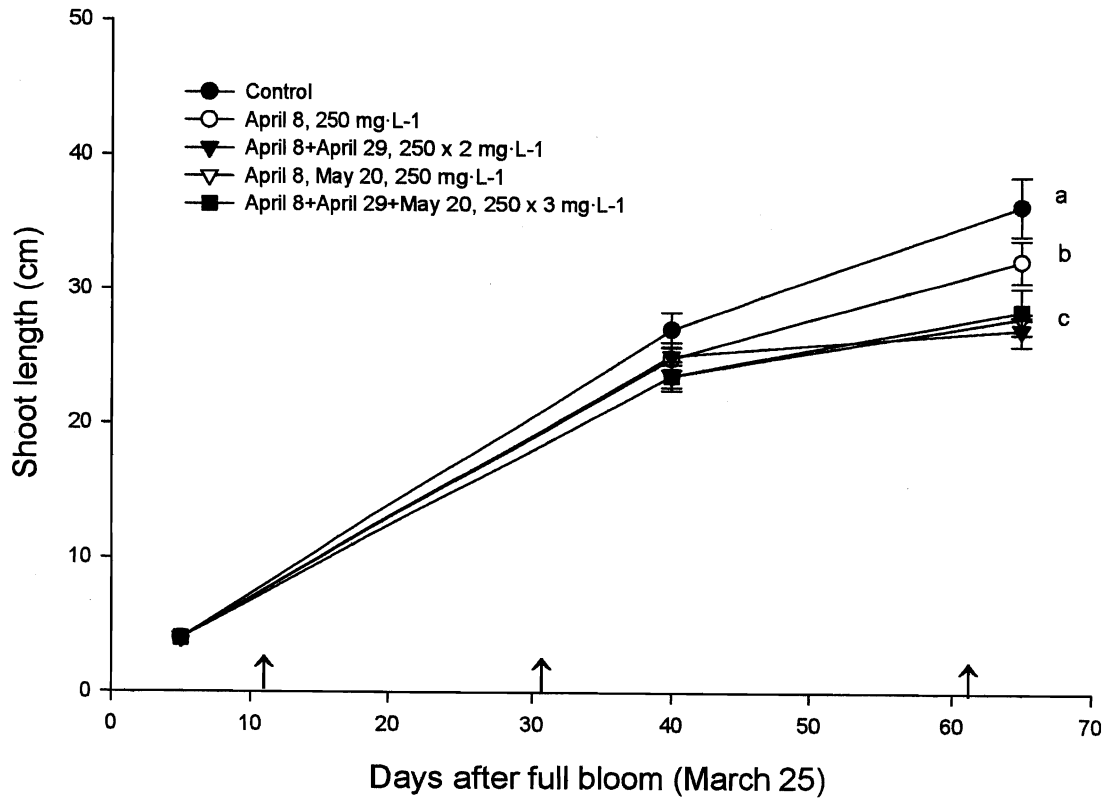


Figure 4. Effect of Apogee® (applied at 200 gallons per acre) on mean lateral shoot growth (\pm s.e.) of 'French' prune in 2003. Arrows indicate dates of application of Apogee.