COVERS ON CRANBERRIES: A POSITIVE RESPONSE?

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Use of spunbonded fabrics as covers over actively growing or dormant plants is now commonplace in high-value horticultural crops such as strawberries, ornamentals and tobacco seedbeds. Covers also serve as insect barriers and weed barriers when applied over soil. On strawberry, rowcovers are widely used and are reported to provide increased accumulation of heat units, some protection from frost, earlier flowering, enhanced plant growth and increased yield.

Spunbonded fabrics are continuous, porous sheets created from plastics extruded as tiny fibers. Heat, pressure and chemicals are used to bond the fibers together into strong light sheets of varying thicknesses. Water and air pass freely through the openings in the fabric, thus plants can readily be irrigated without removing the cover. Depending on fabric thickness, soil heat loss is delayed and higher humidity around plants is maintained.

The positive effects of spunbonded covers on other crops suggested a test of covers on cranberries was warranted. An initial test in 1989 at R.S. Brazeau, Inc., Wisconsin Rapids is reported in the attached publication. The trend to increased fruit set and yield with covers in 1989 (Table 1) stimulated our interest in further testing in 1990.

A replicated, more detailed test was initiated at Dubay Cranberries, Inc. on 'Searles' in 1990. Typar covers as described in the 1989 report were applied in mid April after ice melted. Covers were again selectively removed at 3 week intervals up to 21 June. Unfortunately, a severe hail storm on 29 June caused up to 30% losses in final yield. Results of the test were thus complicated by crop injury.

A trend to increased fruit set was again noted in 1990 with covers removed early in the season (Table 2). In 1990, however, yield responses did not parallel the trend in 1989. No clear-cut explanation for this response is apparent at this time. High air temperatures under the covers in late May and June might well have altered plant physiology sufficiently in some way to result in failure of fruit to develop past pinhead and pea stages. Berry weight and anthocyanin content were not influenced by covers in either season.

A strong trend to increased chlorophyll content (Table 3) and increased photosynthesis (PN) in plants under covers is limited evidence covers might alter and enhance earlier carbohydrate synthesis despite shading and reduced light levels (PAR) under the covers.

Despite some conflicting results, cranberry plant responses under early season covers suggest further experimentation is warranted. We recognize of course, at this time no reasonable and feasible means for easily applying and maintaining covers on beds in a commercial cranberry production system exists.

In a different experiment in 1990 designed to evaluate influences of various preplant and postplant treatments on newly established cranberries, Typar spunbonded covers were applied over 'Stevens' immediately after planting. Covers

were kept on the planting through late August. Although some interactions with other factors occurred, main responses on treatments with covers vs no covers generally showed 20% increased upright length and greater bed cover by vines. Additional tests in 1991 are proposed to verify if fabric covers on new beds can consistently enhance bed establishment.

Positive responses with plant covers on other plant species are well documented. Enhancement of early season chlorophyll development, increased plant growth and potential for enhancing fruit set in cranberry with fabric covers should be verified by continued experimentation. Fabric covers appear to offer a viable, non-chemical and renewable means for positively altering cranberry plant growth and fruiting responses in our initial tests.

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Spunbonded Fabric Covers Suggest Possibilities to Alter Early Season Growth and Fruiting in Cranberry

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Use of spunbonded fabrics as covers to alter plant development, modify microclimate, provide protection from insects and animals, and improve productivity, as highlighted by Wells and Loy (1985), is now commonplace for a host of high-value horticultural crops. In strawberry, rowcovers are reported to provide enhanced accumulation of heat units, limited protection from frost, earlier flowering, increased plant growth, and potential for increased yield (Gast and Pollard, 1988; Pollard and Cundari, 1988).

Evaluation of spunbonded fabric covers on cranberry plant development and fruiting has not been reported and was the objective of this preliminary research. Recent research on fruit set in cranberry indicates high levels of soluble carbohydrates in cranberry shoot upright growth at early blossom stages are important in determining subsequent fruit set (Birrenkott, 1989). Onset of earlier seasonal growth as a result of covers, if concurrent with enhanced photosynthesis and higher carbohydrate levels, might offer potential for increased fruit set and productivity.

Typar spunbonded polypropylene fabric (Reemay, Hickory, Tenn.) was placed over a mature, producing 'Searles' cranberry planting in north-central Wisconsin on 5 Dec. 1988. Typar is a heavy-duty fabric with ultraviolet stabilizers added for resistance to degradation by sunlight. Weight of the sheet is 70.6 g-m^{-2}, with substantial resistance to puncturing or tearing and potential for reuse.

A total area of 2100 m^2 was covered using four large sheets of Typar. Uncovered control areas were located adjacent to covered plots in the same cranberry bed. Fabric covers were held in place with g-mm-diameter steel concrete-reinforcing rods laid along the fabric edges, pinned down with heavy-gauge wire hooks inserted into the soil. Remote thermocouples were tied to stakes at plant height (~10 cm) under the covers and in control areas for temperature monitoring. Soil temperatures were measured using a Taylor dial probe thermometer inserted to 15-cm depth through the fabric covers.

The bed was flooded for winter protection by 10 Dec. 1988 and a 25cm-thick ice layer was frozen over control and covered areas. Ice remained throughout Winter 1988-89 until melting and drainage in early April. Individual Typar covers, ~500 m^2 each, were removed at intervals of ~3 weeks, beginning 17 Apr.

The plantings were observed at intervals during the growing season to determine effects of covers on growth and fruiting. Six random samples of ~50 upright shoots and four samples of fruit (~300 g each) were taken from each plot on 29 Sept. 1989 for determination of percent fruit set, fruit weight, yield, and anthocyanin content of fruit.

During the cool early spring, canopy air temperatures under spunbonded fabric were 5 to 6C higher than in exposed control plants. Differences ranged as great as 17C, with a maximum temperature of 45C measured under covers with full sunshine in late May and early June. Temperatures suitable for initiation of active metabolism, estimated to be at 6 to 7C, resulted in earlier greening of leaf tissue under fabric covers. Nevertheless, differences in recognizable stages of current season's growth and flower development were negligible. Despite earlier greening, lack of visible earlier elongation may in part be related to a negligible effect of the covers on soil temperature (Table 1). The cranberry plant canopy appears to provide an insulating effect on soil temperature at least during early spring. However, soil temperature began to increase substantially by late May.

Although no significant differences existed, a trend to increased fruit set was apparent when plant covers remained in place until late May and early June (Table 1). This trend also was noted in samples taken solely for fruit set determination in early September (data not shown). However, no clear trend for increased yield was evident in samples taken at normal harvest. Anthocyanin content of fruit at harvest varied, but did not appear to be related to the time of cover removal.

Current evidence for the positive influence of soluble carbohydrates at early blossom on fruit set in cranberry (Birrenkott, 1989) suggests that earlier leaf greening, if concomitant with enhanced soluble carbohydrate production, could enhance subsequent fruit set. Evidence in this study is not adequate to warrant a conclusion that spunbonded fabric covers either provided earlier enhanced carbohydrate levels or enhanced fruit set.

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Table 1. Soil temperature and fruit characteristics in 'Searles' cranberry as influenced by date of removal of Typar polypropylene fabric cover.

Date of cover removal	Soil temp (°C) 2 May	23 May	6 June	Fruit set (%)	Yield[z] (g/81 cm^2)	Anthocyanin[y] (mg/100 g)
17 Apr.	2.3	12.4	15.3	35.8	37.8	20.5 c
2 May	1.3	12.5	14.2	34.4	31.7	17.5 a
23 May	1.7	12.5	15.1	42.0	43.2	19.3 b
6 June	3.3	13.7	17.6	42.6	37.2	21.5 c
No cover	2.5	11.4	14.0	39.6	41.4	21.0 c
				NS	NS	

[z]Adjusted yield using number of flowering uprights as a covariate.
[y]Mean separation at P = 0.05, Fisher's protected LSD; NS, nonsignificant.

Table 2. Flowering and yield, 1990.

Cover removal date	No. flowering shoots'	% Fruit set	Yield(g)[z]	Mean berry weight(g)	Anthocyanin (mg $100g^{-1}$)
No cover (control)	16.4a	22.5b	11.7a	1.12	23.1
9 May	12.0b	29.2a	9.5a	1.11	21.2
30 May	10.5b	23.7ab	6.4b	1.11	23.6
21 June	10.4b	17.7b	5.1b	1.10	22.0
	*	*	*	NS	NS

[z]Sample size reduced in 1990 vs. 1989.

Table 3. Photosynthesis and chlorophyll, 1990.

Cover removal date	Photosynthesis PN ($\mu mol \cdot m^{-2} \cdot s^{-1}$)		Light PAR ($\mu mol \cdot s^{-1} \cdot m^{-2}$)		Chlorophyll ($\mu g \cdot g^{-1}$ FW)
	30 May	21 June	30 May	21 June	
No cover (control)	2.38	2.07	1931a	1773a	.250
9 May	1.44	2.73	1975a	1798a	.236
30 May	2.44	2.79	1973a	1535a	.304
21 June	1.48	3.00	1257b	988b	.417
	NS	NS	*	*	NS