

# Ringling the bell on bellvine

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**B**ellvine is an aggressive weed, found throughout much of the Queensland cotton area and spreading in northern NSW.

It is closely related to and similar to cowvine (also called peachvine) — both belong to the genus *Ipomoea*. Bellvine often occurs in the same field as cowvine, but has a number of distinguishing features.

Bellvine and cowvine seedlings will emerge at about the same time, but bellvine has a rounded cotyledon leaf, compared to cowvine's long, fine cotyledons. This more-rounded leaf-shape in bellvine remains throughout the plant's life.

Early plant growth is similar in the two species, but bellvine is a more aggressive climber than cowvine, twining through and climbing over other plants.

Bellvine will climb up cotton plants and emerge above the top of the crop later in the season. This twining and climbing habit makes bellvine infestations difficult to manage, as weed plants become inseparable from crop plants and will climb between adjacent rows. Inter-row passes and harvesting operations can be severely hampered by a heavy bellvine infestation which can block and tangle in equipment.

Unlike cowvine, bellvine appears to have little hard-seed, potentially resulting in very large numbers of bellvine seedlings emerging at the same time as the cotton crop. This characteristic makes bellvine difficult to control in cotton with conventional weed management systems, but should allow a bellvine infestation to be brought under control by careful management over a couple of seasons, provided all bellvine plants are prevented from setting seed. This theory is yet to be tested in practice.

Bellvine seeds readily emerge from depths of up to four cm in the soil, with some emergence from as deep as 10 cm.

Bellvine appears to have a photoperiodic requirement for flowering, meaning that it will not set flowers until day-length begins to decline in late-summer and autumn. So plants do not set seed in spring and early summer, but large quantities of seed can be produced in autumn.

This makes the management of bellvine plants that emerge in cereal crops and fall-



**Bellvine plants are not readily distinguishable from cotton and may not appear to be a serious problem until later in the season when plants emerge over the top of the cotton crop.**

lows in spring less critical than is the case with cowvine seedlings, as no seed should be produced by these plants provided they are controlled by mid-summer.

This later flowering habit and low seed dormancy make good management of bellvine in fallows a must. A clean summer/autumn fallow should go a long way towards controlling this weed.

## RESIDUAL HERBICIDES

Bellvine is not well controlled by any of the soil applied residual herbicides available for use in cotton. Experiments indicate that of the residual herbicides, trifluralin and Zoliar give the best control and may reduce seedling establishment by up to 50–70 per cent.

But unacceptably high densities of bellvine seedlings may still emerge through these herbicides and will need to be controlled early in the crop's life. Diuron, and to a lesser extent prometryn and fluometuron, also have some residual activity on bellvine.

Results from tank-mixes of two residual herbicides were generally better than results from a single residual herbicide.

Of the non-cotton residual herbicides tested, only picloram (Tordon) gave any lasting residual control of bellvine emergence, but this herbicide is not registered

for bellvine, has a long plant-back period to many crops and can not be used on fields that are to be planted to cotton.

Cotton growers facing a bellvine problem would be well advised not to rely solely on residual herbicides to control this weed, but to choose a residual herbicide program targeted to the remaining weeds on a field and concentrate on controlling bellvine post-emergence and in fallows.

## POST-EMERGENCE HERBICIDES

Like cowvine, there are a number of post-emergence options for controlling small bellvine seedlings in cotton, but large plants are extremely difficult to control without damaging the crop. The twining character of bellvine also makes it very difficult to get good herbicide coverage on larger plants that are embedded in the crop. Shielded sprayers and directed sprays are generally of little value for controlling large bellvine plants as they are not able to direct spray to enough of the weed's foliage.

Spray.Seed is very effective and is registered for controlling bellvine pre-planting. It may be a valuable tool where a flush of bellvine seedlings emerges prior to planting.

Of the available in-crop herbicides, high rates of Roundup Ready herbicide, prome-



Pre-plant residual herbicides suppressed bellvine seedling growth and reduced bellvine numbers by 50–60 per cent in this experiment compared to an untreated plot in the foreground, but 5–10 seedlings per metre of row still established and required control early in crop life.

tryn, diuron and Envoke can all give very good control of bellvine seedlings under favourable conditions. But results with these herbicides were not reliable, with up to 100 per cent control on some occasions, but much poorer results on other occasions. Nevertheless, good levels of suppression were observed on seedlings

that were not killed, with seedling growth suppressed for 4–6 weeks following the herbicide application.

Neither Envoke nor Roundup Ready herbicide are registered for controlling bellvine in cotton.

The inclusion of spray additives with Roundup CT (glyphosate) did improve

suppression of large bellvine plants compared to results from Roundup CT alone — with inclusion of a non-ionic surfactant at one per cent giving the best result. The improved suppression with a surfactant was equivalent to the result with Roundup Ready herbicide alone.

Tank mixes of Roundup Ready and Envoke or Roundup Ready and Staple herbicides were tested and initially appeared to give very good results. But further testing did not show a consistent advantage compared to Roundup Ready herbicide alone.

Combinations of Roundup Ready herbicide and other additives (Pledge, Oust, Hammer and Goal) were also tested, but none of these gave an advantage over Roundup Ready herbicide alone.

### AN IN-CROP BELLVINE MANAGEMENT SYSTEM

A range of herbicide systems was tested in cotton over three seasons on fields that had high bellvine densities.

The initial lessons from these experiments were:

- Systems that relied solely on pre-plant residual herbicides became unmanageable later in the season;

- Inter-row cultivation was very effective in controlling bellvine plants in the furrow;
- Systems that didn't include Roundup Ready cotton were difficult to manage, as Roundup Ready herbicide was a very valuable tool for controlling the first flush of bellvine seedlings in the plant line sprayed over-the-top at the four leaf stage of crop growth; and,
- Good crop agronomy was essential. Bellvine did climb up through a highly competitive crop, but was almost unmanageable in an uncompetitive crop.

Provided that all bellvine seedlings were controlled early in the season using Roundup Ready herbicide and inter-row cultivation, a range of herbicide strategies gave good control later in the season. A common factor in these treatments was an early post-emergence directed application of a residual herbicide, generally diuron, applied when the next flush of bellvine seedlings was at about two to four leaves, followed by a second directed residual herbicide at layby.

Roundup Ready herbicide was tank-mixed with the residual herbicide in many of these treatments, but similar results



Bellvine plants (left) have distinctly rounded cotyledon leaves, and much rounder adult leaves than cowvine (peachvine) plants (right).

were achieved where only the residual herbicide was applied. Other work over many years has shown that glyphosate should not be tank-mixed with diuron, prometryn or fluometuron as these herbicides are antagonistic with glyphosate, including the Roundup Ready herbicide formulation of glyphosate.

The presence or absence of a pre-plant residual herbicide also made no difference to the level of bellvine present later in the season. The pre-plant residual did reduce the bellvine density early in the season, but the over-the-top Roundup Ready herbicide application largely removed this early difference.



A tank-mix of Roundup Ready and Envoke herbicides gave the best result in this experiment (foreground), but some bellvine plants still survived this treatment.

## SUMMARY

Important components of a bellvine management system for cotton are:

- Ensure bellvine plants are controlled before they set seed.
- Control bellvine in fallows whenever possible.
- Use inter-row cultivation to remove plants from the furrow.
- Roundup Ready herbicide over-the-top of Roundup Ready cotton at or before the four leaf crop stage may suppress bellvine seedlings that emerge with the crop.
- Use good crop agronomy to ensure a competitive crop.
- Use cultivation and directed residual herbicide applications to control bellvine seedlings that come up later in the season.

**Disclaimer:** Some of the herbicides named in this article are not registered for controlling bellvine. Always read the product registration label and only apply herbicides in accordance with the label.

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