CEREAL COVER CROPS FOR VEGETABLE PRODUCTION IN TASMANIA

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Summary. Cereal cover crops, rye and barley were compared to a no-mulch treatment in onions, broccoli and sweet corn. Rye cover crops achieved a 75% reduction in weed biomass 50 days after sowing. In broccoli, an early rye cover crop maintained low weed biomass through the life of the crop (130 days) with only a slight reduction in yield. Both onions and sweet corn plant establishment was affect by the cover crops primarily due to sowing difficulties.

INTRODUCTION

Weed control is a major component in vegetable production, with cultivation and the use of herbicides as the main control methods employed. Any reduction in either of these control methods will be economically beneficial and in the case of cultivation better for the soil structure. The use of cover crops can reduce both the use of cultivation and herbicides by decreasing weed populations through chemical and physical suppression by the mulch (4, 6). Residues of cereal rye, *Secale cereale*, have been shown to provide up to 100% weed control (1, 2, 4, 5, 6, 7) with no reduction in crop yield.

METHODS

A series of experiments was established to evaluate cereal rye and barley, *Hordeum vulgare*, as dead mulches in providing weed control in onions, broccoli and sweet corn. The cover crops were sown on 8 September 1992, with barley cv. Franklin sown at 80 kg/ha and cereal rye sown at 160 kg/ha. No fertiliser was added at sowing.

A split plot design with four replications was used in all the experiments, with the main plots being the type of cover crop (no-mulch, barley or rye) and the sub plot consisting of the mulch management. The sub plots (3.2x6 m) consisted of (a) mulch killed at planting (early), (b) mulch killed 1-2 weeks after planting or sowing (mid) and (c) mulch killed off 3-5 weeks after planting or sowing (late). The no-mulch plots received the same herbicides that were used to kill the barley and rye.

Onions cv. Cream Gold were sown at 120 seeds/m^2 with 500 kg/ha 14:16:11 fertiliser on 12 October 1992. The early mulch treatments were sprayed off using 0.54 g a.i./ha glyphosate in 250L/ha water volume on 24 October 1992. Middle and late cover crops were killed off using 0.424 kg a.i./ha fluazifop (butyl ester) in 250 L/ha water volume on 13 November 1992 and 28 November 1992 respectively. The onion part of the experiments was terminated on 15 December 1992.

Broccoli cv. Greenbelt was planted on 16 November 1992 at 3.75 plants/m^2 with fertiliser 13:14:13 pre drilled at 500 kg/ha. Early cover crop treatment was killed off on 14 November 1992 with 0.72 kg/ha glyphosate. On 28 November 1992, 0.424 kg/ha fluazifop was applied to the middle cover crop treatments. The late treatments had 0.12 kg/L glyphosate applied through a wiper on 2 December 1992. All no-mulch plots had glyphosate at 0.12 g/L applied through a hand held wiper. Broccoli was harvested between 11 and 18 January recording head weights and assessing marketability.

Sweet corn cv. Sno Sweet was sown on 14 November 1992 at 8 seeds/m^2 with fertiliser 14:15:13 at 500 kg/ha. Early and late cover crops were killed off with 0.72 kg/ha glyphosate on 14 November 1992, or by wiper using 0.12 kg/L glyphosate on 2 December 1992 respectively. There was no middle cover crop treatment for sweet corn. The late barley cover crop treatments and no cover crop treatments had 1.5 kg a.i./ha MCPA (dimethyl amine salt) and 10 g a.i./ha dicamba applied interrow on 22 December 1992. The sweet corn was harvested between 24 March 1993 and 29 March 1993 with individual cob weight and marketability being recorded.

Plant establishment counts were conducted on 15 December 1992 for onions and 11 January for the broccoli and sweet corn. Both weed dry matter and cover crop dry matter was assessed through the trial on 27 October 1993, 12 February 1993, 12 March 1993 and 30 March 1993.

RESULTS AND DISCUSSION

Plant establishment in onions and sweet corn was significantly (P=0.01) affected by the different levels of mulch. In onions, only the no-mulch plots and the early barley treatments gave commercially acceptable plant stands (Table 1). All late treatments and rye treatments, significantly (P=0.01) reduced corn plant numbers. This was due to machinery planting problems rather than the direct effect of the mulch on corn germination. The effects of low plant establishment numbers in the onions and the sweet corn was reflected throughout the trial and was the primary influence on yield in sweet corn. Neither onion or sweet corn yield data is presented. There were no significant differences in plant establishment levels in the broccoli.

Table 1. Crop establishment numbers per m^2 of onions, broccoli and sweet corn under different mulch regimes

	Onions			Broccoli			Sweet corn	
	Early	Mid	Late	Early	Mid	Late	Early	Late
No-mulch	50.5	44.3	51.5	2.53	1.23	1.81	7.98	4.52
Barley	40.3	22.0	20.0	1.98	1.77	1.81	7.83	1.36
Rye	29.5	18.8	11.3	2.09	1.63	1.60	4.07	0.71
l.s.d. (P=0.01)	13.5			n.s.			3.19	

Broccoli yield was significantly (P=0.01) greater in all early treatments than any mid or late treatments (Fig. 1). Though the yield in the early rye plot was significantly (P=0.01) lower than the early no-mulch treatment, no herbicides were used in the rye plots. The no-mulch treatments had a post-emergent herbicide application. A better result may be achieved with broccoli by having the rye mulch killed prior to planting as in soybeans, rye mulch killed off two weeks prior to sowing, gave better yields than rye killed off at sowing (4). This could also apply for sweet corn and onions, as long as sowing difficulties can be overcome.

Fifty days after the sowing of the mulches, the barley and rye plots had significantly reduced dry weight of all species present (Fig. 2). Total dry weight was significantly reduced by 75% (P=0.01) in the rye mulch. However there was no difference between mulches in plant numbers (Fig. 2). The main species present, in order of importance were wireweed, *Polygonum* *aviculare*, field bindweed, *Convolvulus arvensis*, spurry, *Spergula arvensis*, speedwell, *Veronica hederifolia*, and chickweed, *Stellaria media*. Barnes and Putman (1) also achieved a reduction of this magnitude with a rye mulch without reducing weed germination. Others (5) found that a rye mulch gave biomass reductions in both broadleaves and grasses, where forage oats only gave a reduction in broadleaf weeds biomass. As broadleaves were the only weeds present in magnitude in this experiment, the relative effectiveness of rye and barley on grass weed biomass production can not be made.

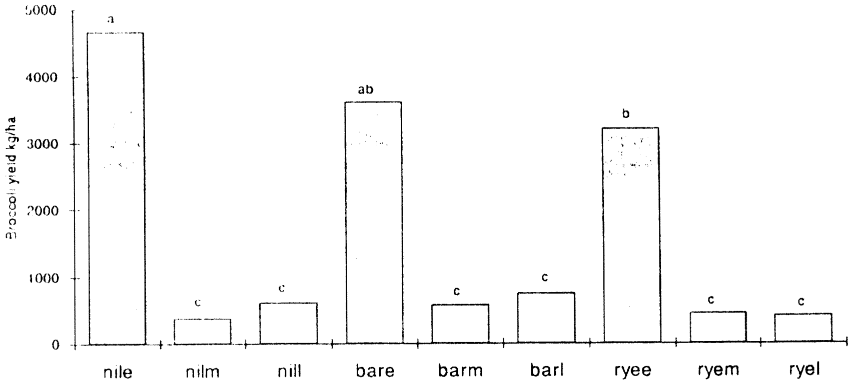

Figure 1. Yield of broccoli under different mulch regimes (nile = no-mulch early, nilm = no-mulch. mid, nill = no-mulch late, bare = barley early, barm = barley mid, barl = barley late, ryee = rye early, ryem = rye mid and ryel = rye late). Means followed by the same letter are not significant at the P=0.01 level as determined by Fisher's protected l.s.d.

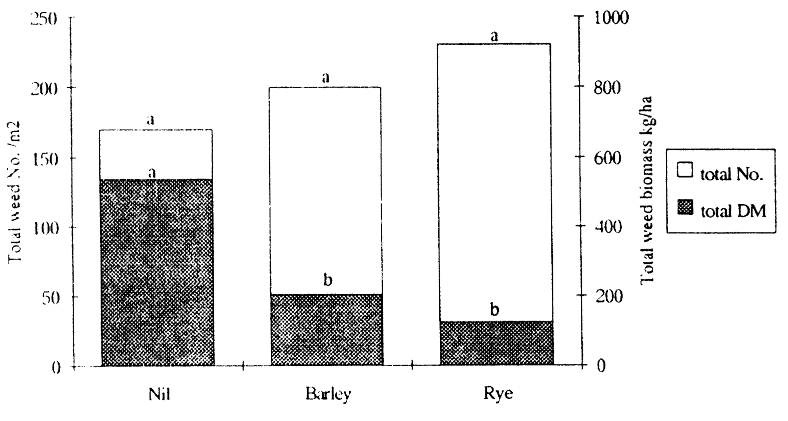

Figure 2. Total weed numbers and weed biomass (DM), 50 days after the sowing of the mulches prior to herbicide application. Means within each variable followed by the same letter are not significant at the P=0.01 level as determined by Fisher's protected l.s.d..

At broccoli harvest each mulch type was significantly different (P=0.01) from each other, with rye > barley > no-mulch (Fig. 3). The differences between the rye and barley could be due to either the initial sowing rates, 160 kg/ha vs 80 kg/ha or that rye does not break down as quickly. The early rye treatment maintained low weed biomass levels for 130 days (until harvest) being significant (P=0.05) from all other treatments except the early barley treatment. The other rye treatments did not achieve the same reductions in weed biomass. The cause is most probably in the method of killing off the mulch with the mid treatments using fluazifop which has no effectiveness against broadleaves and the late treatments having glyphosate applied through a wiper which would be above the weeds height. This indicates that the reduction in weed biomass had more to due with a physical effect from the mulch than an allelopathic (chemical) effect. While other studies of rye mulch have indicated that mulch levels need to be in excess of 4000 kg/ha to reduce weed biomass for 30-60 days (3), in this experiment, rye mulch levels reduced weed biomass until broccoli harvest (130 days) with mulch levels around 3000 kg/ha (Fig. 3).

The different levels of weed biomass for the early treatments (nile, bare and ryee) (Fig. 3) are the inverse to the yield of broccoli (Fig. 1). The mulch levels from these treatments corresponded to the yield. This indicates that the level of mulch present had a direct effect on yield.

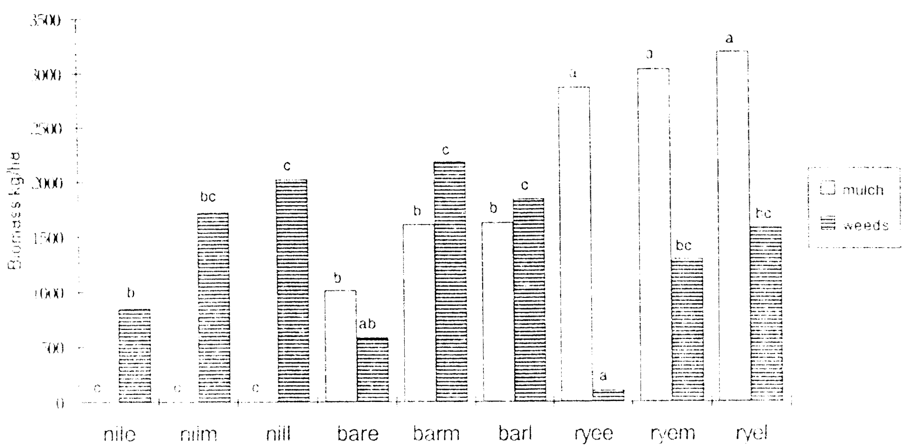

Figure 3. Weed and mulch biomass levels at broccoli harvest under different mulch regimes (nile = no-mulch early, nilm = no-mulch. mid, nill = no-mulch late, bare = barley early, barm = barley mid, barl = barley late, ryee = rye early, ryem = rye mid and ryel = rye late). Means within each variable followed by the same letter are not significant at the P=0.01 level for mulch and P=0.05 level for weed biomass as determined by Fisher's protected l.s.d..

While some reduction in yield occurred in all crops studied, the role of cereal cover crops to reduce weed biomass for up to 130 days with no added herbicides holds promise of using these mulches to reduce inputs of cultivation and herbicides into our vegetable cropping systems.

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REFERENCES

1. Barnes, J.P. and Putnam, A.R. 1983. J. Chem. Ecol. 9, 1045-1057.
2. Barnes, J.P. and Putnam, A.R. 1986. Weed Sci. 34, 384-390.
3. Lanfranconi, L.E., Bellinder, R.R. and Wallace, R.W. 1992. Weed Tech. 6, 1021-1026.
4. Liebl, R., Simmons, F.W., Wax, L.M. and Stoller, E.W. 1992. Weed Tech. 6, 838-846.
5. Perez, F.J. and Ormeno-Nunez, J. 1993. Weed Res. 33, 115-119.
6. Teasdale, J.R.and Mohler, C.L. 1992. Proc. 1st Inter. Weed Con. Conf., Melbourne. pp 516-518.
7. Worsham, A.D. and Blum, A. 1992. Proc. 1st Inter. Weed Con. Conf., Melbourne. pp 577-579.