1-1-1987

The potential for skeleton weed

John Dodd

F. D. Panetta

Follow this and additional works at: https://researchlibrary.agric.wa.gov.au/journal_agriculture4

Part of the Agricultural Economics Commons, Agronomy and Crop Sciences Commons, Plant Biology Commons, and the Weed Science Commons

Recommended Citation
Available at: https://researchlibrary.agric.wa.gov.au/journal_agriculture4/vol28/iss1/8

This article is brought to you for free and open access by Research Library. It has been accepted for inclusion in Journal of the Department of Agriculture, Western Australia, Series 4 by an authorized administrator of Research Library. For more information, please contact jennifer.heathcote@agric.wa.gov.au, sandra.papenfus@agric.wa.gov.au.
IMPORTANT DISCLAIMER

This document has been obtained from DAFWA's research library website (researchlibrary.agric.wa.gov.au) which hosts DAFWA's archival research publications. Although reasonable care was taken to make the information in the document accurate at the time it was first published, DAFWA does not make any representations or warranties about its accuracy, reliability, currency, completeness or suitability for any particular purpose. It may be out of date, inaccurate or misleading or conflict with current laws, polices or practices. DAFWA has not reviewed or revised the information before making the document available from its research library website. Before using the information, you should carefully evaluate its accuracy, currency, completeness and relevance for your purposes. We recommend you also search for more recent information on DAFWA's research library website, DAFWA's main website (https://www.agric.wa.gov.au) and other appropriate websites and sources.

Information in, or referred to in, documents on DAFWA's research library website is not tailored to the circumstances of individual farms, people or businesses, and does not constitute legal, business, scientific, agricultural or farm management advice. We recommend before making any significant decisions, you obtain advice from appropriate professionals who have taken into account your individual circumstances and objectives.

The Chief Executive Officer of the Department of Agriculture and Food and the State of Western Australia and their employees and agents (collectively and individually referred to below as DAFWA) accept no liability whatsoever, by reason of negligence or otherwise, arising from any use or release of information in, or referred to in, this document, or any error, inaccuracy or omission in the information.
The potential for SKELETON WEED

By J. Dodd and F. D. Panetta, Research Officers, Weed Agronomy Branch

Since its introduction into Australia during the early 1900s skeleton weed has become one of the most economically significant weeds. Its presence in cereal crops in south-eastern Australia has caused severe yield reductions and harvesting problems.

Skeleton weed was first found on a Western Australian farm in 1963. Since then it has been the subject of an intensive eradication campaign organised by the Agriculture Protection Board and funded largely by an annual levy on wheat growers. Such campaigns, which rely mainly on volunteer searchers, do not exist in eastern Australia because the weed is so widespread it would be impossible to eradicate.

Studies conducted by Weed Agronomy research officers, F. D. Panetta and J. Dodd, have led to a greater understanding of the biology and potential of skeleton weed in Western Australia. The following article is a sequel to their earlier article in the Journal of Agriculture (Panetta and Dodd 1984) and assesses what influences the establishment and spread of skeleton weed in this State.

Background

Since 1963, skeleton weed infestations have been found on 200 farms in five areas of the south-west (Figure 1):

- inland of Geraldton,
- around Moora,
- in Narembeen Shire and adjoining shires,
- inland of Esperance and
- inland of Albany

Over the past seven years, from six to 32 farms have been placed in quarantine each year because skeleton weed has been found on them (Table 1). Although these figures are of great concern to the farming community and the Agriculture Protection Board, the individual infestations are not large; many consist of a small number of plants occupying only a few square metres. Consequently, the total area of land infested by skeleton weed in Western Australia is much less than that of a typical wheatbelt farm.

Despite being present in this State for more than 20 years, skeleton weed remains a very localised weed that exists in relatively small numbers. By comparison, during the first 20 years following its introduction to south-eastern Australia in the early 1900s, skeleton weed spread explosively. Extensive...
infestations developed throughout hundreds of square kilometres of the New South Wales wheat-growing areas and thousands of hectares of wheat land were abandoned to pasture.

In view of the weed's rapid spread following its introduction to south-eastern Australia, it is pertinent to ask:
• why skeleton weed is not already more widespread and abundant in Western Australia, and
• whether Western Australia will eventually become as extensively and densely infested as the south-eastern States.

Factors favouring skeleton weed

Large numbers of viable seeds can be produced by skeleton weed plants growing at locations throughout the Western Australian wheatbelt, even in the absence of significant amounts of summer rain. Total seed output of up to 27,000 seeds per plant has been recorded (Table 2), with flowering and seed production spread from January to late May. Normally, about 80 per cent of the total seed output is viable.

Table 1. Progress in the skeleton weed eradication campaign

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Area searched (ha)</td>
<td>12,036</td>
<td>13,000</td>
<td>13,872</td>
<td>17,583</td>
<td>16,400</td>
<td>22,245</td>
<td>24,300</td>
<td>26,700</td>
</tr>
<tr>
<td>Farms quarantined</td>
<td>6</td>
<td>9</td>
<td>24</td>
<td>20</td>
<td>24</td>
<td>13</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>Farms released</td>
<td>54</td>
<td>58</td>
<td>75</td>
<td>92</td>
<td>114</td>
<td>121</td>
<td>124</td>
<td>151</td>
</tr>
<tr>
<td>Affected properties</td>
<td>9</td>
<td>14</td>
<td>21</td>
<td>24</td>
<td>26</td>
<td>32</td>
<td>45</td>
<td>50</td>
</tr>
<tr>
<td>Plants per farm</td>
<td>63</td>
<td>72</td>
<td>96</td>
<td>116</td>
<td>140</td>
<td>153</td>
<td>169</td>
<td>201</td>
</tr>
<tr>
<td>Search machines</td>
<td>1600</td>
<td>1200</td>
<td>1712</td>
<td>2048</td>
<td>2333</td>
<td>2484</td>
<td>2426</td>
<td>2070</td>
</tr>
</tbody>
</table>

Table 2. Seasonal seed production totals and average seed viability for skeleton weed growing at sites in the Western Australian wheatbelt

<table>
<thead>
<tr>
<th>Site</th>
<th>Seed total per plant</th>
<th>Average percentage viable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narrow-leaved form</td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Miling (1983-84)</td>
<td>23,300</td>
<td>78</td>
</tr>
<tr>
<td>North Miling (1984-85)</td>
<td>15,600</td>
<td>81</td>
</tr>
<tr>
<td>Dulyabin Rock 1 (1983-84)</td>
<td>3,100</td>
<td>32</td>
</tr>
<tr>
<td>Dulyabin Rock 1 (1984-85)</td>
<td>9,470</td>
<td>73</td>
</tr>
<tr>
<td>Moorine Rock</td>
<td>1,700</td>
<td>83</td>
</tr>
<tr>
<td>Badgingarra</td>
<td>8,430</td>
<td>74</td>
</tr>
<tr>
<td>Broad-leaved form</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Merredin</td>
<td>4,380</td>
<td>41</td>
</tr>
<tr>
<td>Narembeen 1</td>
<td>8,450</td>
<td>91</td>
</tr>
<tr>
<td>Narembeen 2 (1983-84)</td>
<td>27,600</td>
<td>72</td>
</tr>
<tr>
<td>Narembeen 2 (1984-85)</td>
<td>13,200</td>
<td>66</td>
</tr>
<tr>
<td>Narembeen 3</td>
<td>5,580</td>
<td>82</td>
</tr>
<tr>
<td>Narembeen 4</td>
<td>8,440</td>
<td>92</td>
</tr>
<tr>
<td>Dulyabin Rock 2</td>
<td>4,300</td>
<td>54</td>
</tr>
<tr>
<td>Badgingarra</td>
<td>14,120</td>
<td>79</td>
</tr>
</tbody>
</table>

Figure 1. The distribution of farms in quarantine for skeleton weed in January 1987. The numbers show how many farms are in quarantine within each ½° x ½° grid cell (approx. 47 x 55 km). Note: Formerly infested farms inland of Esperance have recently been released from quarantine.
Both the narrow-leafed and broad-leafed forms of skeleton weed are present in Western Australia (Panetta 1984). The narrow-leafed form has attained the most extensive distribution in south-eastern Australia, although the broad-leafed form appears to have greater regenerative ability.

The narrow-leafed form is widely distributed in Western Australia, whereas the broad-leafed form is found mainly in and around Narembeen Shire. The large numbers of infestations found around Narembeen may be a reflection of the greater regenerative ability and persistence of the latter form.

Biological control agents have reduced the vigour of the narrow-leafed form of skeleton weed in south-eastern Australia, but none is present to attack this form in Western Australia (Groves and Cullen 1981). The search for biological control agents for the other forms of skeleton weed (including an intermediate form which is not found in this State) is continuing throughout the weed’s native range in southern Europe and Asia Minor. Since the control agents cannot exist without their skeleton weed host, they may not be introduced successfully to Western Australia unless large, natural populations of skeleton weed are also present. The aim of the Agriculture Protection Board’s eradication programme, however, is to prevent development of large populations.

Competition from annual pasture legumes and lucerne in south-eastern Australia has reduced the abundance of skeleton weed (Groves and Cullen 1981). Such competition is unlikely to take place on a large scale in Western Australia because the crop-pasture rotations practised here do not favour the maintenance of dense, legume-based pastures, particularly in the drier parts of the wheatbelt.

**Limitations to skeleton weed**

Despite the massive output of skeleton weed seeds, the chances of plant establishment from seed are extremely small. Germination will occur in summer even after two to five millimetres of rain, but the resulting seedlings invariably die from lack of further moisture. The seedling root grows too slowly to escape the rapid drying of surface soils and reach moisture reserves at depth in the days following the cessation of rain. This factor would be especially important in the State’s wheatbelt because of the sporadic nature of our summer rain.
Unlike many weeds, skeleton weed does not accumulate large numbers of dormant seeds in the soil. Its seeds lose viability relatively quickly and survive for less than 12 months in the field.

In Western Australia, ants have been observed to remove large numbers of skeleton weed seeds from the soil surface (Table 3).

Although this is an observation gained from limited experimental work, it appears that ants have the potential to remove and destroy (by eating) a large proportion of the seeds produced by skeleton weed. It is probable, however, that the same also applies to south-eastern Australia.

Skeleton weed seedlings germinating in late autumn in Western Australia are likely to be killed during land preparation and crop seeding at the break of season. Seedlings less than six weeks old cannot survive these practices, while only a small proportion of older seedlings will be able to regenerate after such treatments.

Cultivation and crop seeding effectively reduce the numbers of skeleton weed seedlings surviving at a time of year when conditions are, otherwise, optimal for germination and seedling establishment. This means that seedling establishment is probably limited to pastures, particularly those which follow intensive cropping, where low pasture plant densities provide gaps for skeleton weed seedlings. Their slow growth during winter also makes skeleton weed seedlings susceptible to smothering by more vigorous plants in the pasture.

Traditionally, cultivated fallows were used throughout the cereal growing areas of temperate Australia, in a two-year, cereal-fallow rotation. Cultivation of skeleton weed infested land once or twice at times of abundant soil moisture during the fallow year can result in a proliferation of the weed from root fragments.

In Western Australia, cultivated fallows are now seldom used; less than 5 per cent of cropping land was fallowed in 1983. By comparison, cultivated fallows are still widely used in south-eastern Australia and were even more prevalent in the early years of the spread of skeleton weed. The rapid development of dense infestations of this weed in south-eastern Australia can be attributed to both the impact of mechanical (as opposed to chemical) fallowing and unsuccessful attempts to eradicate the plant by cultivation. Individual skeleton weed infestations in Western Australia would probably be much larger if mechanical fallowing were practised more widely here.

In Western Australia the skeleton weed eradication campaign, conducted by landholders and the Agriculture Protection Board, has resulted in most infestations being detected at an early stage of development, when they consist of just a few plants. The eradication programme that follows discovery has led to 25 per cent of infested properties being released from quarantine as a result of the eradication of infestations (Table 1). A high degree of public awareness of skeleton weed has developed in Western Australia because of the publicity given to this weed. As a result, most new infestations reported each year are found by members of the farming community, usually during harvest.
following year. In addition, daughter rosettes emerged some distance from the root crown between November and the following June. Insect attack and lack of rain in early summer killed rosettes which were produced from November to January. Most rosettes emerged in March, following heavy rain in late February, and further rosettes appeared until June. Nearly all the rosettes produced from March onwards persisted and flowered in the following summer.

On average, six daughter rosettes were produced by each parent plant in addition to the three rosettes at the root crown. Overall, there has been a nine-fold increase in rosette numbers during the second year of growth.

Most of the daughter rosettes produced by the narrow-leafed form of skeleton weed were between 10 and 30 cm from the parent plant with a mean distance of 17 cm. For the broad-leafed form, the daughter rosettes were mostly 20 to 40 cm from the parent plant, with a mean distance of 24 cm. The maximum distance between a daughter rosette and its parent plant was 53 cm for the narrow-leafed form and 47 cm for the broad-leafed form. These results are in full agreement with distances reported from south-eastern Australia and, therefore, cast doubt on the contention that vegetatively produced daughter rosettes can grow from lateral roots several metres from the parent plant.

The future

How do the factors discussed in this article affect the future of skeleton weed in Western Australia? Although skeleton weed can produce large numbers of viable seeds under wheatbelt conditions, many seedlings fail to survive. Those that reach maturity represent a very small proportion of the seed output of the parent plant, but once established they are highly persistent. In addition, seed persistence will be favoured by very dry summers and seedling establishment by well-defined seasonal breaks.

Mechanical fallowing causes rapid vegetative increase of skeleton weed. However, plant numbers will also increase vegetatively in the absence of fallowing, either by the production of daughter rosettes from buds on the near-surface, lateral roots of undisturbed plants, or from root fragments generated from other cultivations for the crop. The time required for an extensive infestation to develop following routine cultivation for cropping would be greater than if the plants had been subjected to fallow cultivations, taking perhaps 10 to 20 years, rather than two to five years.

The virtual absence of mechanical fallowing in Western Australia will not "protect" against vegetative increase of skeleton weed, but it will mean that the rates of vegetative increase will be lower. If the resulting infestations remain undetected, or are not reported and controlled, large areas of skeleton weed will eventually develop.

A recent economic analysis (Pannell and Panetta 1986) has indicated that potential economic losses, should skeleton weed become widespread, easily exceed the $600 000 spent on the eradication campaign in 1986 or the projected expenditure for the continuation of the campaign. Detecting and destroying infestations at the earliest possible stage will contribute much to limiting skeleton weed to manageable proportions, since experience in this State has shown that it is possible to eradicate individual infestations.

References


