LONG TERM USE OF RESIDUAL HERBICIDES FOR CONTROLLING WEEDS IN BLUEBERRIES ON PEAT

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SUMMARY

Two long term trials involving six successive annual applications of various soil acting herbicides demonstrated the safety of using hexazinone at 2 kg ai/ha, terbacil at 4.5 kg ai/ha and dichlobenil at 10 kg ai/ha on mature blueberries (*Vaccinium corymbosum*) grown on peat. However at rates of 4 and 8 kg ai/ha hexazinone accumulated to toxic levels after three and two applications respectively and at the higher rate reduced berry yields after three applications. Hexazinone and terbacil controlled weeds more effectively than dichlobenil.

INTRODUCTION

Blueberries are grown in various parts of New Zealand on a wide range of soils and under a variety of climatic and soil conditions. A large proportion of these plantings have been on the peat soils of the Waikato. Because of weed control problems experienced on many sites research was initiated by the Ruakura Soil and Plant Research Station in 1975 to overcome this problem (Staniland *et al* 1978).

In 1978 work began on the use of the new herbicide hexazinone in mature bushes with the objective of achieving adequate weed control with an annual application. Results showed that hexazinone controlled a wide range of vegetation including annual and perennial grasses and broadleaf weeds. It also showed a long period of activity and was well tolerated by the blueberries (James 1980).

However, little was known about the behaviour of soil-residual herbicides in peat soils and particularly the residual activity of hexazinone from successive applications. Two trials were conducted, each of 6 years duration, to determine the long-term effects of annual applications of hexazinone and other soil-acting herbicides on the crop.

MATERIALS AND METHODS

Two trials were conducted simultaneously on Rukuhia peat (53% organic matter) from 1979 to 1985. Trial 1 compared repeated annual applications of hexazinone (Velpar-L), terbacil (Sinbar) and dichlobenil (Casoron 7.5G) with untreated control (Table 1) while Trial 2 compared only various rates of hexazinone.

TABLE 1: Blueberry production from 1979-80 to 1984-85 for Trial 1.

Treatment	Rate (kg ai/ha)	Berry production (kg/plot)					
		1979-80	1980-81	1981-82	1982-83	1983-84	1984-85
untreated	—	1.9	1.5	4.1	8.1	2.3	14.0
hexazinone	2.0	1.6	1.8	4.0	12.7	5.0	16.4
hexazinone	4.0	2.3	0.9	1.8	5.5	2.6	12.0
hexazinone	8.0	2.5	0.5	0.7	3.1	1.4	4.4
terbacil	4.5	2.4	2.1	5.7	11.6	3.6	13.2
dichlobenil	10.0	2.3	3.3	4.3	9.2	4.1	16.2
CV%		36.3	77.6	56.7	44.0	44.2	28.6
SED		0.5	1.0	1.4	2.6	1.0	2.6

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Trials were of a randomised block design of four replications with three blueberry bushes in each plot. The herbicides were applied with a precision sprayer applying 370 litres/ha at 200 kPa except for dichlobenil which was applied with a hand-held granule applicator. The treatments were banded at a width of 0.75 m on either side of the row and applied in September each year.

Data recorded were berry yields, visual assessments of weed control and weed dry matter. Berry yields were determined by harvesting the berries as they matured from December through to February and recording the total production. Weed control assessments were made at the end of harvest, and/or immediately before the next application of herbicide to determine the persistence of the treatment. Weed dry matter determinations were made by harvesting and drying 0.1 m^2 samples of weeds to corroborate the visual assessments.

RESULTS

Blueberry production and crop damage

Both trials produced similar results therefore only the data from Trial 1 are presented (Table 1). In the first year (1979-80) there were no differences in berry production between any of the treatments. The yield in the second year was more variable and although differences between the highest and lowest producing treatments were significant, no treatments were significantly different from untreated control. However, for the third and subsequent years the yield from plots treated with hexazinone at 8 kg ai/ha was significantly less than all other chemical treatments except hexazinone at 4 kg ai/ha. Hexazinone at 8 kg ai/ha was not always significantly different from control but this was due to the variability, from year to year, of production from the untreated plots.

As well as reducing yield the high rate of hexazinone also caused visible damage to the bushes. These symptoms first appeared after the 1980 application with typical necrosis affecting the older leaves of 50% of the treated bushes. After the 1981 application all bushes were affected with half showing severe (>50%) leaf drop. The level of damage in subsequent years was similar although two bushes out of the 24 treated died as a result of the damage.

In the third (1981-82) and subsequent years hexazinone at 4 kg ai/ha also caused low levels (<5%) of leaf necrosis in 50% of the treated bushes.

No other chemical treatment resulted in visible damage to the bushes.

TABLE 2: Weed control scores for 1979-80 to 1984-85 for Trial 1.

Treatment	Rate (kg ai/ha)	Weed control score*					
		7.2.80	10.2.81	26.2.82	21.9.83	23.8.84	2.5.85
untreated	—	0	1.5	1.0	0.8	0.5	0.3
hexazinone	2.0	7.0	7.3	8.8	7.0	6.8	7.8
hexazinone	4.0	8.5	10	10	9.0	8.3	9.0
hexazinone	8.0	9.5	10	10	9.8	8.8	9.3
terbacil	4.5	5.0	6.0	9.0	7.8	7.5	8.8
dichlobenil	10.0	7.0	6.5	6.8	4.8	3.3	5.5

* 0-10 scale, 10 = total weed control, treatments applied in September each year.

Weed control

During the period that these trials were conducted hexazinone consistently gave excellent weed control at all rates tested (Table 2). For the last 3 years of the trials the two high rates of hexazinone resulted in weed control all year round from the one application. Some weeds appeared in the second half of the year in the plots treated with the low rate of hexazinone.

Repeated use of terbacil resulted in better weed control every year for the first 3 years. After this a steady state was attained with a similar level of control each

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subsequent year. This was similar to the level of control given by 2 kg ai/ha of hexazinone.

Weed control achieved with dichlobenil was mediocre throughout the trial.

DISCUSSION

These results show that repeated use of hexazinone at the higher rates caused damage to the blueberry bushes and also reduced berry yields. In the high organic matter environs of peat, higher rates of herbicides were needed compared to mineral soils to obtain similar levels of weed control (Rahman *et al* 1975; Rahman *et al* 1982). However it appears that these higher rates also had longer persistence and in the case of hexazinone over a number of years, led to accumulation to toxic levels (Table 2). The time taken for this accumulation was dependent on the rate used. At 8 kg ai/ha hexazinone caused damage to bushes after two successive annual applications and reduced yields after three applications. At 4 kg ai/ha hexazinone caused damage after three applications but showed no significant effect on production after six applications. At 2 kg ai/ha hexazinone showed no signs of toxicity to the blueberries over 6 years of use.

A good indicator of accumulation of any herbicide from year to year is the length of effective weed control obtained. If no weeds, or only a few grow between applications then the probability that the chemical is accumulating is high. This phenomenon was observed when hexazinone was used repeatedly at 4 and 8 kg ai/ha.

Although successive applications of terbacil resulted in better and longer weed control each year, they never reached the point of controlling weeds for the whole year. The improved weed control could have been caused by a lowering of weed pressure from the seed source and perennial weeds rather than accumulation of the herbicide (Table 2). Dichlobenil gave only short term weed control and performed consistently over the period of the trial. Its efficacy did not improve during the 6 years of application and is probably due to the fact that it has much shorter residual activity than hexazinone or terbacil.

These trials demonstrated several herbicides which can be used in blueberries on peat with complete safety year after year. However high rates of chemicals can lead to accumulation to toxic levels with repeated use. A sure indication of this is when a single application of herbicide completely controls the weeds for the whole year. If this occurs then the application rate of the herbicide should be reduced or the area completely spelled from the use of residual herbicides, using only non-residual or mechanical methods of weed control for one or two seasons.

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