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Killing old poplar trees using chemicals

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EXECUTIVE SUMMARY

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Large or old poplar trees planted for soil conservation and now considered a safety risk can be poisoned, killed and left standing using appropriate herbicide applied to the conducting tissue in the trunk. Herbicide should be applied between spring and autumn, with best results achieved when applied in spring and summer.

Advised application is by drilling 3 cm holes angled downwards at 45° into the trunk, at 10 cm intervals around the circumference of the trunk and at a height convenient to the operator, and filling the holes with herbicide at concentrations as per the manufacturer's recommendation for trees.

Defoliation occurs within weeks, but disintegration of the woody tissues of tree is gradual.

Risks associated with disintegrating branches and trunks need to be identified and managed.

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1 INTRODUCTION

Poplars and willows were planted on farmland for reducing soil erosion and retaining valuable topsoil on slopes as early as the 1950s. Planting rates increased during the 1960s and into the 1970s, and most of the trees planted then are still alive and well, and very big.

There is much discussion about how to reduce the risk associated with the presence of large poplars and willows, and in particular, how to remove them where it is difficult to get machinery access.

Figure 1. Felled poplars will resprout and grow readily in the absence of browsing animals.

1.1 Options

- Felling with chainsaws is associated with risk where the operator is not a skilled woodsman, and the felled tree is still alive if the stump is not poisoned as well (Figure 1).
- Killing the tree by ringbarking at ground level is also feasible, has no risk from falling trees during the operation, but on a slope and even on the flat there is risk of accidents to the operator from the chainsaw or axe, and considerable work is involved
- Killing the tree using herbicide is an alternative approach requiring much less skill and accompanied with much lower personal risk.

1.1.1 Poisoning with herbicide

A trial was carried out on poplars of unknown parentage and age on hill country farms at Kawhatau near Taihape and Kiwitea near Feilding to evaluate the effectiveness of inoculation with herbicide in killing large poplars.

We treated selected mature trees (mean diameter at breast height of 70 cm–101 cm for the different treatments) with one of two commercially available herbicides, either Roundup® (glyphosate) or Escort® (metsulfuron) at two-monthly intervals starting in October, 2005 and finishing in April 2006. Holes 7 mm in diameter were drilled 30 mm into the trunk at a 45° downward slope, at regular spacing right around the tree at waist height and 2 ml of chemical was injected into each hole.

Herbicide was applied at two-monthly intervals between October 2005 and April 2006, and success in killing the trees was finally evaluated in February 2007. Both herbicides were effective in killing the large trees but interaction of timing of the treatment, concentration of the herbicide and spacing of the inoculation sites around the trunk need to be considered.

1.1.2 Treatment

- Escort was applied at three concentrations 0.5x, 1x and 2x the manufacturer's recommended application rate (10g/L, 20g/L and 40g/L) and at 10 cm hole spacing around the trunk. We also trialled Escort at 40g/L and at 20 cm spacing around the trunk, i.e. double the recommended application rate but at double the spacing, in February and April only.
- Roundup was used undiluted but the hole spacing was varied – either 20 cm, 10 cm or 5 cm apart, these rates also being 0.5x, 1x or 2x the manufacturer's recommended application rate.

1.2 Signs of effectiveness

Injected trees were assessed in mid-November 2006. At this stage untreated trees had a full canopy of leaves. A further assessment of the trees injected in April 2006 was done on 22 February 2007 since in November 2006 those trees were showing less effect of the herbicide compared with trees injected from October–February.

The response of the mature poplar trees to the herbicide treatments is summarised in Table 1. The variable for the Roundup treatment was the hole spacing, not the herbicide concentration,

so Roundup concentration was always scored as 1. In contrast, both the hole spacing (February and April treatments only) and the concentration were varied for the Escort treatments.

1.3 Symptoms and scoring

It was clear that the trees had assimilated the herbicides and that there had been conduction throughout the canopy. Treated trees lost almost all their leaves by the next treatment date (Figure 2). Where branches still retained leaves, we considered that the conducting wood to that branch was carrying less than an effective concentration to kill the tissue in that branch. Often this was a single small branch so an assessment for leaf cover of <1%, <10% and <25% is used in the table rather than total absence or presence of leaves. At the time of assessment there were other significant signs that trees were not healthy. Smaller branches had fallen off, bark was easily lifted and in some trees had almost completely fallen off. Most trees treated up to February had weeping fungal and bacterial infections close to the base of the trunk and other fungal infections. We used all these observations collectively to rate the effectiveness of each treatment from 5 (highest) to 1 (lowest) and our recommendations (Table 1) are based on the rating.

1.4 Timing

Treatment earlier in the growing season appeared to be more effective than treatment towards the end of the growing season (April), based on the emergence of leaves in the following season. Despite there being significant leaf emergence on the trees treated in April (Table 1), the leaves were sparsely distributed, had burst bud later, were smaller and showed classic signs of chlorosis (lack of green colour in the leaves) (Figure 3) and leaf browning around the edges. This suggested that water and nutrient conduction from the roots was severely disrupted. Conduction activity is mainly towards the roots in autumn so the emergence of a sparse leaf canopy in the trees treated in April may be fuelled by resources in the branches, and is considered unlikely to save the tree.

1.5 Application rate

The undiluted Roundup was effective at the 10 cm hole spacing and even at the 20 cm spacing except at the end of the growing season (April). It appeared unnecessary to reduce the spacing to less than 10 cm. The recommended rate of 20 g/L applied into holes at 10 cm spacing is sufficient to kill the tree. Doubling the hole spacing at the same concentration reduced the effectiveness of the chemical (based on leaf presence). Although in the end this may be sufficient to kill the tree, at this stage we cannot be sure. Leaves, while present, were invariably chlorotic (Figure 3).

Treatment with Escort at the recommended rate was successful in killing the tree, and reducing the spacing below 10 cm is not recommended. Doubling both concentration and spacing did not reduce effectiveness when applied in February, but the April timing showed reduced effectiveness.

Table 1. Effectiveness of herbicide application in killing poplar trees at different concentrations, hole-spacing and time of year. Blocks are shaded to visually show the more effective treatments

Chemical used	Hole spacing cm	Timing	Herbicide Concen-tration	Number of trees treated	Number of treated trees with that % leaves compared with untreated trees				Rating	Recommended as a practice
					<1%	<10%	<25%	>25%	1-5	Yes / No
Roundup®	20	Oct	1	3	2	3			3	No
	20	Dec	1	3	2	3			3	No
	20	Feb	1	3	0	2	3		2	No
	20	Apr	1	3	0	0	0	3	1	No
Roundup	10	Oct	1	3	3				5	Yes
	10	Dec	1	6	6				5	Yes
	10	Feb	1	6	5	6			4	Yes
	10	Apr	1	6	3	5	6		3	No
Roundup	5	Oct	1	3	3				5	Yes
	5	Dec	1	3	3				5	Yes
	5	Feb	1	3	3				5	Yes
	5	Apr	1	3	3				5	Yes
Escort®	10	Oct	0.5	3	2	3			3	No
	10	Dec	0.5	3	3				5	Yes
	10	Feb	0.5	3	3				5	Yes
	10	Apr	0.5	3	3				5	Yes
Escort	10	Oct	1	6	5	6			4	Yes
	10	Dec	1	6	6				5	Yes
	10	Feb	1	6	6				5	Yes
	10	Apr	1	6	6				5	Yes
Escort	10	Oct	2	3	3				5	Yes
	10	Dec	2	3	3				5	Yes
	10	Feb	2	3	3				5	Yes
	10	Apr	2	3	2	3			3	No
Escort	20	Oct	2	0	NA				x	Not tested
	20	Dec	2	0	NA				x	Not tested
	20	Feb	2	3	3				5	Yes
	20	Apr	2	3	2	3			3	No

Figure 2. Poplar poisoned in February (L) has <1% leaf in the following December compared with a poplar poisoned in April (R, 10–25% leaf), and an untreated poplar (background tree in both pictures).

1.6 Effect of poisoning on adjacent trees

During this experiment trees adjacent to the poisoned trees were inspected for any evidence of poisoning. There was no damage observed at Kawhatau. However at Kiwitea two trees 8 m and 16 m away from a tree treated in April with twice the recommended dose of glyphosate had a leaf canopy estimated at <25% of a healthy canopy, the closest tree being the more seriously affected. A third tree adjacent to a tree poisoned with a normal dose of glyphosate showed a reduced canopy also, though less severe (Figure 4 R). These trees are likely to have roots grafted onto roots of the treated tree, a phenomenon frequently reported for closely related poplars growing in close proximity. Other people have reported adjacent trees being killed during a poisoning treatment so proceed cautiously and experiment where it is important that adjacent trees are not damaged.

Figure 3. Live leaves on trees treated with herbicide show yellowing from chlorosis compared with normal leaves.

Figure 4.Trees dead from poisoning (L). Where two trees are close together (R) root grafts may translocate herbicide from a treated tree to an untreated tree and possibly kill it too.

2 RECOMMENDATION

The rating in Table 1 from 5 (most effective) to 1 (least effective) is based on the % of leaf present on the treated trees. Trees with <1% leaf are effectively dead so if all trees in the treatment did not fall into this category, the treatment rating was reduced. The recommendation is based on the rating score, but readers should avoid poisoning late in the growing season. Where only single branches on a tree retain a high % of leaf, there has been no conduction of herbicide into that branch, probably because the application did not coincide with conduction into the branch. It is likely that the root feeding that branch has also not been poisoned. Innoculate the trunk directly below where the healthy branch leads off the trunk with a dose of herbicide.

2.1 What is happening underground?

Trees at Kiwitea were revisited 11 to 17 months after poisoning and excavations were done to investigate root presence in treated and untreated trees. Roots were collected from random 15 cm x 15 cm x 15 cm plots at 3 m from the trunk for trees poisoned in December, allocated to diameter classes and separated into live and dead root (except for roots < 2 mm diameter) (N = 40) .

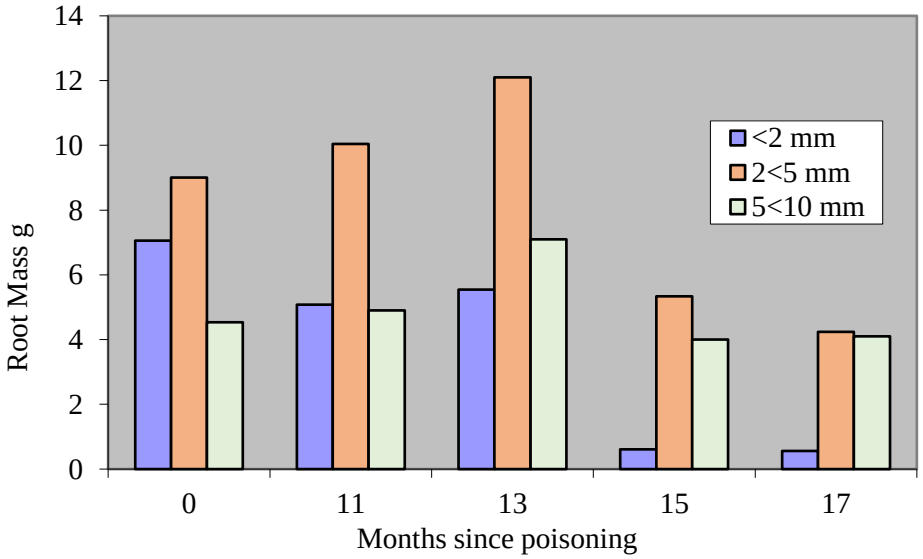

Figure 5. Presence of roots up to 10 cm diameter in the months following poisoning of the trees (N=40)

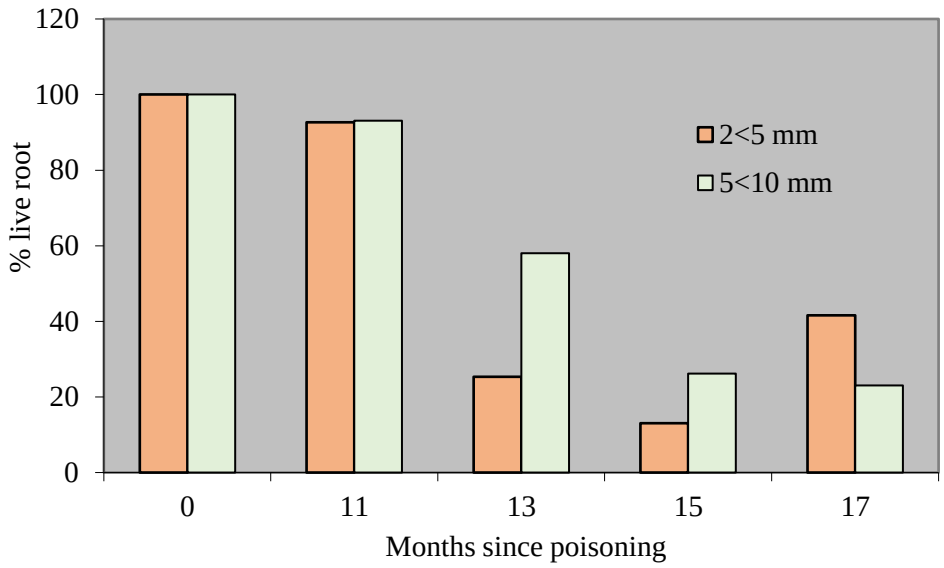

Figure 6. Decline in live root mass for roots with diameters 2<5 mm (and 5<10 mm) following poisoning of the tree (N=40).

Compared with roots of untreated trees (0 months) there was a decline in the amount of root mass in the smaller root diameter classes (<2 mm, 2<5 mm) (Figure 5). This root mass comprises both live and dead roots. Thin dead roots are decomposed much quicker than thicker dead roots, particularly those < 2 mm diameter. Roots < 2 mm in diameter represent over 90% of all root length in poplars so the capacity of killed trees to bind soil is reduced considerably. The % of live roots in the diameter class 2-5mm decreased from 0 to 17 months but the decline is more gradual than for the fine roots (Figure 6). For example, while there was still a lot of root 2-5 mm diameter present in the samples the amount of this root still live decreased notably with time (Figures 5, 6).

2.2 After death, what then?

Decay and tissue breakdown happens quickly for the smaller roots, twigs and leaves, and slowly for the large roots and branches. The trees will continue to stand for several years, but progressively lose roots and branches of increasing dimensions (Figure 8).

2.3 Long-term hazards

Branches can fall unpredictably and pose some risk to stock and farm staff. There have not been any reported farm deaths or injury from falling branches or trunks of poisoned trees in New Zealand, though there are cases of live trees falling unpredictably in both rural and urban settings, including at an early childhood centre in Auckland in 2017. Branch or trunk fall is more likely in windy conditions, but should be considered a potential risk at all times and stock, vehicle or pedestrian traffic minimised under poisoned trees.

Figure 7. With inadequate treatment (L) foliage remains on the tree six months after application of herbicide, whereas with adequate treatment no leaves are present and light to pasture has increased dramatically.

Figure 8. Poplars poisoned 10 years previously showing the gradual disintegration and woody debris around the tree.

3 CONCLUSION

Both glyphosate (as Roundup) and metsulfuron (as Escort) are effective in killing large poplar trees when applied by injection into drilled holes at the recommended dosage and a hole spacing of 10 cm.

Injection should be done between October and February when the trees are actively growing. The treatments showed reduced effectiveness when applied in April.

The easiest approach to poisoning big trees is to use a 12-volt cordless drill with a 7 mm bit, connected to a small auxiliary battery. Drill into the tree 30 mm angling the drill hole downwards at 45° with one hand. Then inject 2 ml of the recommended dilution into the drill hole using an old vaccinating gun or drench dispenser connected to a supply bottle.

A tree with a circumference of 3 m will require 30 drill holes and 60 ml of chemical so an auxiliary battery and a litre of chemical in the supply bottle should be sufficient to poison 15 or so trees at a time.

Trees where the initial poisoning was insufficient (Figure 7) should be re-treated with application targeting parts of the tree that are still living.

4 ACKNOWLEDGEMENTS

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