

Polymeria take-all: The rhizome story

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Polymeria take-all (*Polymeria longifolia*) is a troublesome perennial weed of irrigated cotton production, particularly in western and northern areas. In patches with even moderate densities of 100 stems per square metre, cotton yields are reduced by more than 50 per cent.

Existing control measures based on herbicides and shallow cultivation are largely ineffective and inconsistent in their results. This is due in part to the large below-ground mass of rhizomes. A rhizome is a fleshy underground stem that acts as a carbohydrate storage organ and is responsible for the spread of various vegetatively reproducing species such as *Polymeria* take-all.

A root is different to a rhizome in that roots are responsible for absorbing and transporting water and nutrients and may help in anchoring the plant. The roots of *Polymeria* take-all commonly arise from the rhizome nodes.

It is important to understand how the rhizomes of *Polymeria* take-all grow and where they are distributed down the soil profile because normal management techniques such as shallow defoliation or single applications of knockdown herbicides do not work effectively against the weed. The shallow damage to the rhizome system results in further shoot emergence and maintenance of the problem.

This article suggests that deeper damage is needed to try to manage the weed effectively. Since accurate identification of the take-all weeds, and in particular *Polymeria* take-all, is important for management, the reader is referred to the article *Polymeria* and take-all Volume 23, no. 5, pages 54–60 in *The Australian Cottongrower*.

Rhizome distribution

To determine the depth at which rhizomes and roots grow, three 1.5 metre wide soil profiles were dug down to at least 1.5 metres deep in the middle of a large *Polymeria* take-all patch in an irrigated cotton field.

A total of 80 per cent of rhizomes and 65 per cent of roots of *Polymeria* take-all were found in the top 40 cm of the soil profile (Table 1). Nearly 50 per cent of all rhizomes and 37 per cent of roots were found in the 10–30 cm layer.

Although rhizomes were found to a depth of 150 cm, very few were found deeper than 100 cm (Table 1). An average of 13 rhizomes and 277 roots were observed below 100 cm compared with the larger numbers above.

The large number of rhizomes and associated roots in the top 40 cm of the soil profile has important implications for the management of this weed. Inter-row cultivation (commonly to a depth of 10 cm) would do little to disturb the bulk of the rhizomes of this plant, because less than 20 per cent of the total rhizome and root numbers occur at this depth.

Other means of management need to be investigated to disturb or kill the bulk of the rhizomes — for example by achieving herbicide translocation to depth or even deep ripping. Various observations indicate that *Polymeria* take-all shoots can emerge from rhizomes at a depth of at least 20 cm.

Research by Vikki Osten from Qld DPI at Emerald on a similar creeping perennial species, *Haloragis* take-all, indicates that reshooting can occur from a depth of 50 cm. Whether *Polymeria* take-all can emerge from similar depths is unknown and requires further research.

Polymeria take-all competes strongly with the cotton crop because they share the upper soil profile. Research has shown that up to 80 per cent of all cotton roots can be found in the top 45 cm of the soil even though the rooting depth commonly extends down to at least 80 cm. Competition for water and nutrients between

cotton and Polymeria take-all has been investigated and will be presented in a future article.

A description of the rhizomes of Polymeria take-all

One way to try to manage Polymeria take-all is to cut or kill the shoots (defoliation) either by cultivation or herbicides. To understand what happens to Polymeria take-all when defoliation occurs, it is important to first understand how the rhizome system of the weed is composed.

The shoots of Polymeria take-all are connected to a network of rhizomes below the ground. Pic 2 illustrates the various rhizome types of Polymeria take-all. These rhizomes have been split into three groups:

- Vertical shoot-bearing rhizomes;
- Horizontal rhizomes that produce vertical shoot-bearing rhizomes but also produce shoots; and,
- Vertical rhizomes which penetrate down into the soil.

There are a number of fibrous roots that are clustered at the nodes and other points along the rhizomes. These are largely responsible for water and nutrients entering the plant, as outlined above. The horizontal and vertical rhizomes probably have two functions.

Firstly, they give rise to roots and secondly, they produce other shoot material at some distance from the existing plant allowing the weed to spread.

What happens when Polymeria take-all shoots are removed by either cultivation or herbicides?

After Polymeria take-all shoots are removed (defoliation), new shoots arise from undamaged rhizome nodes (Pics 2 and 3). Pic 3 illustrates a shoot that was killed by herbicide but then partially buried by cultivation and preserved in the soil. The vertical shoot-bearing rhizome was dead down to the point where the new unemerged shoot developed.

Polymeria take-all responds similarly to defoliation by either cultivation or herbicides in that the next undamaged node down the vertical shoot-bearing rhizome produces a new shoot with the remaining stump becoming brown and hardened (Pic 2).

Shoot regeneration

Although the rhizome system of Polymeria take-all is somewhat fragile and easily broken by either cultivation or when pulled by hand, rhizomes of over one metre in length have been recovered. On average, a rhizome has a node every 11 cm (this varies from six to 21 cm) and produces a number of shoots. One uncommon example of a 20 cm length of horizontal rhizome of Polymeria take-all produced five vertical shoot-bearing rhizomes, four of which then produced two shoots each and one produced four shoots — a total of 12 new shoots for the 20 cm length.

But in general, a shoot is produced on each 28 cm of rhizome although this can vary from 0–94 cm. So the rhizome of Polymeria take-all can be very long and produce a large number of shoots, making the management of the entire plant difficult unless all shoots with rhizomes attached are killed.

Conclusion

Management aimed at removing shoots of Polymeria take-all, or shallow disturbance of the rhizome mass of the weed, will be largely ineffective because shoot emergence can occur from deeper-seated rhizome material and from further along undamaged rhizomes.

It is likely that successful management will rely on better translocation of herbicides and more aggressive destruction of rhizome material at depth with cultivation. These means of management need to be investigated further.

For further information on the growth stages of Polymeria take-all, refer to the Weed identification and information section in WEEDpak. For management information refer to the Management of problem weeds sections of

WEEDpak. Copies of WEEDpak are now available on the Australian Cotton CRC website at <http://www.cotton.crc.org.au/Publicat/Weeds/WPContent.htm>, from Cotton Industry Development (Extension) Officers and directly from the Technology Resource Centre of the Australian Cotton Cooperative Research Centre.

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