# EFFECT OF HERBICIDES ON GROWTH AND BULB PRODUCTION OF FOUR O'CLOCK (*OXALIS PURPUREA* L.) AND SOURSOB (*OXALIS PES-CAPRAE* L.)

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*Summary.* Soursob is a troublesome weed in cereals in Western Australia. Since the introduction of chlorsulfuron, soursob densities have been reduced, and gradually replaced by four o'clock, which appears to be more tolerant to this herbicide. A pot experiment was conducted on soursob and four o'clock using the herbicides diflufenican, metsulfuron-methyl, glyphosate and imazethapyr followed by defoliations at two times after spraying. Leaflet production, dry weight and bulb production was recorded. Defoliation of untreated soursob had no effect on the number of bulbs produced, but did reduce the numbers produced by four o'clock. Treating with glyphosate or metsulfuron caused the greatest reduction in bulb production while glyphosate caused total destruction of foliage. Imazethapyr had some activity on bulb production from defoliated soursob and four o'clock plants that had no defoliation treatment.

## INTRODUCTION

Soursob (*Oxalis pes-caprae*) is a strong competitor in cereal crops (1, 2, 5, 6 and 7), and under certain conditions in pasture can be toxic to stock (3). In Western Australia cereal yields could be increased threefold where dense infestations of the weed are controlled the year prior to cropping (Peirce unpub. 1974).

Extensive research (1, 4, 8 and 9) has resulted in gradual improvement in the control of soursob as the introduction of new herbicides progressed from the substituted ureas in the early 70s, to glyphosate in the late 70s and sulphonyl ureas in the 1980s. Since the introduction of chlorsulfuron soursob has ceased to be a significant cereal weed problem in Western Australia, however, it is being replaced by another bulb-producing oxalis, four o'clock (*Oxalis purpurea*). Four o'clock does not appear to cause the significant cereal yield losses associated with soursob, but is becoming dominant in pastures (Peirce unpub.).

## METHODS

Bulbs of four o'clock and a mid-styled tetraploid form of soursob (6) were collected during the summer of 1988. The bulbs were sized and those in the range (5-9 mm), retained for the experiment. For the remainder of the summer the bulbs were stored at room temperature. During the first week of April three bulbs of four o'clock were planted into each of 48 pots of 150 mm diameter and the same procedure for another 48 pots using bulbs of soursob. On May 31 nine pots of each species were allocated to the following herbicide treatments; diflufenican 75 g.a.i./ha, glyphosate 675 g.a.i./ha, metsulfuron. 3 g.a.i./ha and imazethapyr 60 g.a.i./ha. The wetting agent BS 100 was added to each spray mix at the dilution of 0.25%. Twelve pots were allocated to the nil-herbicide treatment for each species.

At the time of spraying, three pots of each species on the nil-herbicide treatments were harvested by cutting the plant top growth at ground level, the number of leaflets and dry weight were recorded. At 8 and 61 days after spraying the same procedure for removal of top growth was carried out on the nil-herbicide and herbicide treatments. At sampling times the pots after having the top growth removed were replaced in the experimental block. Watering ceased in early October, and in November, after plant maturity, bulbs from all pots were recovered and counted. Top growth had dried up and was not sampled on the final three pots of each treatment. Leaflet and bulb numbers were transformed ( $\sqrt{(x + 0.5)}$) before an analysis of variance was carried out and the means ranked using a Duncan's new multiple range test.

## RESULTS AND DISCUSSION

Leaflet production. Untreated soursob plants reached maximum leaflet production much earlier than four o'clock (Table 1). Only glyphosate and metsulfuron caused a reduction in leaflet production and the accompanying decline in leaflet dry weight some 8 days after herbicide application to both soursob and four o'clock. Glyphosate caused total death of top growth by 61 days after treatment, but the leaflet and dry weights on the metsulfuron treatment remained the same as the values recorded 8 days after herbicide application. Imazethapyr appeared to have little effect on leaflet numbers and dry weight of soursob, but a slight decrease in leaflets per plant occurred on the four o'clock.

Table 1. Leaflet production, top dry wt (g) and bulb production/plant after application of diflufenican, metsulfuron, glyphosate and imazethapyr to soursob and four o'clock.

| Treatment | DAP | DAT | Leaflets/plant | | Dry wt (g/plant) | | Bulbs/plant | |
|---|---|---|---|---|---|---|---|---|
| | | | Sour -sob | Four o'clock | Sour -sob | Four o'clock | Sour -sob | Four o'clock |
| Nil | 54 | 0 | 15.7 bc | 6.3 d | 0.63 bcd | 0.16 bc | 26 ab | 18 abc |
| | 62 | 8 | 13.7 cd | 8.0 cd | 0.47 cde | 0.24 b | 27 ab | 17 abc |
| | 113 | 61 | 14.4 bcd | 13.7 a | 0.73 ab | 0.66 a | 23 ab | 11 bc |
| | | 183 | | | | | 26 ab | 25 a |
| Diflufenican 75 g/ha | 62 | 8 | 15.2 bc | 6.4 d | 0.61 bcd | 0.22 b | 24 ab | 17 abc |
| | 113 | 61 | 21.1 a | 10.8 b | 0.70 abc | 0.52 a | 24 ab | 12 bc |
| | | 183 | | | | | 24 ab | 28 a |
| Metsulfuron 3 g/ha | 62 | 8 | 11.9 cd | 6.6 d | 0.45 de | 0.23 b | 12 cd | 3 de |
| | 113 | 61 | 10.4 d | 6.0 d | 0.47 de | 0.2 b | 9 d | 3 de |
| | | 183 | | | | | 2 e | 9 cd |
| Glyphosate 675 g/ha | 62 | 8 | 11.9 cd | 6.6 d | 0.35 e | 0.16 bc | 1 e | 3 de |
| | 113 | 61 | 0.0 e | 0.0 e | 0.00 f | 0.00 c | 0 e | 3 de |
| | | 183 | | | | | 1 e | 2 e |
| Imazethapyr 60 g/ha | 62 | 8 | 12.6 cd | 7.6 cd | 0.42 de | 0.25 b | 18 bc | 10 bc |
| | 113 | 61 | 18.9 ab | 9.9 bc | 0.87 a | 0.59 a | 15 e | 17 abc |
| | | 183 | | | | | 29 a | 20 ab |

Numbers in each column followed by the same letter do not differ significantly at the 5% level.

DAP Days after planting.
DAT Days after treatment.

Bulb production. In the absence of herbicides, defoliation 54, 65 and 113 days after planting soursob had no effect on bulb production, while four o'clock bulb production declined with defoliation and the greatest reduction occurred with the defoliation 113 days after planting.

Diflufenican had no effect on bulb production of soursob or four o'clock. Imazethapyr reduced bulb production on soursob when the treatment was accompanied by defoliation, but in the absence of defoliation was slightly higher than untreated soursob. Four o'clock treated with imazethapyr produced the fewest bulbs when defoliated 8 days after spraying. Four o'clock plants defoliated 61 days after spraying produced more bulbs than unsprayed plants defoliated at the same time. Four o'clock plants treated with imazethapyr and not defoliated produced

some 20% less bulbs than the untreated plants. Metsulfuron and glyphosate caused large reductions in bulb numbers on plants of both species. Defoliation in the presence of metsulfuron was less effective in reducing bulbs on soursob plants compared to four o'clock.

The slow growth of untreated four o'clock compared to soursob and the decreased bulb production with defoliation indicates that this weed would not be as competetive in crops as soursob and this is supported by cereal yield data from field experiments infested with the weed (Peirce unpublished). The large bulb production, and more prostrate habit of four o'clock in undisturbed situations appears to give the species a competitive advantage in pasture.

Both glyphosate and metsulfuron show considerable activity against four o'clock and soursob. Glyphosate is already recommended as a pre-sowing treatment and metsulfuron is recommended as a pre-sowing and post-emergence treatment for wheat. The effect of combining both chemicals as a pre-cropping treatment is worthy of investigation for control of both species of Oxalis.

Imazethapyr has some activity on four o'clock, and because of its apparent safetly on subterranean clover pasture (10), should be investigated as a potential treatment for pastures infested with four o'clock. The reaction of the common short-styled pentaploid form of soursob (5) to glyphosate and substituted urea herbicides has been investigated (8) but should be repeated using metsulfuron and imazethapyr.

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