Department of Primary Industries and Regional Development
GOVERNMENT OF WESTERN AUSTRALIA

Journal of the Department of Agriculture, Western Australia, Series 4

Volume 25
Number 1 *1984*

Article 17

1-1-1984

A 'natural herbicide' against calotrope?

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Research note

A 'natural herbicide' against

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Buffel grass produces a chemical compound which is toxic to the growth of calotrope seedlings, a declared weed in Western Australia north of the 26th parallel. This new discovery is highly significant in view of the increasing emphasis now placed on weed management as opposed to weed control and the desire to use fewer pesticides.

The calotrope problem

In the north-west of Western Australia, buffel grass (*Cenchrus ciliaris* L.) is an important introduced pasture species now naturalised in northern Australia, and calotrope (*Calotropis procera* (Ait.) W.T. Ait.) is a weed that is spreading rapidly in the East Kimberley, especially on over-grazed pastoral land and newly disturbed areas.

The seeds of calotrope, a native of tropical Asia and Africa, were thought to have reached Australia in the packing of a camel saddle brought from India during one of the gold rushes.

There is no economical method of controlling extensive infestations of calotrope under pastoral situations. The use of Tordon 50-D (Picloram plus 2,4-D), the recommended spray treatment, is too costly for large infestations which are often inaccessible because of the rugged terrain. Thus, very little effort is made to control calotrope.

Fortunately, calotrope is a potential threat only in over-grazed areas and never a problem in cultivated fields. It has also been observed that calotrope seedlings fail to establish in areas with well-grown buffel grass. Such a situation suggests the possibility of an allelopathic effect of buffel grass on calotrope.

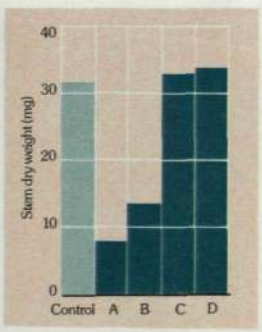

Figure 1. The natural compound in live buffel grass which suppresses calotrope growth is found in the top 20 cm (A) of the soil profile. The deeper into the soil (C, D), the less the effect on calotrope growth (measured as stem dry weight). The control soil contained no buffel grass.

The concept of allelopathy

Certain plants produce substances that can harm other plants or micro-organisms. This phenomenon is known as allelopathy.

The concept of allelopathy has been known for a long time. In 1832 the French scientist DeCandolle suggested that root exudates of certain plants injured some crop plants, and that soil 'sickness' problems in agriculture might be caused by exudates of crop plants. Progress in research on allelopathy offers the possibility of weed resistant crops and crop rotations which could benefit from inherent toxicities of plants, or perhaps the discovery of 'natural herbicides'.

Allelopathy in buffel grass

Experiments have indicated that the inhibitive effects of buffel grass on calotrope are mainly due to the excretion of a phytotoxic compound which acts as a 'natural herbicide' against calotrope. This compound is yet to be isolated and identified, but results so far have revealed that:

- The 'natural herbicide' is released from living buffel grass roots.
- Buffel grass residues (shoots and roots) do not have any toxic effect on calotrope seedlings.
- The 'natural herbicide' is mainly confined to the top 20 centimetres of the soil profile and is very potent against calotrope seedlings.

When calotrope seedlings were grown in soil containing well-established buffel grass plants whose top growth had been removed, leaving only the root system and whatever root exudate produced by the buffel grass, the root, stem and leaf growth of calotrope were drastically suppressed, despite the addition of adequate nutrients.

However the growth of calotrope was not suppressed when grown in soil containing either buffel grass shoots applied to the surface of the soil or incorporated into the soil. The production of the 'natural herbicide' by the living buffel grass roots was mainly confined to the top-most layer, (0-20 centimetres) of the soil profile (see Figure 1). This has important ecological significance since calotrope seeds are found mainly in the topsoil in the field.

The practical significance of the findings mean that proper management of the pastoral areas, ensuring they are not over-grazed and the planting of buffel grass, will prevent calotrope growing in areas that are now free of this weed. Planting buffel grass on land already infested with calotrope should lead to a steady decline in the vigour and density of the plants.

This approach may be considered as a form of biological control with a relatively low labour input which is cheap and environmentally acceptable. While not eradicating the weed, its presence becomes unimportant.

Future work

A future research programme would include looking further into the behaviour of the 'natural herbicide' produced by buffel grass. Its effects on other plants would be examined and attempts would be made to isolate and identify the substance. Hopefully, this may provide new chemistry for use in other areas of weed control.

Further reading

Meadly, G. R. W. (1971). Calotropis, or rubber tree (*Calotropis procera* (Linn.) Dryand.). *Journal of Agriculture*, Western Australia **12:** 69-71.

calotrope?

■ Calotrope.

■ The big calotrope seedlings were grown in soil containing no buffel grass roots. The others were grown in soil containing (from left) 5, 3 and 1 roots of 6-week-old buffel grass whose aerial parts had been removed.

■ The calotrope seedlings in these pots were grown in soil with a surface mulch of (from left) 0, 5, 3 and 1 shoots from 6-week-old buffel grass. The buffel grass shoots did not suppress calotrope growth.