MULCHES FOR WEED CONTROL IN ASPARAGUS AND KIWIFRUIT

A. INGLE and W.T. BUSSELL

*Horticultural Research Centre
MAFTech, Levin*

SUMMARY

Sawdust, straw and bark mulches of about 5 cm depth gave better weed control than a residual simazine (1 kg/ha) treatment in asparagus (*Asparagus officinalis*) or a contact glyphosate treatment in kiwifruit (*Actinidia deliciosa*). Applying herbicides or placing newspaper underneath the mulches did not significantly improve weed control. Thinner mulch layers gave poorer weed control. The mulches had a useful thermal insulating effect but usually reduced worm populations. Bark gave the highest yields but tended to reduce soil nitrogen levels. Straw had to be renewed every 12 months and sawdust and bark every 24 months to maintain good weed control.

INTRODUCTION

Mulching the soil has long been known as a method of reducing weed growth. As a means of minimising the need for herbicides, mulches may well assume greater importance in future horticultural production, especially in organic cropping.

To find a place in a weed control programme, mulch materials must be cost effective. In conventional cropping this means that their overall cost of application and effectiveness must be comparable to that of current herbicide practice. In organic crops, which might command premium market prices, a higher relative cost of weed control may have to be accommodated.

Commercially available mulching materials range from sawdust and bark from the timber industry to various types of plastic sheets. Depending on local availability, chopped cereal straw or even shelter belt trimmings may be utilised economically. Various mulching materials have been tested at Levin Horticultural Research Centre for their ability to maintain long term weed control and their effect on the underlying soil. A preliminary trial was carried out in the absence of a crop. The most promising treatments were then tested in asparagus and kiwifruit crops as described in this paper.

MATERIAL AND METHODS

The three trials were conducted on Levin silt loam soil. In the preliminary trial, conducted between November 1980 and May 1981, the mulch treatments were applied to bare soil plots 1m × 1m in area. There were three replicates in a randomised block design.

Different depths of straw, sawdust and bark; the use of black polythene; and the effect of simazine (Gesatop) or newspaper underneath a mulch were examined. Details of the treatments are given in Table 1. Weed seedling populations were recorded three times during the course of the trial — 1, 3 and 6 months after the mulches were applied. All weeds were removed, using paraquat-diquat and hand weeding with minimum disturbance, after each recording. In May 1981 soil temperatures at 2 cm below the soil surface were monitored hourly for 1 week, soil nutrient levels were determined, and worm populations were recorded by removing the mulches and applying three drenches of dilute formaldehyde to the soil to bring the worms to the surface.

In the asparagus trial, mulch treatments (Table 2) were applied to bare ground in late September 1981 in a crop of Mary Washington 500W (MW500W) asparagus planted 12 months before. Each plot was 6m × 1.5m and there were four replicates in a randomised block design. Mulches were renewed as required. Weed seedling

Proc. 41st N.Z. Weed and Pest Control Conf.

populations were recorded six times during the course of the trial — 1, 5, 8, 21, 26 and 32 months after mulch treatments were first applied. All weeds were removed after each recording. Spot treatments, using a range of herbicides, were applied as required to perennial weeds. Wheat seedlings on the straw mulch plots were removed by a non-residual selective herbicide in spring 1981, 1982 and 1983. Soil nutrient levels were determined by taking five cores per plot at 0-5 cm depth in late autumn 1982 and 1983. Yields were recorded in spring 1982 and 1983. The trial was terminated in late May 1984.

For the kiwifruit trial, mulch treatments (Table 3) were first applied in April 1986, 3 months after the crop was planted. Each plot was 5m × 7.5m and contained three plants 2.5m apart. There were four replicates in a randomised block design. Mulches were renewed as required. Percentage ground cover by weeds was recorded 6, 12, 18, 21 and 23 months after mulch treatments were first applied. All weeds were removed, using glyphosate, after each recording. Soil nutrients were analysed from nine cores per plot at 0-15 cm depth in November 1986 and July 1987. Fruit was harvested in early May 1988.

RESULTS AND DISCUSSION

Weed Control

Comparisons of weed seedling populations in the preliminary trial (Table 1) showed that overall weed control in many mulch treatments was at least as good as simazine at 1 kg/ha. Complete weed control for the duration of the trial was obtained only with black polythene. The main mulch materials used (sawdust, straw, bark) gave the best weed control at their greatest depth. Newspaper and simazine beneath sawdust or bark did not significantly improve weed control. In the straw mulch treatments a flush of cereal seedlings (excluded from weed counts) produced soon after application was killed quickly with a specific herbicide. Otherwise very good weed control was obtained. There was some indication that the degree of control of individual annual weed species varied under the main mulches used. For example, control of shepherd's purse (*Capsella bursa-pastoris*) and willow weed (*Polygonum persicaria*) was excellent while control of black nightshade (*Solanum nigrum*) and wild portulaca (*Portulaca oleracea*) was only moderate under each of the mulches.

Good weed control was obtained with sawdust, straw and bark mulches in both the asparagus and the kiwifruit trials (Tables 2, 3 respectively). In the asparagus trial, control by the mulches was better than by simazine at 1 kg/ha. The straw mulches in these trials had to be renewed every 12 months and the sawdust and bark mulches every 24 months to ensure continued good weed control. Newspaper or simazine under sawdust in the asparagus trial did not significantly improve weed control.

Soil Factors

Soil temperature recordings from the preliminary trial suggested that both bark and straw have a useful insulating effect. Mean temperatures were about 1.5 °C higher than under black polythene or in bare soil.

Worm counts made in the preliminary trial (Table 1) indicated that black polythene, and the deeper layers of sawdust and bark, all reduced worm populations compared with bare ground. The soil beneath straw mulch, on the other hand, had a relatively high worm count. The worm population in undisturbed pasture around the trial area was about five times higher than that recorded in bare ground plots.

The soil test levels of phosphorus and potassium under sawdust, straw and bark mulches and black polythene were similar to those in bare ground in all trials (Tables 1, 2, 3). Total nitrogen levels were lower under bark mulches in two out of three experiments, while levels under sawdust and straw were more variable. In the preliminary trial, a high nitrogen level was recorded under the black polythene mulch, probably because of protection from leaching.

Yield

Total yields of asparagus in all mulch treatments were not significantly different from the bare ground treatment in both harvest years (Table 4). The bark mulch produced the highest yield in both years and straw tended to depress yield. Total yields of kiwifruit from each treatment were not significantly different (Table 4) but the bark mulch treatment had the highest yield.

TABLE 1: Preliminary trial: Effect of mulching treatments on mean weed density from three recordings (% of bare ground); worm population (no/m²); and soil test levels (ppm)

Treatment	Depth (cm)	Material under	Weed density %	Worm popn. No/m ²	Soil test N	test P	levels K
Sawdust	2	-	20	-	-	-	-
Sawdust	4	-	11	27	-	-	-
Sawdust	6	-	3	16	30	52	200
Sawdust	4	NP ^a	6	41	-	-	-
Sawdust	4	SZ	5	-	-	-	-
Bark	2	-	28	-	-	-	-
Bark	4	-	11	15	-	-	-
Bark	6	-	3	7	13	54	250
Bark	4	NP	1	8	-	-	-
Bark	4	SZ	3	-	-	-	-
Straw	2	-	36	-	-	-	-
Straw	4	-	13	52	-	-	-
Straw	6	-	3	68	22	56	275
Black Polythene	-	-	0	11	165	48	250
SZ ^a	-	-	65	37	-	-	-
Bare Ground	-	-	100 ^b	37	23	51	225
LSD 5%			13	28	-	-	-
cv%			40.2	57.3	-	-	-

^a NP = one layer of newspaper

SZ = 1 kg ai/ha of simazine

^b Mean weed density of bare ground treatment was 104 weeds/m².

TABLE 2: Asparagus trial: Effect of mulching treatments on mean weed density from six recordings (% of bare ground) and mean soil test levels (ppm).

Treatment	Depth (cm)	Material under	Weed density %	Soil test N	levels P	K
Sawdust	5	-	49	2.7	30	250
Bark	5	-	48	2.1	31	250
Straw	5	-	25	4.9	28	350
Sawdust	2.5	SZ ^a	43	-	-	-
Sawdust	2.5	NP	26	-	-	-
Bare Ground	-	-	100 ^b	4.7	31	350
LSD 5%			24	2.1	7	59
cv%			33.0	44.4	11.9	11.9

^a NP = one layer of newspaper

SZ = 1 kg ai/ha of simazine

^b Mean weed density of bare ground was 225 weeds/m².

TABLE 3: Kiwifruit trial: Effect of mulching treatments on mean weed cover from five recordings (% of bare ground) and mean soil test levels (ppm).

Treatment	Depth (cm)	Weed cover %	Soil test levels		
			N	P	K
Sawdust	5	35	23	52	400
Bark	5	19	24	52	425
Straw	5	61	31	58	500
Bare Ground	-	100 ^a	27	55	400
LSD 5%		23	9	12	64
cv%		24.5	20.5	14.0	12.0

^a Mean percentage ground cover by weeds was 38%.

TABLE 4: Total yields of asparagus (t/ha) in 1982 and 1983 seasons and of kiwifruit (kg/plant) in 1988 season.

Mulch*	Asparagus		Kiwifruit 1988
	1982	1983	
Bark	2.70	3.46	4.3
Sawdust	2.07	2.19	2.5
Straw	1.62	1.93	1.6
Sawdust/SZ	2.42	2.67	-
Sawdust/NP	2.64	2.84	-
Bare Ground	2.06	2.37	1.7
LSD 5%	0.69	1.09	2.7
cv%	20.3	28.8	67.0

* for details see Tables 2, 3.

ACKNOWLEDGEMENTS

We gratefully acknowledge Mr T.I. Cox for designing and initiating the trials, Robyn Kerr for technical and supervision assistance, and the NZ Kiwifruit Authority for partial funding of the kiwifruit trial.