

EFFECT OF WHITE CLOVER DEFOLIATION ON SEED PRODUCTION AND MATURITY

Slepetys and R. Dapkus

Lithuanian Institute of Agriculture,

Dotnuva - Akademija, Kedainiai distr., Lithuania LT 5051

ABSTRACT

Experiments were carried out in Lithuania over the period 1990-1995. They involved white clover (*Trifolium repens* L.) cultivars Atoliai (large-leaved) and Bitunai (intermediate-leaved). Different defoliation treatments were carried out at a height of 5, 10 and 15 cm every week over the period from 7 May to 18 June. On 21-28 May, two more treatments consisting of an application with 0.5 and 1.0 l ha⁻¹ reglone were added. When defoliation was carried out on 11-18 June, the seed of cv. Bitunai and cv. Atoliai matured 7 d and 13 d later, respectively than the seed of the non defoliated stand. A delayed defoliation tended to reduce the weed incidence, lodging and stem height, however, the number of seed-bearing heads, was reduced except in cv. Atoliai. The development of white clover before defoliation does not determine the amount of the seed yield of the aftermath. It is more dependent on the weather conditions during flowering - harvesting time.

KEYWORDS

Clover, seed, yield, maturity, defoliation

INTRODUCTION

White clover is one of the most commonly clover species grown in Lithuania. Owing to changeable and rainy weather white clover seed production is difficult. Clover grows intensively, produces many shoots, lodges early and therefore the seed yield is very low. Since old times it has been a common practice to try to harvest luxuriant, weed-infested white clover stands in spring, hoping to get seed from the aftermath. There is a lower amount of vegetative mass, a higher number of inflorescences in the aftermath, pollination is better, and there are more favourable conditions for seed maturity and harvesting (Mølgaard, 1975; Clifford, 1979). However, it has been established that the number of inflorescences is dependent on the cultivar and the year (Thomas, 1981; Marshall et al., 1993). Duration of the stand use has an even larger negative effect on the number of inflorescences and seed content (Evans et al., 1986). Cutting white clover in spring sometimes reduces the seed yield markedly. This happens when owing to the drought the inflorescence become considerably shorter and therefore a lot of heads are left unthreshed during the combine harvesting. Furthermore, when chemicals are available (herbicides, growth regulators) it is possible to produce a seed crop without cutting (Marshall and James, 1986; Budhianto et al., 1995).

The objectives of this work were: 1. To investigate the effect of spring defoliation time and height on the seed maturation and yield of the two white clover *Trifolium repens* L. cultivars Bitunai (intermediate-leaved) and Atoliai (large-leaved). 2. To investigate possibilities of using of "reglone" as an alternative to spring defoliation.

MATERIALS AND METHODS

Experiments were carried out over the period 1990-1995 in Lithuania. Several treatments involving time and height of cuttings were evaluated (table 1). White clover was cut with a small field mower at a height of 5, 10 and 15 cm every 7 d starting May 7 and finishing June 18. If owing to cold dry weather the stand had not reached the required height that cutting term was skipped. On May 21 and 28, in addition to the cutting height treatments, white clover was sprayed with reglone at 0,5 and 1,0 l ha⁻¹ (0,1 and 0,2 kg ha⁻¹ of active ingredient). The spray solution was applied at 200-300 l/ha with a

knapsack sprayer. Experiments were carried out on record plots of 33.75 m² (15x2.25) involving 4 replications. The seed was harvested with a combine Sampo 500 after desiccation with reglone applied at 4 l ha⁻¹. In 1994, owing to the drought seed was harvested without desiccation. The seed yield data were converted into 100 % purity and 13 % moisture. Clover seed maturity was established from three samples per treatment from an area of 0.25 m². Seed heads were detached from the stalk and divided into three groups: 1) immature (green calyxes); 2) semi mature (grey calyxes, seed of wax maturity); 3) fully mature (brown calyxes with hard seed). Harvesting time was established according to the percent of fully and semi-mature heads (65-70%). The summers in 1990 and 1991 were moderately wet and not very favourable for the maturation of white clover seed. There was practically no seed yield in 1992 due to the drought and in 1993 due to an extremely high incidence of Scelerotinia rot (*Scelerotinia trifolium Erikss*). In 1994 - 1995 the summers were dry and favourable to seed production. The seed was harvested from the 1-yr-stand in 1990-1994 and from 2-yr-stand in 1995.

RESULTS AND DISCUSSION

White clover dry matter yield (DMY) depended on the stage of development and defoliation time. DMY of both clover cvs. On May 7 was 0.04 - 0.06 t ha⁻¹. The highest growth rate was in the first part of May, when DMY increased 4 - 10 times a week, and gradually reduced later on. When defoliating was performed on June 18 at the 5 cm height an average of 1.60 t ha⁻¹ of DM was obtained. At that time clover had started flowering or had been at the stage of mass flowering (1990 and 1995). When cutting was done at the 5 cm height, 89 - 100 % of inflorescences and 38 - 58 % of buds were cut off. Atoliai started flowering 3 - 5 days later than cv. Bitunai. Stands cut in May and early June matured the seed at the same time as uncut ones. Cut taken around mid-June delayed seed maturity slightly with the effect more pronounced on Bitunai (table 1). Spring application of reglone did not effect flowering time and seed maturation. The number of heads on Atoliai was not affected by cutting treatments although a reduction was observed with late cutting. This can be explained by a good regrowth of broad leave and formation of new inflorescences during the whole vegetative growth period. The number heads of cv. Bitunai was reduced by 22.0-14.6 % when cutting was performed June 11-18 at the 5 cm height, and by 18.3 % when cutting was done June 18 at 10 cm height. There were 81.4 % more heads in Bitunai than in Atoliai, however Atoliai produced 44.9 % more seeds per head than in Bitunai. Cutting time and height and spraying with reglone did not have any more marked effect on the seed content which was strongly determined by the annual meteorological conditions. Delaying defoliation reduced lodging of aftermath consistently, however the length of inflorescence stalk became shorter and most of the heads were closer to the soil surface. In the dry 1994 year the major parts of heads of Atoliai and Bitunai cut June 18 were at 11 and 6 cm respectively from the soil surface. Combines did not take 45-48 % of the heads. In wet years the height of heads was not affected by late cuttings. Every year 10-18 weed species were identified in the field. The most prevalent species were: *Matricaria inodora*, *Taraxacum officinale*, *Rumex crispus*, *Capsela bursa pastoris* and *Agropyrum repens*. Cutting in June reduced the number of *Rumex crispus* seeds in the aftermath seed by 1.1-9.8 times, and that of *Matricaria inodora* - by 1.9-27.1 times. The shorter and later

defoliation significantly reduced weed incidence but reglone application did not reduce it.

Delaying defoliation had little effect on 1000 seed weight, and seed germination although they were slightly reduced by late cutting (table 1). Because of a significant year x cutting treatment interaction, it is difficult to single out the best treatment. Seed production more dependent on the meteorological conditions at flowering and harvesting them development before defoliation (table 2). As the seed yield are rather similar the choice of defoliation height and time should be determined by the level of weed infestation because shorter and later defoliation reduced weed incidence.

Therefore it is recommended to defoliate white clover - at the 5 cm height toward the end of May or early June. Instead of cutting, large - leaved cv. Atoliai can be sprayed with 0.5-1.0 l/ha reglone at the end of May.

REFERENCES

Budhianto, B., J.G. Hampton, M.J.Hill and R.G. Thomas. 1995.

Table 1

Stand and seed quality indicators of the white clover defoliated in spring at different time and height. (Mean of 1990 - 1995)

	Number of days from flowering till maturity		Number of heads m ²		Number of seeds in 10 heads		Height of heads from the soil surface (cm)		Field weed incidence (%)		Seed germination (%)		1000 seed weight, (g)	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Undeveloped	53±5.1	45±3.8	560	1016	655	452	18±1.3	18±1.7	100.0	100.0	88.4	88.4	0.65	0.70
7 May, 5 cm	53±5.1	45±3.8	536	1020	604	442	20±0.9	19±1.4	94.9	82.8	89.8	86.0	0.65	0.68
14 May, 5cm	53±5.1	45±3.8	516	988	684	451	20±2.2	18±1.3	71.4	68.1	87.4	84.8	0.65	0.69
14 May, 10cm	53±5.1	45±3.8	544	1016	621	443	20±2.0	21±0.0	96.9	60.7	88.2	84.7	0.64	0.69
21 May, 5 cm	53±5.1	45±3.8	564	1052	670	448	20±2.3	17±0.9	70.4	63.8	89.6	84.8	0.63	0.68
21 May, 10 cm	53±5.1	45±3.8	600	1000	677	476	21±1.1	20±2.0	80.6	64.4	88.4	84.6	0.64	0.68
21 May, 15 cm	53±5.1	45±3.8	572	1000	627	468	20±1.6	20±1.6	89.8	50.3	89.3	84.3	0.65	0.69
21 May, R _{0.5} ⁺	53±5.1	45±3.8	544	980	708	465	20±1.9	17±1.7	86.7	103.1	89.0	88.3	0.64	0.69
21 May, R _{1.0} ⁺	53±5.1	45±3.8	552	1004	695	461	20±2.2	17±1.1	89.8	77.9	90.8	86.8	0.65	0.69
28 May, 5 cm	52±5.0	45±3.8	568	984	692	452	19±1.7	18±1.3	43.9	60.7	91.8	86.9	0.64	0.69
28 May, 10 cm	52±5.0	46±4.0	572	992	651	474	19±1.8	17±2.1	64.3	66.9	88.2	87.6	0.63	0.69
28 May, 15 cm	53±5.1	45±3.6	528	1000	702	483	21±1.6	20±1.6	91.8	85.3	90.6	84.1	0.64	0.69
28 May, R _{0.5} ⁺	53±5.1	45±3.8	576	1004	708	432	20±0.9	17±1.0	65.3	109.2	89.4	86.8	0.64	0.69
28 May, R _{1.0} ⁺	53±5.1	45±3.8	532	960	690	402	19±1.6	17±1.5	104.1	95.7	90.1	88.9	0.64	0.69
4 June, 5 cm	52±4.9	46±4.6	572	1048	669	488	17±2.0	17±1.7	54.1	36.2	88.8	84.2	0.63	0.70
4 June, 10 cm	53±6.6	46±4.1	560	1020	642	435	17±1.3	18±1.7	55.1	49.1	88.7	85.5	0.64	0.69
4 June, 15 cm	52±4.9	47±4.2	564	1036	699	443	21±1.8	19±1.3	67.3	57.7	88.9	85.9	0.64	0.68
11 June, 5 cm	49±5.4	42±3.1	516	868	744	500	16±2.3	15±2.3	25.7	16.6	87.3	85.6	0.63	0.68
11 June, 10 cm	51±5.5	44±3.8	484	944	731	463	19±1.6	17±1.8	54.1	33.7	85.0	86.2	0.64	0.67
11 June, 15 cm	50±5.0	46±4.1	528	956	694	478	20±2.0	18±1.8	82.7	52.1	88.6	86.9	0.63	0.68
18 June, 5 cm	45±5.0	41±5.0	500	792	755	495	15±2.4	12±2.6	40.8	15.3	87.7	82.1	0.62	0.66
18 June, 10 cm	47±5.5	41±5.4	512	840	670	440	18±3.9	14±2.1	41.8	21.5	88.3	86.3	0.64	0.66
18 June, 15 cm	47±4.5	42±4.8	520	940	673	453	18±1.6	16±1.9	44.9	30.1	88.4	83.8	0.63	0.66
LSD _{0.5}			74.0	98.0	132.7	59.1			29.0	47.4	2.62	2.74	0.020	0.021

*R_{0.5} Sprayed with 0.5 l ha⁻¹ reglone. *R_{1.0} Sprayed with 1.0 l ha⁻¹ reglone. Cultivars: A - Atoliai, B - Bitunai

Table 2

Seed yields of the white clover defoliated in spring at different time and height

Defoliation time and height	Atoliai					Bitunai				
	1990	1991	1994	1995	Mean	1990	1991	1994	1995	Mean
Undeveloped	108	212	491	243	264	158	185	695	224	316
7 May, 5cm	123	212	484	249	267	177	209	681	231	324
14 May, 5cm	134	224	557	239	288	196	209	703	253	340
14 May, 10cm	126	210	491	232	265	174	195	695	244	327
21 May, 5cm	137	216	528	247	282	209	211	685	237	336
21 May, 10cm	135	218	539	230	281	194	203	682	226	326
21 May, 15cm	130	225	491	269	279	179	211	678	235	326
21 May, R _{0.5} ⁺	123	210	523	257	278	155	213	689	232	322
21 May, R _{1.0} ⁺	114	225	541	241	280	160	193	729	210	323
28 May, 5cm	152	237	529	256	294	196	216	659	228	325
28 May, 10cm	143	224	540	244	288	190	218	675	258	335
28 May, 15cm	133	232	541	242	287	180	206	624	238	312
28 May, R _{0.5} ⁺	133	235	576	260	301	136	185	702	241	316
28 May, R _{1.0} ⁺	140	234	577	262	303	119	163	648	231	290
4 June, 5cm	137	245	500	217	275	123	199	624	233	295
4 June, 10cm	136	233	532	208	277	153	211	675	228	317
4 June, 15cm	140	248	544	219	288	164	218	694	241	329
11 June, 5cm	121	263	389	202	244	101	231	553	159	261
11 June, 10cm	129	264	518	204	279	105	222	602	199	282
11 June, 15cm	128	227	559	221	284	129	223	742	222	329
18 June, 5cm	111	281	127	131	162		264	152	93	170
18 June, 10cm	118	254	369	177	229		260	393	149	267
18 June, 15cm	120	275	467	183	261		246	496	167	303
LSD _{0.5}	25.0	35.9	48.6	22.9	17.3	11.9	30.7	105.0	19.0	27.9

* R_{0.5} Sprayed with 0.5 l ha⁻¹ reglone

* R_{1.0} Sprayed with 1.0 l ha⁻¹ reglone

Effect of time of harvest and paclobutrazol on seed yield in white clover cv. Grasslands Pitau. New Zealand Journal of Agricultural Research. **38**, No 1: 1-6.

Clifford, P. 1979. Effect of closing date on potential seed yields from Grasslands Huia and Grasslands Pitau white clover. New Zealand Journal of experimental Agriculture. **7**, No 3: 303-306.

Evans, D.R., T.A. Williams and W. Ellis Davies. 1986. Potential seed yield of white clover varieties. Grass and Forage Science. **41**: 221-227.

Marshall, A. and I. James. 1986. Evaluation of chemicals for spring gapping white clover seed crops. Ann. Appl. Biol. **108**: 110-111.

Marshall, A.H., P.A. Hollington and D.H. Hides. 1993. Spring defoliation of white clover seed crops. **1.** Inflorescence production of contrasting white clover cultivars. Grass and Forage Science. **48**: 301-309.

Mølgaard, A. 1975. Hvidkløverens afpudsning. Tidsskr. Frøavl. **63**, No 754: 185-187.

Thomas, R.G. 1981. Effect of defoliation on flower initiation in white clover in summer. Grass and Forage Science. **36**: 121-125.