



Cotton field showing good leaf drop about two weeks after application of defoliant. Rain will start regrowth of leaves within ten days.

# Efficacy of cotton defoliants

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**C**hemical defoliation is a standard practice on all 1.31 million acres of cotton grown in California (10-year average acreage). In many cases, a second treatment is required to prepare plants for harvest: Irrigation and nitrogen management have a large effect on the amount of vegetative growth produced. Cultural practices that stimulate growth reduce the effectiveness of chemicals.

Defoliants injure leaves, resulting in production of ethylene and abscissic acid, which in turn stimulates the formation of an abscission zone and causes leaves to fall. Desiccants, on the other hand, kill leaf tissue but do not cause formation of an abscission zone, so that leaves do not drop.

Environmental factors affect the capacity of chemicals to penetrate the waxy protective layer of leaves as well as the activity of the chemical once penetration has occurred. Depending on the application rate and environmental conditions, defoliants have the capacity

to act as desiccants, and desiccants can act as defoliants.

## Field tests

We conducted replicated field trials at the U.S. Department of Agriculture Cotton Research Station in Shafter and at the University of California West Side Field Station (WSFS) in Five Points to study responses to chemicals used in California. Among chemicals evaluated were the nonregistered use of Banvel (dicamba) in combination with organophosphates (either Def or Folex), as well as the experimental compound PPG 1013, which showed promise in earlier testing.

Treatments were applied with ground equipment at the rate of 20 gallons per acre at 45 psi. Nonionic surfactant was added to all treatments at 0.25 percent by volume. Combinations were applied as tank mixes, except for the two treatments where Prep was applied one week before defoliants. Extra nitrogen and irrigation water were applied to

encourage regrowth and to allow evaluation of chemicals under worst-case conditions. The cultivar Acala SJC-1 was grown at WSFS and Acala SJ-2 at Shafter.

Temperatures were cool several days after application, but favorable temperatures followed; average temperatures for the 15-day period were 67°F at Shafter and 69°F at WSFS (table 1). Temperatures above 65°F are generally considered favorable.

Rainfall occurred soon after treatments in one test and altered the efficacy of some chemicals.

## Results

Treatment effects on the number of green bolls were similar at Shafter and WSFS and are therefore presented as means in table 2. More rapid opening of mature bolls or shedding of young bolls could result in fewer bolls. Although the mean number of green bolls in the sequential treatment of Prep and sodium chlorate was less than one-half that

of the control, plot-to-plot variability was large and differences were not statistically significant. These differences are consistent with other observations and are believed to be real.

The mean efficacy of all treatments was higher at Shafter than at WSFS. The differences could have occurred because cotton plants in WSFS plots were more actively growing and not as well conditioned for defoliation, because it rained during the evening following application at WSFS, or both. Because some treatments differed between locations, efficacy ratings are given for each location.

All chemicals performed acceptably at Shafter, and differences between treatments were significant but small. With the exception of the nonregistered tank mix of OP + Banvel, treatments had lower efficacy ratings at WSFS. (If the same treatment differed by 1.1 or more between locations, it was statistically significant.) Dropp, OP (organophosphate Def or Folex) + Dropp, and PPG 1013 differed significantly between locations. The Dropp label indicates that performance may be reduced if rainfall occurs within 24 hours of application; this is probably responsible for its poor performance at WSFS. Uptake of PPG 1013 was also adversely affected by precipitation soon after application (within



A single application of defoliant to a West Side Field Station cotton test plot achieved good defoliation (center rows), equal to that normally obtained by two treatments.

eight hours), but not to the same extent as was Dropp. Other treatments were not significantly affected by the environment.

Leaf fall is an index of whether leaves

injured by treatments abscised (defoliated) or remained attached to plants (desiccated). Individual treatments responded similarly at both locations and are presented as a single value.

Tank mixes of OP and Banvel resulted in desiccation. Other treatments resulted in acceptable leaf abscission (a rating of 7 or above), but varied: sodium chlorate desiccated more leaves and Dropp desiccated the fewest.

Only the treatment containing Banvel controlled regrowth in both experiments. Regrowth control makes the harvest date more flexible, but Banvel creates potential harvest problems by desiccating leaves and adding risk to other crops grown near cotton. Where cotton plants were more conditioned for defoliation (Shafter) several of the treatments provided a limited degree of regrowth control.

## Conclusion

The chemicals used in California cotton provide acceptable defoliation. None of the registered materials controls regrowth, and a second application of a defoliant will continue to be common. Banvel controls regrowth but desiccates leaves. PPG 1013 appears to show promise but, like Dropp, is more sensitive than the other chemicals to rainfall on the day of treatment.

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TABLE 1. Environmental conditions during defoliation testing

| Days after application | Shafter (applied 9/27/84) |     |      |        | WSFS (applied 9/28/84) |     |      |        |
|------------------------|---------------------------|-----|------|--------|------------------------|-----|------|--------|
|                        | Temperature               |     |      | Rain   | Temperature            |     |      | Rain   |
|                        | Max                       | Min | Mean |        | Max                    | Min | Mean |        |
|                        | °F                        |     |      | inches | °F                     |     |      | inches |
| 0                      | 79                        | 60  | 70   | —      | 83                     | 58  | 70   | 0.15   |
| 1                      | 79                        | 59  | 69   | —      | 69                     | 61  | 65   | 0.57   |
| 2                      | 67                        | 60  | 64   | —      | 67                     | 57  | 62   | 0.88   |
| 3                      | 72                        | 57  | 65   | 0.36   | 71                     | 57  | 64   | —      |
| 4                      | 76                        | 56  | 66   | 0.39   | 76                     | 51  | 63   | —      |
| 5                      | 74                        | 48  | 61   | —      | 78                     | 54  | 66   | —      |
| 15-day mean            | 79                        | 55  | 67   | —      | 81                     | 57  | 69   | —      |

TABLE 2. Comparison of cotton defoliants at two locations in the San Joaquin Valley

| Treatment       | Rate/acre        | Green bolls (no./25 ft) | Efficacy rating† |      | Leaf fall‡ | Regrowth control† |      |
|-----------------|------------------|-------------------------|------------------|------|------------|-------------------|------|
|                 |                  |                         | Shafter          | WSFS |            | Shafter           | WSFS |
| Dropp           | 0.3 ai‡          | 100                     | 8.3              | 3.0  | 8.4        | 5.0               | 0.0  |
| OP*             | 2.0 pt           | 93                      | 8.0              | 7.5  | 7.3        | 3.8               | 0.0  |
| Sodium chlorate | 5.0 ai           | 76                      | 7.5              | 6.8  | 6.8        | 3.3               | 0.0  |
| OP + sod. chl.  | 1.5 pt + 4.0 ai  | 90                      | 8.3              | 7.8  | 7.4        | 2.3               | 0.0  |
| OP + Accelerate | 2.0 pt + 1.5 pt  | 88                      | 7.5              | 7.3  | 7.3        | 0.5               | 0.0  |
| OP + paraquat   | 2.0 pt + 0.33 pt | 84                      | 8.5              | 8.3  | 7.8        | 2.5               | 0.0  |
| OP + Banvel     | 2.0 pt + 0.25 pt | 81                      | 8.5              | 9.0  | 2.4        | 10.0              | 8.5  |
| OP + Dropp      | 2.0 pt + 0.3 ai  | 84                      | 7.5              | 6.0  | 7.9        | 2.3               | 0.0  |
| Prep: OP        | 2.0 pt; 2.0 pt   | 71                      | 8.3              | 8.8  | 8.0        | 0.0               | 0.0  |
| Prep: sod. chl. | 2.0 pt; 5.0 ai   | 45                      | 7.8              | 7.3  | 7.9        | 0.0               | 0.0  |
| PPG 1013        | 0.05 ai          | 93                      | 9.0              | 6.5  | 8.0        | 1.3               | 0.3  |
| Control         | —                | 102                     | 0.0              | 0.0  | 0.0        | 0.0               | 0.0  |
| L.S.D. 0.05     |                  | N.S.                    | 0.7              | 1.4  | 0.9        | 2.8               | 0.3  |
| % C.V.          |                  | 55                      | 7.0              | 15.1 |            | 74.7              | 31.0 |

\*OP = organophosphates and refers equally to Def or Folex.

†Ratings on a scale of 0 to 10 with 10 being 100 percent effective and 0 completely ineffective.

‡ai = active ingredient, expressed as pounds per acre.