

OPTIMUM RATES OF OXYFLUORFEN FOR DIFFERENT POPLAR AND WILLOW CLONES

A.N. GILCHRIST

Plant Physiology Division, DSIR, Private Bag, Palmerston North

In an unpublished trial conducted at Aokautere in 1984/85 height growth of two poplars and two willows was better when oxyfluorfen was used for weed control than with any other of eight herbicides. Overall, oxyfluorfen at 1.44 kg/ha was the only treatment that was not significantly poorer than cultivation. Although there was a very highly significant species x treatment interaction, in no species did either rate (the other was 0.72 kg/ha) result in significantly lower height than with cultivation. Oxyfluorfen was as useful as diuron or simazine for weed control in poplars and willows and, moreover, had some knockdown properties.

A trial to determine response curves and optimum rates of oxyfluorfen was therefore laid down, similar to those conducted to determine response curves and optimum rates of diuron (Gilchrist 1986) and simazine (Gilchrist 1988).

Cuttings 25 cm long of a hybrid black poplar (*P. deltoides* x *nigra* 'Veronese'), two black x balsam poplars (*P. deltoides* x *maximowiczii* 'Eridano' and *P. deltoides* x *yunnanensis* 'Kawa'), a Matsudana hybrid tree willow (*Salix matusdana* x *alba* 'Aokautere' or 'NZ 1002') and purple osier (*S. purpurea* 'Irette') were planted in cultivated Manawatu fine sandy loam at Aokautere on 25 September 1986, 40 cm apart in rows 1 m apart. There were two adjacent rows of each clone in each replicate with a single guard row of one clone randomly allocated to positions in each of four blocks with a single guard row of one clone randomly selected for each side of each block.

On 15 October 1986 oxyfluorfen treatments were applied in 2.8 m wide strips across the rows using an "Algen" precision sprayer. This gave a split block design with plots containing an average of 14 cuttings (two rows of seven) of which 10 were to be measured. The treatments included 0, 0.36, 0.72, and 1.08 kg/ha. Owing to a miscalibration 1.92 kg/ha was applied to three replicates of an intended 1.44 kg/ha treatment, and a separate 1.44 kg/ha mixture applied to the fourth replicate.

Weed control and damage were assessed by eye 6 weeks later. In February 1987 the tree species were pruned to a single leader. At the end of the growing season, in late May, height of all clones, diameter at breast height or half height (d.b.h.h., i.e. diameter at 1.4 m for trees 2.7 m or more tall, diameter at half height for those 2.6 m or less) of tree species, and number of stems 1.35 m or longer for purple osier, were measured or counted.

All rates of oxyfluorfen gave very good to excellent weed control. A wide range of weeds were present where the treatment was zero. By the end of the season the dominant species on all treatments was Canadian fleabane (*Conyza bilbaoana*).

Oxyfluorfen caused slight injury to all clones, with 'Kawa' poplar damaged slightly more than the others. There was no more damage at 0.72 kg/ha than at 0.36 kg/ha, but damage increased slightly at higher rates. In November the sprayed plants were smaller than the unsprayed, but by January this had reversed and the unsprayed plants' foliage was much lighter in colour than that of the sprayed plants, indicating an induced nutrient deficiency from weed competition.

Survival by the end of the season was good in all clones except 'Eridano' poplar. The poor survival here, 48%, was unrelated to treatment. One plot of 1.08 kg/ha had such poor survival of 'Eridano', 20%, and the height and diameter of the survivors were so low compared with the three other replicates that the data from it were replaced by values fitted by the method of least squares. A neighbouring plot of 'Kawa', with uncharacteristically low measurements had its data replaced by the same method. Indices of volume were calculated by squaring the d.b.h.h. and multiplying by height.

Proc. 42nd N.Z. Weed and Pest Control Conf.

TABLE 1: Mean volume growth of poplars and Matsudana hybrid tree willow, and mean tallest stem height per plant and number of well-grown osier stems, with increasing rates of oxyfluorfen.

Rate of application (kg ai/ha)	'Eridano' hybrid poplar	'Kawa' hybrid poplar	'Veronese' hybrid poplar	'Aokautere' Matsudana hybrid willow	'Irette' purple osier		No. (n) of plots
	(cm ³)	(cm ³)	(cm ³)	(cm ³)	(m)	(no)	
0	19	105	61	30	1.19	0.40	4
0.36	97	319	430	116	1.75	2.10	4
0.72	128	327	457	107	1.89	2.18	4
1.08	131	504	468	125	1.98	2.10	4
1.44	56	588	418	98	1.91	2.30	1
1.92	187	406	430	130	1.85	2.70	3
SEM (trial)*	37	37	37	37	0.10	0.19	
SEM (clone)*	33	33	31	10	0.07	0.19	

* Where n = 4. These are standard errors pooled for the trial and for the clone respectively. Where n < 4, i.e. for 1.44 and 1.92 kg/ha and also for the 1.08 kg/ha treatment in 'Eridano' and 'Kawa', the SEMs are somewhat larger.

These are shown in Table 1, along with mean height of purple osier plants and the number of stems at least 1.35 m long.

There were significant clone x rate interactions for height, d.b.h.h., and volume index. Thus, although the main effect of oxyfluorfen was a large increase in growth with 0.36 kg/ha compared to untreated and lesser increases at higher rates, the behaviour of individual clones was significantly different from each other and warranted separate examination. Regressions of the different growth measurements against herbicide rate were significant in all cases. From these, response curves were obtained which initially were used to predict the missing 1.44 kg/ha values. In most cases, however, better fit was obtained using the single 1.44 kg/ha volume measured. These better fitting response curves were used to predict optimum rates of oxyfluorfen for the different clones.

Biologically sensible quadratic curves were obtained for all measures of all clones. For most, however, there were significant deviations from quadratic which were accounted for by cubic models. Those for which the deviation from quadratic was not significant, 'Kawa' (all measures), 'Aokautere' diameter, and 'Irette' height, predicted maximum responses from 1.25 to 1.6 kg/ha. Peaks in the cubic curves occurred at rates ranging from 0.69 to 0.97 kg/ha.

The peaks at lower rates shown by cubic curves mean that more economical recommendations can be made than those predicted by the quadratic curves. Even with 'Irette' the maximum observed height was at a lower rate (1.08 kg/ha) than the predicted optimum and with 'Kawa' the observed 1.44 kg volume index from a single, generally high yielding, replicate is 100 cm³ more than the predicted value and probably would have been lower in the other three blocks if they had contained this treatment. The observed growth at 0.36 kg/ha of all clones was greater than that at the zero control by a margin considerably more than the response to rates higher than 0.36 kg/ha. Thus, in general, 0.36 kg/ha gives growth responses which are not greatly extended by higher rates.

The tolerance of 'Kawa' to higher rates tends to make it an exception to this generalisation. Akinyemiju and Dickmann (1982) found that intersectional crosses between Tachamahaca (balsam poplar) and Aigeiros (black poplar) species were relatively intolerant of simazine and diuron compared with pure Aigeiros clones. It appears that we may have in oxyfluorfen a herbicide of which these intersectional crosses such as 'Kawa' and Eridano' are relatively tolerant. More clones would need to be tested (Akinyemiju and Dickmann tested seven Tacamahaca x Aigeiros clones) to verify this.

ACKNOWLEDGEMENTS

Nursery staff at the Soil Conservation Centre, Aokautere, under the supervision of Mr P. Yalden, planted the trial. Mr R.H. Fletcher, Applied Mathematics Division, checked the statistical calculations.

REFERENCES

- Akinyemiju, O.A. and Dickmann, D.I., 1982. Variation among 21 *Populus* clones in tolerance to simazine and diuron. *Can. J. For. Res.* 12: 708-712.
- Gilchrist, A.N., 1986. Rates of diuron for weed control in poplar and willow beds. *Proc. 39th N.Z. Weed and Pest Control Conf.*: 99-101.
- Gilchrist, A.N., 1988. Simazine rates and mixtures for poplar and willow cuttings. *Proc. 41st N.Z. Weed and Pest Control Conf.*: 164-168.