

Managing seed dormancy

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Introduction

Weed seeds can lie in the soil for years before they germinate. The period between seed set and germination will depend upon the dormancy level of the seeds, environmental conditions, the depth of seed burial, natural seed death (predation and decay) and any physical seed removal practices.

These factors are important for weed management because they define how long a weed needs to be managed. Figures of three years for annual ryegrass and five years for wild radish are often quoted but variations from these can be large. Dormancy can also determine seasonal germination patterns that can affect the timing of weed management strategies.

Living seeds are defined as dormant when they cannot germinate under perfect environmental conditions.

Annual ryegrass

Most annual ryegrass seeds are dormant when they are produced on the mother plant and will not germinate under any circumstances. During hot dry summer conditions they gradually lose their dormancy (after ripening), with more of the population becoming able to germinate in late autumn.

New research has shown there is less initial dormancy if conditions are warm and dry during seed development and the rate of dormancy release during the summer months is faster if conditions are hot and wet.

Wild radish

Dormancy of wild radish is controlled at three levels. Wild radish seeds are enclosed within a pod (first level) and within that by a seed coat (second level). These two physical external barriers inhibit the embryo from germinating by restricting water absorption.

The third level of control is contained within the embryo, which once the physical barriers have broken down, senses the environment and allows germination only when conditions are right. For buried seeds, conditions for germination are maximal in autumn/early



DEVICES LIKE THE HARRINGTON SEED DESTROYER [PICTURED] AND CHAFF CARTS CAN MINIMISE HARVEST-TIME RENEWAL OF THE WEED SEED BANK. PHOTO COURTESY GRDC.

winter, with a secondary peak in spring.

Wild radish seed is very difficult to germinate until the two physical barriers are removed by physically breaking down the pod and seed coat. Once this occurs there is no restriction to germination. For this reason fresh seed is very hard to germinate while weathered seed or seed that has been physically damaged at harvest or by tillage or stock will germinate with any significant rain event.

This explains why an 'autumn tickle' is so effective in promoting the germination of wild radish, provided there is enough moisture, and conversely why, in a no-till system, seed can remain dormant for longer, making other factors such as predation and natural seed death much more important in driving the seed bank down.

What happened

During the drought in 2010, environmental conditions were not

suitable for germination of all 'non-dormant' weed seeds and most of these would have carried over to 2011. This carry-over was additional to the seasonal breakdown of dormancy in annual ryegrass and wild radish seed populations over the summer of 2011. The combination of this massive seed bank with the good rains and perfect conditions for germination created a 'perfect storm' of weed germination in 2011.

The high level of germination means there has been a massive reduction in the weed seed bank over 2011, so this is the perfect year to remove or destroy seed during harvest to minimise renewal of the weed seed bank. For maximum benefit, harvest-time seed removal or destruction should be maintained for the next three to five years, but taking action in 2011 is important because of the reduced number of weed seeds in the soil after the good germination of the past season.

Deep burial – mouldboard ploughing

Weed seeds buried at depth enter into a 'secondary' dormancy because they are placed in an environment where they cannot germinate because there is no light, oxygen and sometimes moisture, which are germination requirements for most seeds. On top of this it is physically impossible for the weeds to emerge from depth (coleoptile length).

The downside to deep burial as a weed control technique is that weed seeds at depth can survive up to 10 years for most grasses and 15 years for hard-seeded broad leaved weeds. This means that any tillage event within these time frames will bring weed seeds back to the soil surface.

The bottom line is that deep burial of weed seed should be considered a once-off option and not something to be repeated every few years, particularly in our fragile soils.

Predictions for 2012

Given that the finish to this season could be 'soft', I would predict relatively high annual ryegrass dormancy in 2012. However, this dormancy will be broken



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down if the coming summer is hot and wet. If this is the case, prepare for a good germination at the start of the 2012 season. If summer is mild and dry, expect germination to be slower than normal, with multiple germinations during the season.

The information in this article is based on research by Dr Kathryn Steadman and co workers from the Western Australian Herbicide Resistance Initiative (now Australian Herbicide Resistance Initiative), CSIRO and DAFWA.



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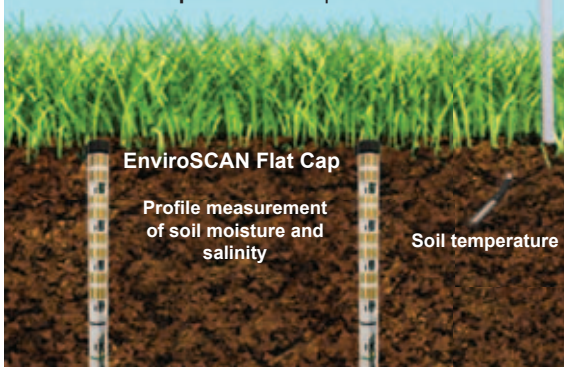
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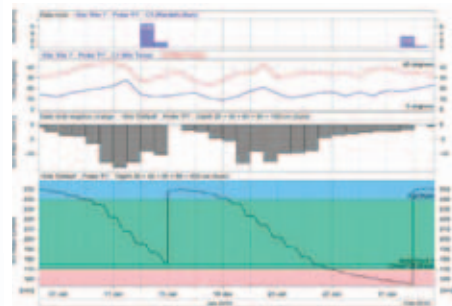
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