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Late season manipulation of crop bulk in white clover – does it pay?

Key Points

- Only one of 10 experiments gave a significant seed yield response to mechanical topping of white clover seed crops.
- There was a trend for topping to increase seed yield as the amount of dry matter removed increased above 2000kg DM/ha (when topping at 70mm height at first flower) with heavier soils tending to be associated with seed yield increases.
- Soil characteristics (and possibly location, temperature) influenced the response to topping.
- The application of 2,4-D Ester suppressed seed yields when applied at 2 and 3l/ha in July at four sites in the 2007/08 season.
- Late season herbicides (applied at first flower) showed variable results but did not enhance seed yield.
- Moddus applied at first flower reduced seed yield.

Introduction

In 2005, FAR with the support of MAF Sustainable Farming Fund, set up a three year project to investigate issues with crop bulk during flowering and seed development. In white clover the shading of running stolons from bulky vegetative crops can occur during late spring and is a recognised factor that can reduce seed yield. Shading of developing stolons can cause the abortion of developing seed heads or individual florets. Crop bulk is a result of ongoing growth and development. Growth is the increase in plant size through increases in canopy size/biomass while development refers to the irreversible shift to reproductive development. Unlike annual crops both growth and development can occur simultaneously in perennial crops e.g. continued leaf production while flowering and seed growth occurs compared to annual crops such as cereal where once the growing point has finished leaf production, it produces seed (grain). There are many factors which can influence crop growth and therefore give differences in crop bulk. These include;

- soil moisture status;
- soil fertility and nitrogen status;
- temperature and
- plant population and row spacing.

Crop development is primarily influenced by exposure to low winter temperatures followed by lengthening days.

This update summarises three years of experiments set up to investigate either mechanical topping or chemical topping/plant growth regulators and their effects on seed yield.

Method

Mechanical topping was carried out on 10 individual experiments over a period of three years. Topping was imposed with either a ride on or push lawn mower cutting to approximately 70mm in height. The timing of topping varied each year but generally started at first flower visible. Other treatments included; two weeks later, double topped and an earlier treatment (third year only).

Late season chemical topping experiments were carried out in year one only. These included the application of Paraquat, Jaguar® and Tropotox® at first flower. Early season canopy manipulation was employed in year three using 2,4-D Ester at rates of either 2 or 3l/ha during July at three sites. Moddus was applied to white clover either as a standalone product or in sequence with 2,4-D Ester. 2,4-D Ester was applied in July while Moddus was applied at first flower.

All experiments were located in grower paddocks and received grower practice for all other crop inputs. Plots were desiccated as per the host grower practice and machine harvested using a Wintersteiger small plot combine.

Results

Mechanical topping

In only one experiment (Leeston 2006/07) was there a significant seed yield benefit to topping. The average relative seed yield from topping was 102 (no topping = 100), with a range from 91 to 114 for all sites (Figure 1). There was a trend for topping to enhance seed yield when crops were bulky, often associated with heavier soils. On heavy soil the benefit of topping was a tighter flowering period and increased seed yields (Table 1). However on lighter soils the trend was for topping to lower seed yields (Table 2). There was a trend for increased seed yield when topping removed greater than 2000kg DM/ha at first flower visible (Figure 1).

Flower emergence rates are driven by day length and temperature, peaking during a two week period around the longest day (21st December to 5th January) and then declining rapidly. Any topping treatment that reduces the number of flowers at peak flowering will significantly reduce seed yield. This can include early topping treatments where the leaf

associated with a flower head is removed, causing abortion of either florets or flower heads.

Based on these experiments topping should be the exception rather than normal management and only in exceptional seasons of growth (and probably only on heavier soils with larger leaf cultivars).

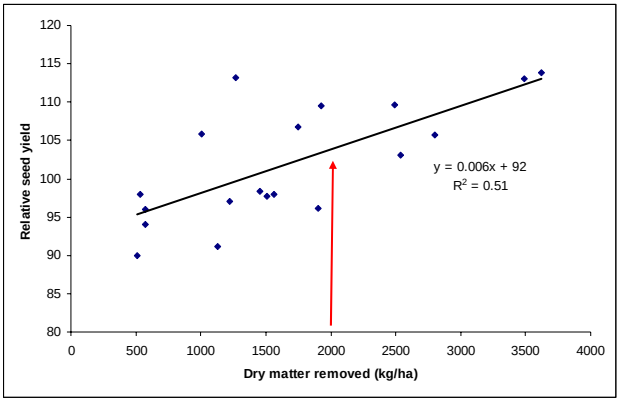

Figure 1. *Relationship between amount of dry matter removed by topping and relative seed yield (mean of 10 experiments).*

Table 1. *Herbage removed at topping and seed yield (kg/ha) for five topping treatments at Leeston cv Riesling (2006/07).*

Topping treatment	Date	Kg DM/ha	Seed yield	Significance $LSD_{0.05}$ = 50kg/ha
Untreated			710	B
Early - topped at 1st flower	14-Nov	1512	690	B
Mid - (+14 days)	29-Nov	3486	800	A
Double - early & mid	14 & 29 Nov	1926	770	A
Late - (+ 21days)	5-Dec	3620	800	A

Table 2*. Effect of three topping treatments on medium-light irrigated soils in a dry year (2007/08) expressed as relative seed yield (%).*

Topping	Barhill	Broadfields	Dorie	AVG
Untopped	100	100	100	100
Early - (1st flower)	97	90	96	94
Mid - (+14 days)	100	97	98	98

2,4-D Ester application

The herbicide 2,4-D Ester is commonly used at 2 to 3l/ha in mid-late winter to control broadleaf weeds and to reduce spring growth. In experiments at four locations in the 2007/08 season, that compared 0, 2 and 3l/ha of 2,4-D Ester, there was a suppression of seed yield in three experiments while in the fourth (Dorie) seed yield was the same as the control (Table 3). Of these sites the Dorie site used considerably more irrigation while the Broadfield site was under irrigated in a dry year.

Table 3. *Relative seed yield (%) from the use of 2,4-D Ester at four Canterbury locations. The mean seed yield of the control was 750kg/ha (100).*

2 4-D (L/ha)	Barhill	Broadfields	Dorie	Greendale	Average
0	100	100	100	100	100
2	86	83	99	83	88
3	78	60	99	Xx[1]	79

[1]xx no treatment

Late season chemical application

When applied at first flower paraquat reduced seed yield in one but not the other experiment (Table 4). Tropotox (MCPB/MCPA mix) had no effect while Jaguar significantly reduced seed yield in both experiments (Table 4). Both mechanical and chemical topping showed no advantage when compared with the untreated at both sites.

Table 4. *Effect of mechanical topping and chemical topping / late herbicide application[1] on seed yield (kg/ha) at two locations, 2005/06 season.*

Location	Leeston		Newlands	
Cultivar	Riesling		Tribute	
Untreated	1260	a	850	ab
Early Top[2]	1240	ab	780	bc
Late Top[3]	1020	c	570	d
Double Top	1030	c	500	d
Paraquat[1]	1010	c	790	abc
Jaguar	1000	c	740	c
Tropotox	1190	ab	860	a
Mean	1110		730	
$LSD_{0.05}$	**145**		**79**	

[1]herbicides applied 4 days after early topping (to untopped plots); paraquat 2l/ha (250 g/L); Jaguar 2l/ha; Tropotox 1.5l/ha
[2]early top dates; Leeston 2 Nov; Newlands 21 Oct;
[3]late top dates; Leeston 25 Nov, Newlands 21 Nov.

Moddus plant growth regulator

In a dry year, irrigated white clover seed yields were depressed with Moddus while the sequence with 2,4-D ester was additive, resulting in a severe depression of seed yield (Table 5).

Table 5. *Effect of Moddus and 2,4-D alone and in mixture on white clover seed yield and relative seed yield (2007/08).*

Treatment	L/ha	M.D. Yield kg/ha	Relative seed yield (%)
Untreated		570 a	100
2,4-D Ester	2.0	390 b	68
Moddus	2.0	400 b	70
2,4-D Ester fb Moddus		260 c	46
	LSD	52	
	sig	***	

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