# DISTRIBUTION AND HERBICIDE OPTIONS FOR THE MANAGEMENT OF *EUPHORBIA DAVIDII* R. SUBILS

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**Summary** *Euphorbia davidii* is a weed of summer cropping and waste places, which appears to be extending its current range. *E. davidii* is often mistaken for a closely related species *E. dentata*. Searches of herbaria databases highlighted the lack of reference specimens being held for this species and the need for a review of the genera.

*Euphorbia davidii* is tolerant of many of the commonly used herbicides with none being registered. This led to three preliminary trials being conducted by the northern Weed Research and Demonstration Unit in the summer of 1995–96.

Imazapyr, atrazine and metsulfuron methyl at 375 g, 1.5 kg and 6 g a.i. $ha^{-1}$ gave the best results applied pre-emergence while paraquat, paraquat plus atrazine and bromoxynil at 400 g, 400 g plus 1 kg, and 420 g a.i. $ha^{-1}$ respectively, were the best treatments post-emergent fallow. In grain sorghum, fluroxypyr plus atrazine at 100 g plus 1 kg a.i. $ha^{-1}$ gave the best control followed by 2,4-D amine + picloram plus atrazine at 225 g + 56 g plus 1 kg a.i. $ha^{-1}$. Further trials will be conducted to refine rates and gather data for obtaining Pesticide Orders.

## INTRODUCTION

*Euphorbia davidii* is an erect summer growing, frost sensitive, annual weed of fallow, cropping and waste areas. It originally comes from Argentina (Subils 1984). In northern New South Wales (NSW) *E. davidii* can germinate from September through to early June.

The Weed Research and Demonstration Unit's attention was drawn the plant by both government and private agronomists and farmers, who wished to know which herbicides could be used to control it. The weed was of concern because many of the more commonly used herbicides, such as glyphosate, had little effect.

An investigation of herbicide registrations found there were no herbicides registered in NSW for the control of *E. davidii*. Also there is no common name listed for the species in Australia. Usually it is referred to as 'that spurge'.

This lack of registration led to the planning of three herbicide evaluation trials during the summer of 1995–96 to gather some basic efficacy data on a range of best bet herbicides in pre-emergent fallow, post-emergent fallow and post-emergent in sorghum.

A literature search failed to find any references specifically referring to *E. davidii* as a weed, or any work in Australia on weedy spurges. However there is a large volume of work on a range of other Euphorbia species considered as weeds, particularly in North America. Harris (1984) states that the *Euphorbia esula-virgata* complex, are herbaceous perennials of European origin that have become problem weeds in central northern United States and the Canadian prairies. This species is considered one of Montana's worst weeds (Lacey and Fay 1984). Other spurges considered weeds in the United States were outlined in a survey conducted in the Mississippi Delta by Elmore and McDaniel (1986), which included *E. maculata* (spotted spurge), *E. humistrata* (prostrate spurge), and *E. hyssopifolia* (hyssop spurge). *E. dentata* Michaux (dentate spurge) is a weed of onions and cereals in southern Russia and Uzbekistan (Kuryavtseva and Chernetsova 1993).

## DISTRIBUTION OF *E. DAVIDII* IN AUSTRALIA

On discussing the issue of *E. davidii* with colleagues in the area of weed management in northern NSW the general impression was that of an increase in distribution and frequency during the past ten years. James and Harden (1990) gives the NSW distribution as the north west slopes, central west slopes, north west plains and the south west plains. In Queensland there is no record of *E. davidii* however, *E. dentata* Michaux, a closely related species is misapplied.

To help put a perspective on how great a weed problem *E. davidii* might be across Australia a database search was conducted of more northern herbaria in Australia. The Queensland Herbarium has eight records of *E. dentata*, with most coming from around Kingaroy and one from Inverell, NSW. The Australian National Herbarium has one specimen of *E. davidii* from near Tamworth and three of *E. dentata* from the Northern Territory. It was felt that the specimens from the Northern Territory were unlikely to be the same species (C. Dunlop personal communication 1996). It is likely however the specimens of *E. dentata* from the South Burnett region and *E. davidii* in northern NSW are the same species. As outlined by Hosking *et al.* (1996), checks need to be made on the correct identity of the herbarium specimens and more well presented specimens need to be sent to herbaria for future reference.

## HERBICIDE TRIALS

The search of the literature showed most of the herbicide work has been on *E. esula* complex in the United States (Messersmith 1982, Alley *et al.* 1983, Lym and Messersmith 1983). Initially soil sterilants were used, then picloram became popular because of its greater selectivity (Harris 1984). Combinations of 2,4-D, dicamba and picloram were the mainstay of control programs. Fluroxypyr (Ferrell and Whiston 1989) and triclopyr (Krall and Hackett 1985) were also used as selective herbicides on *E. esula*. Stougaard *et al.* (1994) evaluated three imidazolinone herbicides for the control of *E. esula* and found them to be effective when applied in autumn. Sulfometuron methyl was also found to be toxic to *E. esula* (Lym and Messersmith 1987).

## MATERIALS AND METHODS

All herbicides were applied with a hand held three metre wide boom with a 50 cm nozzle spacing. Operating pressure was 210 kpa. All trial designs were randomized complete block. An analysis of variance was performed on data from trials 1 and 3. Trial 2 data were analysed using a generalized linear model using binomial errors in a logit link function which made predictions averaging over replicates (McCullagh and Nelder 1989).

**Trial 1 Pre-emergent fallow control** This trial was situated on a property where cotton is grown so most of the herbicides tested were compatible with cotton culture. There were 15 herbicides by three replicates. Visual assessments were performed two months after treatment (MAT) and four MAT and a final plant count four MAT.

**Trial 2 Post-emergent control in grain sorghum** This trial consisted of 16 treatments and three replicates. Sorghum was at 5½ to 6½ leaf stage and the *E. davidii* varied from two cotyledons to four nodes with mature seed (18 cm high). Density of *E. davidii* varied from 56 to 320 plants $m^{-2}$. Herbicide effects were visually assessed at 2 MAT using a 0 (no effect) to 5 (total death) rating system (McMillan and Cook 1992).

**Trial 3 Post-emergent fallow** This trial consisted of 14 treatments and three replicates. *E. davidii* was up to 50 cm tall with mature seed and showing signs of moisture stress. No rain was received between spraying and assessment. Assessment was at 22 DAT with plant count per five square metres.

## RESULTS AND DISCUSSION

The three trials gave useful insights into the herbicide strategies which can be used to manage *E. davidii*.

**Table 1.** Summary of trial information

| Trial Number | Spray Date | Trial Location | Spray Volume (L $ha^{-1}$) | Temp. °C |
|---|---|---|---|---|
| 1 | 23.10.95 | Boggabri | 222 | 20.5 |
| 2 | 4.12.95 | Tamworth | 167 | 32.5 |
| 3 | 19.2.95 | Tamworth | 156 | 35 |

**Trial 1 Pre-emergent fallow control** Imazapyr, atrazine and metsulfuron methyl gave excellent control of *E. davidii* when applied as pre-emergent treatments (Figure 1).

Imazapyr gave total vegetation control. Masters *et al.* (1994) found that autumn application of imazapyr at 280 g a.i. $ha^{-1}$ gave 58% control of *E. esula* 9 MAT. This lower rate was chosen as higher rates had previously been found to seriously suppress the growth of forage grasses. Stougaard *et al.* (1994) found imazapyr at 840 g a.i. $ha^{-1}$ consistently gave 85% control at 9 MAT. Used as a pre-emergent on an annual species such as *E. davidii* would leave room for the adjustment of rates, depending on rotation, soil type and rainfall.

Atrazine would be an obvious choice for summer fallow control with application in spring to avoid the high risk leaching period of late summer. This will also allow greater flexibility with winter options. Metsulfuron methyl was also effective in preventing establishment however the long plant back times will limit flexibility.

**Trial 2 Post-emergent control in sorghum** When this trial was sprayed many of the *E. davidii* plants were larger than desirable for a commercial spray treatment. Actual biomass was significantly reduced in the better treatments however this was not measured.

Fluroxypyr plus atrazine gave over 50% better control than fluroxypyr alone at 200 g a.i $ha^{-1}$ (Figure 2). The farmer sprayed the paddock in which the trial was located with 200 g a.i. $ha^{-1}$ fluroxypyr plus 1 kg a.i. $ha^{-1}$ atrazine the day before the trial was sprayed and obtained 95 % control. Fluroxypyr is used on *E. esula* in North America and has been shown to give better control when applied with 2,4-D amine or picloram (Lym 1992), however the addition of atrazine was not tested.

The mixture 2,4-D amine + picloram plus atrazine gave 100% better control of *E. davidii* 2,4-D amine than picloram alone at 450 g a.i. and 112.5 g a.i. $ha^{-1}$. Dicamba plus atrazine gave 11% better control than dicamba alone at twice the rate. Triclopyr (72 g a.i. $ha^{-1}$), triclopyr and picloram (60 g + 20 g a.i. $ha^{-1}$), clopyralid and MCPA amine (45 g + 1 kg a.i. $ha^{-1}$), 2,4-D amine and picloram (225 g + 56 g a.i. $ha^{-1}$) and MCPA amine (1 kg a.i. $ha^{-1}$) were no different to the unsprayed treatment.

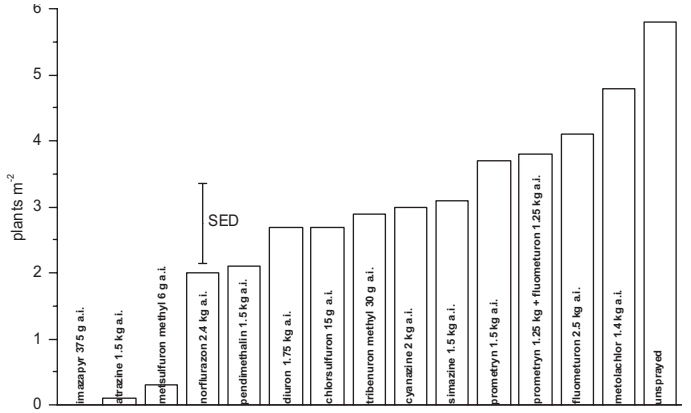


**Figure 1.** Effect of herbicides applied pre-emergent to control *E. davidii*.

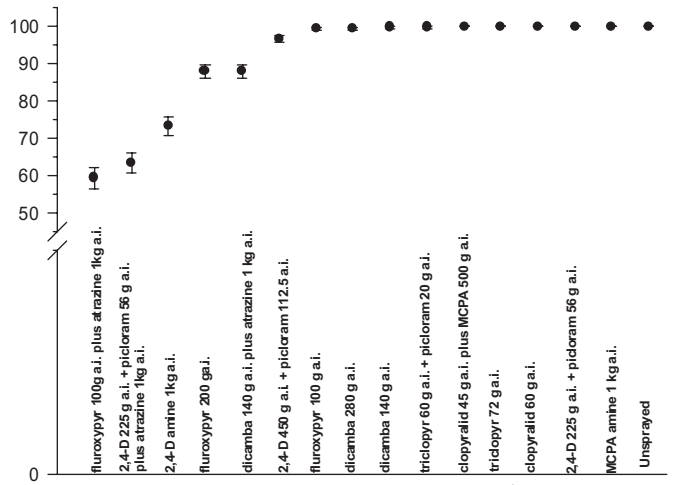


**Figure 2.** Effect of post-emergent herbicides (ha$^{-1}$) on the relative frequency (%) of *E. davidii* in grain sorghum.

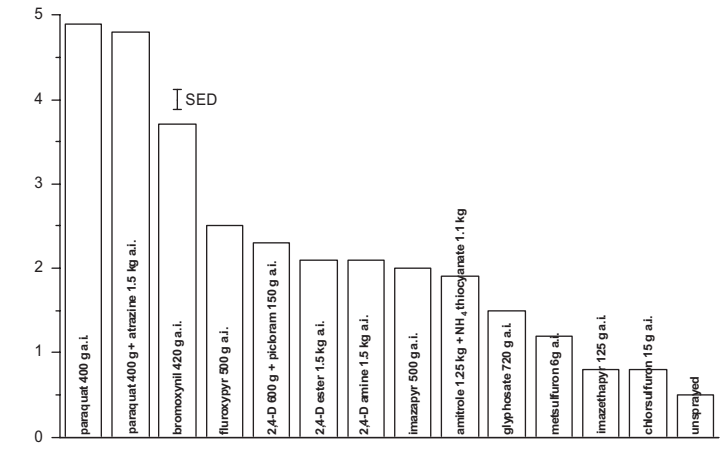


**Figure 3.** Effect of post-emergent fallow herbicides (ha$^{-1}$) on control of *E. davidii* 22 DAT. Each column the mean of three replicates on a 0–5 rating.

Work by Frank and Tworkowski (1994) found that clopyralid had little effect on *E. esula* which coincides with the results from this trial. Clopyralid was tank-mixed with MCPA because it has been shown to act synergistically on other species (McMillan and Cook 1992). Individual standard errors are shown. Relative frequencies were obtained by four stratified samples of 0.25 m$^2$ graduated quadrats per plot.

**Trial 3 Post-emergent fallow** At the time of spraying the weeds were showing moisture stress, which is typical of the situations farmers are likely to experience when controlling weeds in summer. *E. davidii* appears to show symptoms of moisture stress before many other weed species

Paraquat at 400 g a.i. ha$^{-1}$ gave almost 100% control. The addition of 1.5 kg a.i. ha$^{-1}$ atrazine caused a slight reduction in control, which is contrary to the effect of the addition of atrazine to 2,4-D amine + picloram and fluroxypyr in trial 2. However, the addition of atrazine to paraquat is likely to give ongoing fallow benefits by preventing re-establishment following further rain. In spring, the slight reduction in control from the addition of atrazine would be counter balanced by smaller weed size and better soil moisture.

Bromoxynil at 420 g a.i. ha$^{-1}$ gave around 80% control, despite the dry conditions. The high temperatures at the time of application might have enhanced the control and will have to be reassessed under cooler conditions. This has potential for the control of *E. davidii* in lucerne and legume based pastures.

All other herbicides gave significantly lower levels of control. Imazapyr at 500 g a.i ha$^{-1}$ and imazethapyr at 125 g a.i. ha$^{-1}$ performed poorly as a post-emergent herbicide while the former gave excellent control in the pre-emergent trial. Glyphosate gave results in-line with commercial experience. Fluroxypyr and 2,4-D amine + picloram gave control levels which reflect the results in Trial 2.

## CONCLUSION

*Euphorbia davidii* is likely to continue its spread in northern NSW and will become a more troublesome weed than it is at present. It is important to have weed species correctly identified with good quality specimens and collection information lodged with herbaria.

In pre-emergent fallow situations atrazine shows promise for control, while the addition of atrazine to 2,4-D amine + picloram and fluroxypyr gives cost effective selective control in sorghum. Paraquat is an effective knockdown herbicide which can be mixed with atrazine for longer term control. Bromoxynil has the potential to control *E. davidii* in lucerne and legume pastures.

Further evaluation will be required to refine rates and the effects of temperature and moisture on herbicide efficacy, to obtain reliable data for Pesticide Orders.

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