RADIATA MANAGEMENT TECHNICAL NOTE

Site Productivity

Number: RSPTN-017
Date: February 2011

Impact of Buddleia Leaf Weevil on Buddleia Growth

Summary

The buddleia leaf weevil (*Cleopus japonicus*) has the potential to reduce the growth of buddleia (*Buddleja davidii*) during re-establishment of radiata pine, reducing the requirement for chemical control. If so, this would assist in meeting Forest Stewardship Council (FSC) certification criteria associated with reduced chemical (herbicide) use in plantation management. This research complements other FFR funded research to develop new FSC-compliant methods for weed and pest control in New Zealand plantation forestry.

This study summarises the results of three releases, each of 1000 weevils, made at three North Island forestry sites, as well as further work by Scion. Three years following their release, the weevils had achieved up to 95% defoliation within a 150-metre radius of the release and were spreading at between 27and 66 metres per year. While the results are promising, it is too early to recommend a strategy for using this weevil for buddleia control in forestry. A trial established in 2009 combines non-chemical control treatments (such as oversowing) and buddleia leaf weevil release to control buddleia. The results will be available in 2012.

Weevils are available for FFR members to try in their own forests. Please contact the main author at Scion, michelle.watson@scionresearch.com

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Buddleia in Forestry

Buddleia *(Buddleja davidii)* markedly reduces the growth and increases the mortality of newly planted radiata pine and other plantation species. This weed alone has been estimated to cost the New Zealand plantation forest industry up to $2.9 million annually in control costs and lost production [1]. Currently, buddleia is controlled for up to three years after tree planting using herbicides that are applied aerially immediately before, and again after planting. Typically, a mix of glyphosate and metsulfuron is applied for pre-plant control and terbuthylazine and hexazinone for post-plant control. However, after initial control buddleia can continue to invade the plantation until complete canopy closure occurs in five to eight years, when most buddleia plants are shaded out by radiata pine. Following this, buddleia populations along road sides and forest edges provide the main source for future infestations since the seed bank persists for only up to three years.

Although forest managers achieve adequate initial control of buddleia using herbicides, the Forest Stewardship Council (FSC) requires that the certified forest industry strives towards pesticide free pest management. Biological control has been advocated by FSC as one of the preferred non-chemical weed control options [2].

Buddleia Biocontrol

The buddleia leaf weevil, *Cleopus japonicus,* was first released in New Zealand in 2006 as a biological control agent against buddleia. The weevil has two damaging life stages, the larva and adult, which both feed externally on the foliage of buddleia, causing heavily damaged leaves to wither and drop. Larvae can move only short distances, while adults can fly. The adults can live up to 300 days and lay up to 20 eggs per day. It is hoped the agent will spread and increase rapidly to damaging population levels.

Competition studies between buddleia and radiata pine have shown that the buddleia leaf weevil needs to reduce both height and leaf area of buddleia in order to be considered an effective management option [3, 5]. Because buddleia can strongly compensate for defoliation [4], significant height reductions occur only after at least 30% of the foliage has been removed [5]. To the best of our knowledge, no studies have been conducted to assess the potential of using biological control agents for weed management during the crop establishment phase in plantation forestry.

Initial Releases of the Weevil

Initial releases of the weevil were made in 2006 at three radiata pine plantations located at Whakarewarewa, Kinleith and Esk forests in the North Island, New Zealand. At each site, 1000 adults

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were released at a central point and their movement has been monitored for three years along four 150-m transects, radiating outwards from the point of release. Measurements included the establishment and rates of spread of buddleia leaf weevil, as well as assessments of damage to buddleia by the weevils.

The buddleia leaf weevil established at all sites. Feeding damage to buddleia was strongly seasonal, with damage peaking each autumn, and achieving up to 95% defoliation within three years. A model of adult dispersal probability from the central release point predicted the population front was moving on average 66 m, 42 m and 27 m per annum at each of the three sites. There was an initial time lag of approximately one year between the arrival of the weevil dispersal front, and the agent causing damage of greater than 30% defoliation.

For the weevil to be used as a management tool, effective buddleia control needs to occur in the first few years after planting. Our results suggest that the buddleia leaf weevil could be used for control of buddleia during this time if integrated with a complementary weed management technique, such as spot application of FSC-certified herbicides around plantation seedlings, rather than broadcast application of herbicides. This could maximize buddleia leaf weevil establishment throughout young stands as the weevil food source is retained between the tree rows.

Figure 1. *Buddleia* defoliated by weevils, released three years previously. April 2010

Controlled Field Trial

If buddleia leaf weevil can reduce the growth rate of *buddleia* during the five years following plantation establishment, it has the potential to reduce the need for chemical control. Due to this short timeframe, two key attributes will determine the success of this weevil for buddleia biocontrol in plantation forestry:

1. rapid agent dispersal into newly planted areas, and,
2. rapid population build up to a level that reduces buddleia height growth rates.

To determine agent efficacy, buddleia seedlings were planted in an insecticide exclusion trial where the dispersal of buddleia leaf weevil and feeding damage on plants was monitored according to distance from a single source population. Buddleia leaf weevil dispersed through the seedlings at a rate of approximately 100 m per annum. There was a strong correlation between larval numbers per plant and percentage defoliation. A significant reduction ($P= 0.01$) in buddleia height by 19% in untreated compared to insecticide-treated plants was recorded at 463 days after the buddleia was planted. This suggests that the buddleia leaf weevil has the ability to suppress the growth of buddleia seedlings.

Whether this level of control will be sustained and is sufficient to reduce the competitive advantage of buddleia in commercial forests still needs to be determined. The greatest benefits of this biocontrol agent would be if buddleia leaf weevil were able to disperse rapidly into newly planted areas and reduce the height of buddleia across entire compartments within the first three years.

Ongoing Field Trials in Commercial Forests

The next stage in this programme will be to develop an integrated weed management protocol for control of buddleia in New Zealand commercial forests. To test this, several field trials were implemented in 2009 which incorporate oversowing and spot treatment with buddleia leaf weevil to determine the best alternative method to reduce buddleia competition with plantation species.

Growing Potential?

Recent findings of the buddleia leaf weevil more than 50 km from the closest release site has shown the weevil is capable of long-distance dispersal to new areas. At the Kinleith release site, damage to buddleia for three consecutive seasons has resulted in almost no re-growth of some plants in Spring 2010.

As population numbers of this agent build and the weevil becomes more widespread, we will gain a better insight into the potential of this agent to control buddleia within plantation forests. It has

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demonstrated an ability to completely defoliate buddleia (Fig. 1) and repeat this damage in following seasons. Given that repeated defoliation can reduce the growth and flowering of buddleia, the signs are promising that this agent may bring both financial and environmental benefits to the forest industry in New Zealand.

References

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