**SUMMARY REPORT**

Dormant Alfalfa Sharpen Tolerance Trial 2014-1

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There is interest in registering saflufenacil (Sharpen) in dormant alfalfa to provide burn-down and residual control of important broadleaf weeds, including horseweed, groundsel, and winter mustards. This herbicide is sold under various trade names, including Treevix in nut crop orchards in California. A field trial was conducted in 2013/14 to evaluate the growth response of alfalfa when treated with Sharpen at different times during dormancy. This trial was run at the UC Kearney Agricultural Research and Extension Center in Parlier, CA in a 3-year old alfalfa hay field. The study was started during winter 2013 and concluded following the third cutting in 2014.

The trial was set up as a split-plot experimental design with four replications. Main plot treatments were three application timings (December 13, 2013; January 7, 2014; and February 10, 2014). Each main-plot measured 14 feet wide by 100 feet long. Sub-plot treatments were four herbicides and rates (no herbicide, Sharpen at 2 fl oz/acre, Sharpen at 4 fl oz/acre, and Gramoxone Inteon at 32 fl oz/acre). The Gramoxone Inteon treatment represented the grower standard for the area. Each sub-plot measured 14 feet wide by 25 feet long. Granular ammonium sulfate and a methylated seed oil was added where herbicides were used. The first treatment in December was applied after the filed was clipped and the hay removed, and when there was three to four inches of alfalfa growth. The January and February treatments were applied to alfalfa with four to six inches of growth. Herbicides were applied with a $CO_2$ pressurized back-pack sprayer and hand-held spray boom. A spray volume of 23.8 gpa was used at an operating pressure of 40 psi. Four TT11002 broadcast spray nozzles were used on the spray boom at a 20" spacing to deliver the spray in a seven foot-wide swath. Two spray passes were made in each plot.

Evaluations in the trial included crop recovery after treatment, plant stem count at harvest, crop height at 2nd and 3rd cutting, crop and weed biomass at 1st cutting, crop yield at 1st cutting, and weed control at 30 days after treatment (DAT) and at 1st cutting. The statistical program MSTAT was used with data analyzed using ANOVA and significant means were separated using the LSD test at a probability level of p=0.05.

Both application timing and herbicide treatment influenced recovery time of alfalfa after treatment (tables 1 - 3). Treatments made in January and February resulted in delayed alfalfa growth (24 and 38 percent, respectively) over the December timing at 30 DAT. By first cutting in late March, however, only plots treated in February still lagged significantly behind (11%) earlier treatment times (see photos 1-3). Similarly, Sharpen-treated plots were significantly reduced in growth by 50% behind the no herbicide plots at 30 DAT, while alfalfa in the grower standard (Gramoxone Inteon) treatment was reduced in growth by 19%. By time of 1st cutting, plots treated with Sharpen (regardless of rate) still showed reduced alfalfa growth of about 11%, compared to the Gramoxone Inteon and no herbicide plots.

Alfalfa stem count (an indicator of productivity potential) at 1st cutting was also influenced by both application timing and herbicide (tables 4 - 6). Of the application timings tested, plots treated in February produced significantly fewer stems (3-4) per sample area than plots treated earlier. Also, plots treated with Sharpen at the highest rate (4 fl oz/acre) had significantly fewer stems than the other herbicide treatments, including the lower Sharpen rate. Application timing did not significantly reduce alfalfa yield (wet weight), although weights were slightly lower as treatment timing progressed. While we did not collect harvest weights for the 2nd or 3rd cutting, we did measure crop height before these two cuttings. At the 2nd cutting, alfalfa was significantly shorter only in plots treated in February, irrespective of herbicide treatment. There were no differences in crop height by the 3rd cutting between any of the treatments.

Weed control (including shepherd's-purse, London rocket, and horseweed) was equally good where Sharpen or Gramoxone Inteon were used, regardless of application timing (tables 7-9). Samples collected at 1st cutting showed alfalfa made up on average 99.87% of the sample dry weight composition where herbicides were used, compared to 97.65% where herbicides were not used.

Alfalfa crown recovery after a dormant herbicide is applied is necessary for acceptable productivity. In this study, we were able to show that if Sharpen was applied later than December, there would be a

significant risk of delaying alfalfa recovery at least 30 DAT, and alfalfa treated in February would continue to lag behind earlier application timings even at the 1st cutting. The latest application timing also resulted in fewer stems being produced, and it appeared that rate of Sharpen used may have also influenced stem numbers, as fewer stems were seen in plots treated with the higher Sharpen rate. Interestingly, harvest weights (wet) at 1st cutting were not significantly affected by timing or herbicide, although there was a trend toward lower weights as treatment timing advanced or where herbicides were used. Weed pressure in the trial was light due to lack of winter rainfall, so it is difficult to say how effective the Sharpen was for residual control, although it was clear that weeds were effectively controlled postemergence. Based on the information gained from this study, it would not be advisable to apply Sharpen to dormant alfalfa in the southern San Joaquin Valley any later than December, or one might run the risk of seeing delayed crop recovery, reduced stem count, and possibly lower yields.

Table 1. Effect of application timing and herbicide on alfalfa recovery

| Herbicide | Rate/A | Timing | 7 DAT[2] | 14 DAT[2] | 30 DAT[2] | At harvest |
|---|---|---|---|---|---|---|
| 1. No herbicide | 0 | A (Dec-13) | 10.0 a | 10.0 a | 10.0 a | 10.0 a |
| 2. Sharpen[1] | 2 fl oz | A (Dec-13) | 0.0 b | 4.0 c | 8.4 bc | 10.0 a |
| 3. Sharpen[1] | 4 fl oz | A (Dec-13) | 0.0 b | 4.3 bc | 8.5 bc | 9.9 a |
| 4. Gramoxone Inteon[1] | 32 fl oz | A (Dec-13) | 0.0 b | 5.3 b | 9.2 ab | 10.0 a |
| 5. No herbicide | 0 | B (Jan-14) | 10.0 a | 10.0 a | 10.0 a | 10.0 a |
| 6. Sharpen[1] | 2 fl oz | B (Jan-14) | 0.0 b | 2.8 d | 4.5 e | 10.0 a |
| 7. Sharpen[1] | 4 fl oz | B (Jan-14) | 0.0 b | 2.8 d | 3.5 f | 10.0 a |
| 8. Gramoxone Inteon[1] | 32 fl oz | B (Jan-14) | 0.0 b | 3.0 cd | 8.6 bc | 10.0 a |
| 9. No herbicide | 0 | C (Feb-14) | 10.0 a | 10.0 a | 10.0 a | 10.0 a |
| 10. Sharpen[1] | 2 fl oz | C (Feb-14) | 0.0 b | 0.8 e | 2.8 f | 8.1 c |
| 11. Sharpen[1] | 4 fl oz | C (Feb-14) | 0.0 b | 0.3 e | 2.8 f | 8.4 c |
| 12. Gramoxone Inteon[1] | 32 fl oz | C (Feb-14) | 0.0 b | 3.3 cd | 6.5 d | 9.3 b |
| *Statistical notation* | | *CV (%)* | *0.00* | *13.54* | *7.91* | *1.90* |
| | | *LSD (p=0.05)* | *0.10* | *1.11* | *0.97* | *0.32* |

[1]AMS added at 8.5 lb/100 gal + MSO at 1% v/v.
[2]DAT = Days after treatment
Alfalfa recovery based on a visual rating scale of 0 to 10; 0 = no regrowth and 10 = normal regrowth.

Table 2. Effect of application timing on alfalfa recovery

| Timing | 7 DAT[1] | 14 DAT[1] | 30 DAT[1] | At harvest |
|---|---|---|---|---|
| 1. A (Dec 2013) | 2.5 | 5.9 a | 8.9 a | 10.0 a |
| 2. B ( Jan 2014) | 2.5 | 4.8 b | 6.8 b | 10.0 a |
| 3. C (Feb 2014) | 2.5 | 3.6 c | 5.5 c | 8.9 b |
| *CV (%)* | *0.00* | *13.54* | *7.91* | *1.90* |
| *LSD (p=0.05)* | *n.s.* | *0.58* | *0.85* | *0.28* |

[1]DAT = Days after treatment
Alfalfa recovery based on a visual rating scale of 0 to 10; 0 = no regrowth and 10 = normal regrowth.

Table 3. Effect of herbicide on alfalfa recovery

| Herbicide | Rate/A | 7 DAT[2] | 14 DAT[2] | 30 DAT[2] | At harvest |
|---|---|---|---|---|---|
| 1. No herbicide | 0 | 10.0 a | 10.0 a | 10.0 a | 10.0 a |
| 2. Sharpen[1] | 2 fl oz | 0.0 b | 2.5 c | 5.2 c | 9.4 b |
| 3. Sharpen[1] | 4 fl oz | 0.0 b | 2.5 c | 4.9 c | 9.4 b |
| 4. Gramoxone Inteon[1] | 32 fl oz | 0.0 b | 4.0 b | 8.1 b | 9.8 a |
| *CV (%)* | | *0.00* | *13.54* | *7.91* | *1.90* |
| *LSD (p=0.05)* | | *0.00* | *0.83* | *0.73* | *0.28* |

[1]AMS added at 8.5 lb/100 gal + MSO at 1% v/v.
[2]DAT = Days after treatment
Alfalfa recovery based on a visual rating scale of 0 to 10; 0 = no regrowth and 10 = normal regrowth.

Table 4. Effect of application timing and herbicide on plant stem count, plant height, and yield

| Herbicide | Rate/A | Timing | Stem count[2] (at harvest) | Harvest[3] weight (lbs) | Crop height[4] (2nd cutting) | Crop height[4] (3rd cutting) |
|---|---|---|---|---|---|---|
| 1. No herbicide | 0 | A (Dec-13) | 41.9 abcd | 45.1 | 22.7 ab | 30.5 |
| 2. Sharpen[1] | 2 fl oz | A (Dec-13) | 44.9 ab | 38.1 | 22.3 ab | 31.5 |
| 3. Sharpen[1] | 4 fl oz | A (Dec-13) | 42.6 abcd | 43.6 | 23.9 ab | 33.1 |
| 4. Gramoxone Inteon[1] | 32 fl oz | A (Dec-13) | 45.9 a | 37.7 | 22.1 ab | 30.9 |
| 5. No herbicide | 0 | B (Jan-14) | 47.1 a | 42.7 | 21.6 abc | 29.5 |
| 6. Sharpen[1] | 2 fl oz | B (Jan-14) | 44.4 abc | 43.9 | 22.8 ab | 31.7 |
| 7. Sharpen[1] | 4 fl oz | B (Jan-14) | 40.5 bcd | 40.9 | 21.2bcd | 31.8 |
| 8. Gramoxone Inteon[1] | 32 fl oz | B (Jan-14) | 44.3 abc | 35.9 | 21.6 abc | 31.9 |
| 9. No herbicide | 0 | C (Feb-14) | 44.6 abc | 43.0 | 24.0 a | 30.4 |
| 10. Sharpen[1] | 2 fl oz | C (Feb-14) | 42.5 abcd | 36.2 | 18.5 de | 31.3 |
| 11. Sharpen[1] | 4 fl oz | C (Feb-14) | 37.3 d | 34.5 | 18.1 e | 31.1 |
| 12. Gramoxone Inteon[1] | 32 fl oz | C (Feb-14) | 39.4 cd | 36.5 | 19.3 cde | 30.0 |
| *Statistical notation* | | *CV (%)* | *8.58* | *13.70* | *8.97* | *6.26* |
| | | *LSD (p=0.05)* | *5.30* | *n.s.* | *2.77* | *n.s.* |

[1]AMS added at 8.5 lb/100 gal + MSO at 1% v/v.
[2]Total number of green, productive stems in a 1 $ft^2$ area, and based on three samples per sub-plot.
[3]Wet weight in pounds, using a Cater plot harvester, based on an area of 6 ft wide by 25 ft long in each sub-plot.
[4]Measured in inches from soil line to top of plant, and based on three samples per sub-plot.

Table 5. Effect of application timing on plant stem count, plant height, and yield

| Timing | Stem count[1] (at harvest) | Harvest[2] weight (lbs) | Crop height[3] (2nd cutting) | Crop height[3] (3rd cutting) |
|---|---|---|---|---|
| 1. A (Dec 2013) | 43.8 a | 41.1 | 22.8 a | 31.5 |
| 2. B ( Jan 2014) | 44.1 a | 40.8 | 21.8 a | 31.2 |
| 3. C (Feb 2014) | 40.9 b | 37.5 | 20.0 b | 30.9 |
| *CV (%)* | *8.58* | *13.70* | *8.97* | *6.26* |
| *LSD (p=0.05)* | *2.65* | *n.s.* | *1.39* | *n.s.* |

[1]Total number of green, productive stems in a 1 $ft^2$ area, and based on three samples per sub-plot.
[2]Wet weight in pounds, using a Cater plot harvester, based on a swath 6 ft wide by 25 ft long in each sub-plot.
[3]Measured in inches from soil line to top of plant, and based on three samples per sub-plot.

Table 6. Effect of herbicide on plant stem count, plant height, and yield

| Herbicide | Rate/A | Stem count[2] (at harvest) | Harvest[3] weight (lbs) | Crop height[4] (2nd cutting) | Crop height[4] (3rd cutting) |
|---|---|---|---|---|---|
| 1. No herbicide | 0 | 44.5 a | 43.6 a | 22.8 | 30.1 |
| 2. Sharpen[1] | 2 fl oz | 44.0 a | 39.4 ab | 21.2 | 31.5 |
| 3. Sharpen[1] | 4 fl oz | 40.1 b | 39.6 ab | 21.1 | 32.0 |
| 4. Gramoxone Inteon[1] | 32 fl oz | 43.2 ab | 36.7 b | 21.0 | 31.2 |
| *CV (%)* | | *8.58* | *13.70* | *8.97* | *6.26* |
| *LSD (p=0.05)* | | *3.06* | *4.53* | *n.s.* | *n.s.* |

[1] AMS added at 8.5 lb/100 gal + MSO at 1% v/v.
[2]Total number of green, productive stems in a 1 $ft^2$ area, and based on three samples per sub-plot.
[3]Wet weight in pounds, using a Cater plot harvester, based on an area of 6 ft wide by 25 ft long in each sub-plot.
[4]Measured in inches from soil line to top of plant, and based on three samples per sub-plot.

Table 7. Effect of application timing and herbicide on weed control and plant dry weight

| Herbicide | Rate/A | Timing | Weed control 30 DAT[2] | Weed control At harvest | Alfalfa DW[3] (%) | Weed DW[3] (%) |
|---|---|---|---|---|---|---|
| 1. No herbicide | 0 | A (Dec-13) | 0.0 b | 0.0 b | 96.10 | 3.90 |
| 2. Sharpen[1] | 2 fl oz | A (Dec-13) | 10.0 a | 10.0 a | 100.00 | 0.00 |
| 3. Sharpen[1] | 4 fl oz | A (Dec-13) | 9.9 a | 9.8 a | 99.56 | 0.44 |
| 4. Gramoxone Inteon[1] | 32 fl oz | A (Dec-13) | 9.9 a | 9.8 a | 99.83 | 0.17 |
| 5. No herbicide | 0 | B (Jan-14) | 0.0 b | 0.0 b | 97.47 | 2.53 |
| 6. Sharpen[1] | 2 fl oz | B (Jan-14) | 9.9 a | 9.9 a | 99.82 | 0.18 |
| 7. Sharpen[1] | 4 fl oz | B (Jan-14) | 9.9 a | 9.8 a | 99.82 | 0.18 |
| 8. Gramoxone Inteon[1] | 32 fl oz | B (Jan-14) | 9.9 a | 9.9 a | 100.00 | 0.00 |
| 9. No herbicide | 0 | C (Feb-14) | 0.0 b | 0.0 b | 99.37 | 0.63 |
| 10. Sharpen[1] | 2 fl oz | C (Feb-14) | 10.0 a | 10.0 a | 100.00 | 0.00 |
| 11. Sharpen[1] | 4 fl oz | C (Feb-14) | 10.0 a | 9.9 a | 100.00 | 0.00 |
| 12. Gramoxone Inteon[1] | 32 fl oz | C (Feb-14) | 9.9 a | 9.9 a | 99.89 | 0.11 |
| *Statistical notation* | | *CV (%)* | *1.02* | *2.22* | *1.25* | *182.68* |
| | | *LSD (p=0.05)* | *0.13* | *0.28* | *n.s.* | *n.s.* |

[1]AMS added at 8.5 lb/100 gal + MSO at 1% v/v.
[2]DAT = Days after treatment
Overall weed control based on a visual rating scale of 0 to 10; 0 = no control and 10 = all weeds controlled.
[3]DW = dry weight in a 2 ft$^2$ sample collected by hand, sorted by crop and weeds, dried, and weighed.

Table 8. Effect of application timing on weed control and plant dry weight

| Timing | Weed control 30 DAT[1] | Weed control At harvest | Alfalfa DW[2] (%) | Weed DW[2] (%) |
|---|---|---|---|---|
| 1. A (Dec 2013) | 7.5 | 7.4 | 98.87 | 1.13 |
| 2. B ( Jan 2014) | 7.5 | 7.4 | 99.28 | 0.72 |
| 3. C (Feb 2014) | 7.5 | 7.5 | 99.81 | 0.19 |
| *CV (%)* | *1.02* | *2.22* | *1.25* | *182.68* |
| *LSD (p=0.05)* | *n.s.* | *n.s.* | *n.s.* | *n.s.* |

[1]DAT = Days after treatment
Overall weed control based on a visual rating scale of 0 to 10; 0 = no control and 10 = all weeds controlled.
[2]DW = dry weight in a 2 ft$^2$ sample collected by hand, sorted by crop and weeds, dried, and weighed.

Table 9. Effect of herbicide on weed control and plant dry weight

| Herbicide | Rate/A | Weed control 30 DAT[2] | Weed control At harvest | Alfalfa DW[3] (%) | Weed DW[3] (%) |
|---|---|---|---|---|---|
| 1. No herbicide | 0 | 0.0 b | 0.0 b | 97.65 b | 2.35 a |
| 2. Sharpen[1] | 2 fl oz | 9.9 a | 9.9 a | 99.94 a | 0.06 b |
| 3. Sharpen[1] | 4 fl oz | 9.9 a | 9.9 a | 99.79 a | 0.21 b |
| 4. Gramoxone Inteon[1] | 32 fl oz | 9.9 a | 9.9 a | 99.90 a | 0.10 b |
| | *CV (%)* | *1.02* | *2.22* | *1.25* | *182.68* |
| | *LSD (p=0.05)* | *0.10* | *0.21* | *1.03* | *1.03* |

[1]AMS added at 8.5 lb/100 gal + MSO at 1% v/v.
[2]DAT = Days after treatment
Overall weed control based on a visual rating scale of 0 to 10; 0 = no control and 10 = all weeds controlled.
[3]DW = dry weight in a 2 ft$^2$ sample collected by hand, sorted by crop and weeds, dried, and weighed.

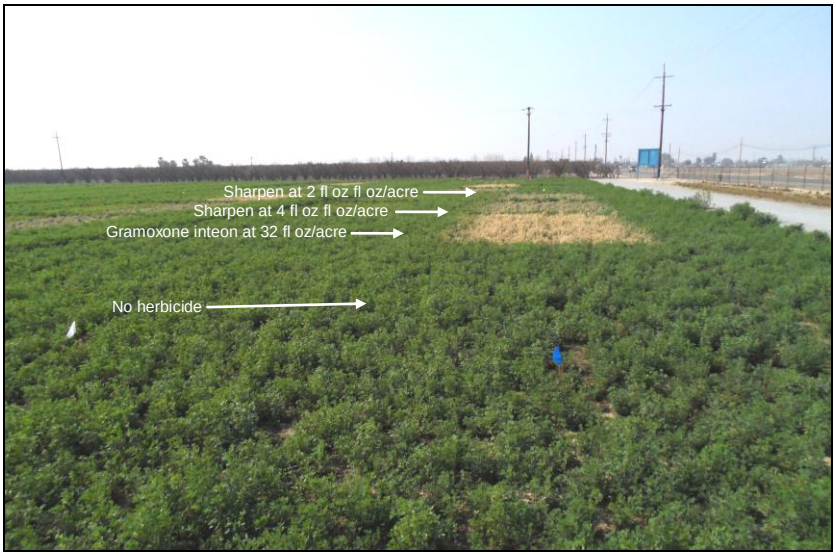

Photo 1. February treatment timing, 7 DAT

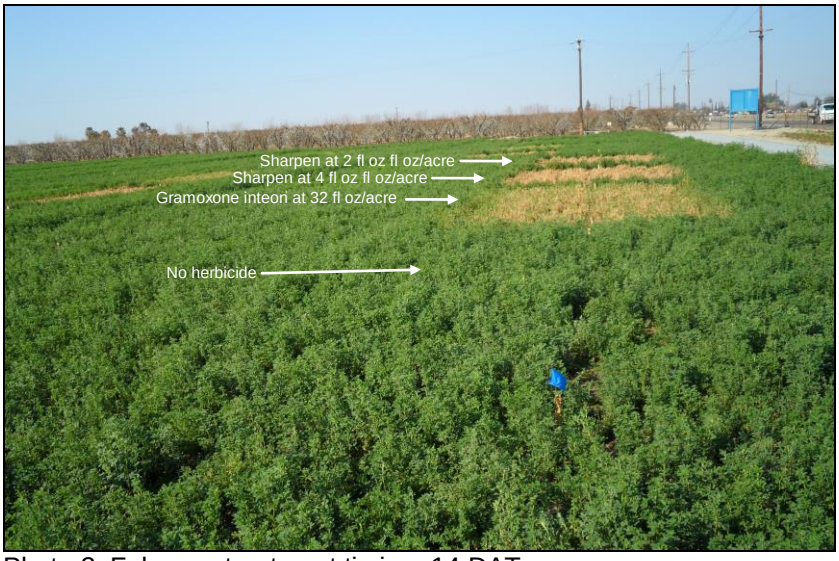

Photo 2. February treatment timing, 14 DAT

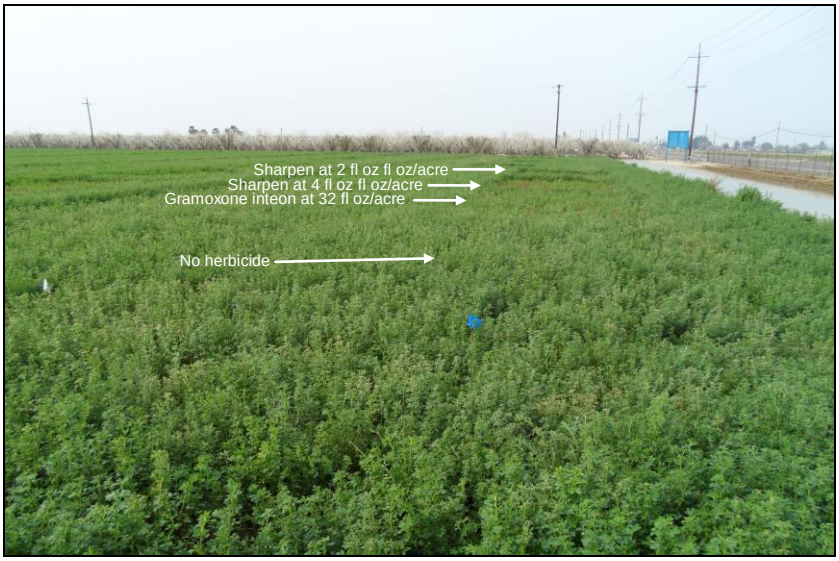

Photo 3. February treatment timing, 30 DAT