What's Cropping Up?

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Evaluating Winter Injury to Alfalfa

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The immediate devastation from the January ice storm in the upper Northeast was obvious. The effect that the lingering ice has on survival of perennial forages, particularly alfalfa, is much less obvious. There certainly is the potential for severe winter damage, but damage can be increased or reduced by a number of factors other than the actual ice cover. Also, the worst part of the winter is often late winter, as far as conditions encouraging winter damage are concerned.

Last winter 1-2 inches of ice covered central Wisconsin in late January and lasted till late March. Farmers were told with confidence that all their alfalfa was likely dead. Ice sheeting on top of alfalfa for more than 30 days should result in almost complete winter kill. Most of their alfalfa, however, actually survived the ice cover. On the other hand, winter damage in the state of Maine last winter killed most of their alfalfa and some of their orchardgrass. Vast acreages of alfalfa in southern Canada have been killed out in recent years due to ice sheeting and cold temperatures. Winter damage is just not very predictable.

Ice Sheeting

Ice sheeting can result in winter kill by smothering plants over a period of time. Very low temperatures following ice sheeting can result in rapid killing, as cold temperatures are easily transferred through ice to the plants. The longer that ice remains, the greater the chances for damage. When alfalfa plants are covered with ice in laboratory studies, plants start dying after about a week, and most are dead in 30-40 days.

Variability

The survival of alfalfa is based on the plant's ability to survive a specific combination of stresses in any given winter. Some of the stresses besides ice sheeting include cold temperature, fluctuating temperatures, lack of snow cover, high soil moisture, low soil fertility, and previous harvest management. Ice sheets formed on frozen soils with low soil moisture, followed shortly by snow cover on the ice, are less likely to do damage. The actual porosity or density of the ice will affect survival. For example, we have observed that ice now on fields in Clinton county is very hard and dense, while ice on fields in St. Lawrence county appears soft and less dense. If there is a snow layer between the ice and soil, chances of alfalfa survival are increased. A snow layer between ice and soil was considered the likely reason alfalfa survived prolonged ice cover in Wisconsin last winter.

Alfalfa varieties with a higher degree of fall dormancy will have a better chance of survival. The age of a stand will affect survival, as will the relationship of the alfalfa crown to the soil level. The older the alfalfa stand, the more likely that insect and disease damage may have weakened plants, such that less stress is necessary to kill them. The more harvests taken the previous season, the more prone the stand is to winter damage.

The mechanical force or weight of several inches of ice does not appear to have any effect on plant survival. Neither does the presence of alfalfa stubble sticking through the ice affect survival, according to past research. Stubble height will affect survival, however, by increasing the chances of snow cover.

Assessment of Damage

Prior to spring, about the only method of estimating damage due to smothering from ice is to actually dig up frozen plants and put them in a greenhouse for evaluation. Plants will green up in a week or less, if alive. We are using a concrete cut-off saw to extract samples from ice-covered fields in northern New York, and it is a tedious process. While this provides an assessment of damage to-date, it does not tell us how much of the alfalfa alive now will actually survive the rest of the winter.

Although the ice storm gives the appearance of a uniform conditions, with ice covering everything, conditions are actually quite variable from the alfalfa's point of view. Fields sampled at Miner Institute in Clinton county had about 1.5 inches of ice cover, usually with snow trapped between the ice and soil. Fields sampled in St. Lawrence county had 2-3 inches of ice cover directly on the soil surface. Some fields have an air pocket several inches thick between the ice and soil, due to snow melt between ice and soil. Some fields are frost-free, others have frost deeper than 6 inches. Snow cover

(see WINTER, page 7)

Weed Control

Combining Reduced Herbicide Rates and Cultivation for Effective Weed Control in Corn

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Introduction

Only 20% of N.Y. field corn growers currently use cultivation to control weeds, either with or without herbicides. Despite years of on-station research demonstrating that banded herbicides and cultivation result in yields equal to broadcast herbicides, most NY corn growers who cultivate still use broadcast, full-rate herbicides (Gift and Mt. Pleasant, 1997). While interest in cultivation is growing, according to both growers and extension agents, growers who cultivate and use herbicides lose money unless they understand the role of banding (Mt. Pleasant et al., 1996).

According to growers, the reasons not to cultivate include time constraints (both amount of time during hay cutting and timeliness due to wet soil) and costs (fuel, equipment). However, both of these concerns can be mitigated with use of a banded herbicide. A banded herbicide enables growers to cultivate later in the season and still control weeds (timeliness), to cultivate only once or twice and still control weeds (lessening hours in the field), and to cut the herbicide portion of weed-control costs by two-thirds. This year, we performed demonstrations of cultivation and banding at three sites, one each in central, western, and eastern NY. These demonstration experiments were designed to make the benefits of banding and cultivation clearer to growers.

Materials and Methods

Demonstrations of a banded herbicide and single cultivation in field corn were held at three sites in NY: Avon (Livingston county), Sharon Springs (Schoharie county), and Dryden (Tompkins county). Each demonstration was planted and fertilized by the grower and sprayed and/or cultivated by the researchers (see dates, Table 1). Data were collected on weed numbers in and between rows, weed species, and yield. Weed numbers and species were counted in quadrats within (0.77 sq. m) and between (1.55 sq. m) rows. Treatments included broadcast herbicide alone, banded herbicide and one cultivation, cultivation only (performed twice), and a weedy check. One site (Schoharie), because of a quackgrass infestation which we anticipated would not be fully controlled by the herbicides, also included a broadcast herbicide and cultivation treatment. Cultivations were done with a standard S-tine row crop cultivator. Statistical analysis was performed using SAS, and analysis of variance and orthogonal contrasts were used to compare treatment means for both weed numbers and yields.

reducing in-row broadleaf weed numbers at two of the sites; the weeds at these sites were possibly relatively small at the time of cultivation, thereby making them more vulnerable to being buried.

Herbicides were generally no more effective than cultivation at reducing grass weed populations; however, in-row grass populations were reduced more by herbicides than cultivation at one site (Tompkins; Table 3). At one site (Schoharie), broadcast herbicide alone was less effective than banding and cultivation, cultivation alone, or broadcast herbicide and cultivation at reducing between-row grass weed populations. However, this is probably due to the fact that the herbicides chosen are not effective for quackgrass control. In Livingston, there were no differences in in-row grass populations among any of the treatments; weed populations at this site were generally extremely low.

Table 1. Critical dates for each site of demonstration

Site	Planting Dates	Spray Dates	Herbicides Amt/A	Cultivation Dates	Harvest Dates
Livingston	May 18, 24, 28	May 27, June 5	Atrazine 1 pt Dual 2 pt Prowl 3.6 pt	June 27	December 9, 16
Schoharie	May 24, June 4	June 4	Atrazine 1 qt Prowl 3.6 pt	June 23, July 2	September 19,22 (silage)
Tompkins	June 7	June 11	Atrazine 1 qt Dual 2.5 pt Prowl 3.6 pt	July 3, July 11	October 19, 20

Results and Discussion

Weed population responses to treatments were relatively consistent across locations. No differences in broadleaf numbers between rows were detected among weed control treatments, though broadleaf weed numbers were higher in the weedy check (Table 2). Within rows, however, herbicidal weed control treatments were more effective at removing broadleaf weeds than the cultivation-only treatment at two of the three sites. Cultivation was effective at

Though yields were somewhat lower for plots with banding and cultivation compared to broadcast-herbicide treated plots (10 bushels/acre at Schoharie; 5 bushels/acre at Tompkins), these differences were not statistically significant (Table 4).

Statistically, all treatments with some herbicide yielded better than the cultivated-only plots, which out-yielded the weedy checks.

At one site (Livingston), which had exceedingly low weed pressure, no yield differences were detected; in fact, the cultivation-only and weedy check plots had higher yields, though not significantly so. We hypothesize that the three-way herbicide mixture inflicted a minimal amount of injury to contribute to this difference. Cultivation did not generally reduce corn stands (data not shown). In general, yields were consistent with weed population results.

Table 2. Broadleaf weed numbers per quadrat, post cultivation						
Site	Schoharie		Tompkins		Livingston	
	In row	B/w row	In row	B/w row	In row	B/w row
BC + Cult.	1.7c	2.9b				
BC	3.4c	4.7b	0.2b	0.1b	0.05b	0b
Band + Cult.	4.6c	10.5b	1.1b	2.6b	0.05b	0.2b
Cult. (2x)	9.8b	7.3b	1.4b	2.9b	1.7a	0.2b
Check	31.1a	62.3a	7.6a	17.5a	1.8a	2.9a

Conclusions

Given that most growers who cultivate are using a broadcast, full-rate herbicide (Gift and Mt. Pleasant, 1997), and that a banded herbicide and single cultivation has the same cost as a broadcast herbicide, using banded herbicides could save money for growers who already cultivate. These growers who are already cultivating have the most to gain from banding, since they are already adept at cultivation and would not have to purchase new equipment. In addition, a grower who is less adept at cultivation is probably more likely to experience the apparent potential for yield loss associated with using a banded herbicide. We believe that future demonstrations of banding and cultivation should be focused more on growers who already cultivate (this was the case for the Livingston demonstration this year). In addition, future studies might include comparisons of banded herbicides and cultivation with reduced-rate broadcast herbicides and cultivation, which have also been shown to result in yields equivalent to full-rate broadcast herbicides. Data collected from such trials could be used to determine whether the general D.E.C. prohibition against reduced-rate herbicide applications should apply to growers who cultivate.

Table 3. Grass weed numbers per quadrat, post cultivation						
Site	Schoharie		Tompkins		Livingston	
	In row	B/w row	In row	B/w row	In row	B/w row
BC + Cult.	3.8b	3.1b				
BC	5.9b	10.7c	1.9c	0.4b	0	0b
Band + Cult.	3.0b	7.6b	1.0c	4.7b	0	0b
Cult. (2x)	4.1b	3.9b	8.7b	1.2b	0.4	0.04b
Check	13.9a	29.8a	16.8a	33.4a	0	0.2a

Table 4. Yields for each weed control treatment (bushels/acre at 15% moisture)			
	Schoharie	Tompkins	Livingston
Broadcast + Cultivation	92.5c		
Broadcast herbicide alone	93.9c	108.0c	155.3a
Band + Cultivation	83.7c	103.4c	153.4a
Cultivation alone (twice)	63.1b	97.7b	156.6a
Weedy Check	27.4a	47.1a	155.7a

References:

Gift, N. and J. Mt. Pleasant. 1997. New York Corn Growers Respond to Survey on Cover Crops and Cultivation. What's Cropping Up? 7(3): 4-5.

Mt. Pleasant, J., J.C. Frisch, C. Mohler, and R. Burt. 1996. Cultivation basics for weed control in corn. Cornell Cooperative Extension Information Bulletin 241.

Crop Management

Crop Rotation Increases Profitability for Cash Crop Producers

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The 1996 Federal Agriculture and Improvement Act gradually eliminates government payments for grain crops. Consequently, grain producers must devise profitable rotations for their farms. Field-scale replicated demonstrations, with participating farmers performing all field operations, were established on four farms in New York to determine short-term economic consequences of three crop rotations: 1) continuous corn, 2) soybean-corn, and 3) soybean-wheat/clover-corn. The continuous corn crop received soil insecticide, broadcast herbicides and about 140 lbs N/acre, whereas corn following soybean or wheat/clover received about 100 lbs N/acre, no soil insecticide, and banded herbicides plus one cultivation.

When averaged across years (1994 to 1996) and farms, continuous corn yielded 127 bu/acre compared to 139 bu/acre for corn following soybean and 141 bu/acre for corn following wheat/clover (Table 1). The continuous corn crop also had greater production costs ($332/acre) compared with corn following soybean ($300/acre) or wheat/clover ($302/acre) primarily because of greater pesticide costs (Table 1). Consequently, corn following wheat/clover or soybean had greater net returns ($153/acre and $149/acre, respectively) than continuous corn ($78/acre). The soybean crop, which averaged 47 bu/acre on the four farms, also had less production costs ($221/acre) compared with continuous corn primarily because of less fertilizer, drying, and machinery costs (Table 1). Nevertheless, the soybean crop had less net returns ($54/acre) than continuous corn. The wheat crop, which averaged 55 bu/acre on the four farms, had greater production costs ($253/acre) than soybeans primarily because of clover seed costs. The wheat crop had a -$40/acre net return. The wheat straw, which greatly improves profitability of wheat production, could not be harvested and accurately weighed, thereby reducing the net return of wheat in this study.

When averaged across years and farms, the corn-soybean rotation had greater net returns ($101/acre) than the soybean-wheat/clover-corn ($54/acre) and continuous corn rotation (Table 2). The combination of greater corn yields and lower production costs for corn following soybean compared with continuous corn offset the lower net returns for soybean vs. continuous corn. If we assume a $75/acre profit for wheat straw production (~ 1 ton/acre x $80/ton with a $.50/bale

Table 1. Production costs, yields, gross returns, and net returns, averaged across four sites in New York, for each crop within three crop rotations.

Input	Continuous Corn	Soybean-Corn	Soybean-Wheat/Clover-Corn	Corn-Soybean	Corn-Soybean-Wheat/Clover
Production Costs			$ acre^{-1}		
Machinery†	83	88	88	67	69
Seed‡	29	29	29	24	48
Fertilizer	44	38	38	4	43
Pesticides	42	11	11	34	-
Drying and Hauling	36	38	40	7	7
Int. on Oper. Capital	26	24	24	17	20
Crop Insurance	12	12	12	8	6
Land Rent	60	60	60	60	60
Total	332	300	302	221	253
Yield (bu/acre)	127	139	141	47	55
Gross Returns*	410	449	455	275	213
Net Returns	78	149	153	54	-40

†Machinery expenses calculated using custom rates
‡Seed costs for soybean include seed innoculate and clover seed for wheat
*Based on marketing year weighted price/bu from 1994 to 1996 for corn ($3.23), soybeans ($5.85) and wheat ($3.88)

Table 2. Production costs, gross returns, and net returns for each rotation, averaged across years, at four sites in New York using the average yield and the average weighted marketing year price from 1994 to 1996 for each crop.

Rotation	Cayuga Co.	Orleans Co.	Seneca Co.	Yates Co.	Site Mean
	Production Costs				
	$ acre^{-1}				
continuous corn	361	329	309	329	332
corn-soybean	276	259	253	254	260
soybean-wheat/clover-corn	271	247	257	260	259
	Gross Returns				
	$ acre^{-1}				
continuous corn	471	403	331	434	410
corn-soybean	428	359	305	353	356
soybean-wheat/clover-corn	338	320	285	310	313
	Net Returns				
	$ acre^{-1}				
continuous corn	110	74	22	105	78
corn-soybean	152	100	52	99	101
soybean-wheat/clover-corn	67	73	29	50	54
LSD (0.05)	33	6	27	11	12

cost), the soybean-wheat/clover-corn rotation would have an additional $25/acre profit and be comparable in net return to the continuous corn rotation.

Sensitivity analysis indicated that on a typical 800 acre cash crop farm a corn-soybean rotation (400 acres corn and 400 acres soybean) resulted in the greatest profitability from 1994 to 1996 (Table 3). If the average prices from 1987 to 1996 are used, the corn-soybean rotation has even greater profitability than continuous corn ($55721 vs. $16848). If the wheat straw were harvested, planting 2/3 of the acreage to the soybean-corn rotation (267 acres of corn and 267 acres of soybean) and 1/3 of the remaining acreage (89 corn, 89 soybean, and 89 wheat/clover) to the soybean-wheat/clover-corn rotation would result in almost the same profitability ($43393 + $6675 = $50068). The continuous corn rotation resulted in the least profitability. With the elimination of government payments for grain crops, cash crop producers should consider the elimination of continuous corn on their farms.

Table 3 Different whole-farm returns for different scenarios for a 800-acre cash crop farm, averaged across sites, based upon varying areas of three rotations, continuous corn (cont. corn), corn-soybean (c-s), and soybean-wheat/clover-corn (s-w/cl-c). Corn-soybean implies one half corn and one half soybean production, whereas the 3-year rotation implies 1/3 production for each crop.

Crop Rotation	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9	Scenario 10
	acres									
cont. corn	800	0	0	267	534	534	267	0	267	0
c-s	0	800	0	267	267	0	534	534	0	267
s-w/cl-c	0	0	800	267	0	267	0	267	534	534
	$ acre^{-1} (1994-96 prices)									
Whole-farm return	62,400	80,800	43,200	62,157	68,541	55,992	74,659	68,251	49,608	55,749
	$ acre^{-1} (1987-96 prices)									
Whole-farm return	16,848	55,721	19,163	30,465	29,822	17,589	42,746	43,393	18,374	31,115

Weed Control

Soybean Yields Similar with Preemergence and Postemergence Weed Control Programs

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Much has been said about yield penalties that may be associated with the use of total postemergence (POST) weed control programs in soybeans, especially if the POST programs rely partially or entirely on non-residual herbicides like Roundup Ultra (glyphosate) or Liberty (glufosinate). These POST programs are usually compared with preemergence (PRE) control programs with residual herbicides. Unfortunately, some of these comparisons are not appropriate because they involve different soybean varieties.

While reported differences are real, they may be more related to varietal yield potential than to differences between PRE and POST weed control programs in soybeans. To be valid, comparisons should be made using isolines of the same variety or be made comparing PRE and POST programs using the same genetically transformed herbicide resistant variety for both programs. Two experiments with Roundup Ready® soybeans at the Musgrave Research Farm near Aurora, NY compared a standard PRE treatment of 2.5 pt/A of Broadstrike + Dual applied either the day of, or the day after planting with POST applications of 1, 1.5 and 2 pt/A of Roundup Ultra.

PRE vs. EPO Experiment

In the first experiment, soybeans 'CX196RR' were planted in 30-inch rows on June 5 and early postemergence (EPO) Roundup Ultra applications made 25 days after planting (DAP) on June 30 when the soybeans were in the 3rd trifoliolate stage of development. Most velvetleaf had 2 to 4 true leaves (less than 6 inches tall) when EPO applications were made. Redroot pigweed, common ragweed, and common lambsquarters were 2 to 4 inches tall while green foxtail and wild mustard averaged 6 and 8 inches tall respectively.

PRE application of Broadstrike + Dual and EPO Roundup Ultra applications controlled at least 95% of the ragweed, green foxtail, and wild mustard. Control ratings for the other weeds and soybean yields are shown in Table 1. Velvetleaf, pigweed, and lambsquarters control was at least 95% with all treatments except for the 1 pt/A rate of Roundup Ultra which controlled 87 and 91% of the velvetleaf and lambsquarters respectively. Perhaps of greatest interest is that soybean yields with the EPO Roundup Ultra treatments were similar to those with the PRE Broadstrike + Dual treatment. The EPO treatments averaged 37 Bu/A compared with 36 Bu/A for the PRE treatment and 18 Bu/A from the untreated check.

Table 1. Weed control ratings and soybean 'CX196RR' yields with PRE and EPO (25 DAP) control programs at Aurora in1997.

PRE vs. EPO WEED CONTROL IN SOYBEANS

Herbicides	Rate Amt/A	When Appl.	% Control VELVE	REPIG	LAMBS	Yield Bu/A
Broadstrike + Dual	2.5 pt	PRE	99	100	100	36
Roundup Ultra	1.0 pt	EPO	87	97	91	38
Roundup Ultra	1.5 pt	EPO	97	99	97	38
Roundup Ultra	2.0 pt	EPO	96	99	97	35
Untreated	-	-	0	0	0	18
LSD (0.05)	-	-	3	2	5	4

PRE vs. LPO Experiment

In an adjacent experiment, soybeans 'APK1.6RR' were planted in 30-inch rows on June 6 and Roundup Ultra treatments were applied late postemergence (LPO) 34 DAP on July 10 when soybeans were in the 5th trifoliolate stage of development. Velvetleaf now had 4 to 6 true leaves (6 to 12 inches tall) and redroot pigweed was 8 to 12 inches tall. Common ragweed and common lambsquarters were 4 to 6 inches tall while green foxtail and wild mustard were about 12 inches tall.

As in the EPO experiment, the PRE Broadstrike + Dual treatment provided excellent control of all weeds including velvetleaf and pigweed (Table 2). Roundup Ultra treatments provided excellent control of ragweed, green foxtail, and wild mustard and good lambsquarters control. Velvetleaf control averaged about 70% (Table 2) for the Roundup Ultra treatments and there was no rate response at rates up to 2 pt/A. Pigweed control was poor with 27% control at the 1 pt/A rate and about 50% control with the 1.5 and 2 pt/A applications.

When 2 pt/A of Roundup Ultra was applied mid-postemergence 31 DAP in a third experiment, velvetleaf and pigweed control ratings were 99 and 100% respectively. It is not clear whether the decline in control of these two broadleaf annual weeds resulted from the delayed application or whether heavy dew at the time of LPO application was responsible for this difference in control between 31 and 34

(see YIELDS, page 7)

(YIELDS, from page 6)

DAP. Although control of these two weeds in the LPO experiment was not acceptable, yields from the Roundup Ultra treatments, which averaged 29 Bu/A, compared favorably with the 31 Bu/A yield from the PRE Broadstrike + Dual treatment. The untreated check in this experiment yielded only 5 Bu/A. These results are in agreement with previous studies from across the country that show early season competition has little, if any, effect on soybean yields if weeds are controlled within 4 to 5 weeks after planting.

Table 2. Weed control ratings and soybean 'APK1.6RR' yields with PRE and LPO (34 DAP) control programs at Aurora in1997.

PRE vs. LPO WEED CONTROL IN SOYBEANS

Herbicides	Rate Amt/A	When Appl.	% Control VELVE	% Control REPIG	% Control LAMBS	Yield Bu/A
Broadstrike + Dual	2.5 pt	PRE	99	100	97	31
Roundup Ultra	1.0 pt	LPO	75	27	89	29
Roundup Ultra	1.5 pt	LPO	65	53	85	31
Roundup Ultra	2.0 pt	LPO	73	50	97	29
Untreated	-	-	0	0	0	5
LSD (0.05)	-	-	12	21	11	6

(WINTER, from page 1)

above the ice in late January varied from a few inches to over 30 inches.

Early Spring Evaluation

Scientists working for Agriculture Canada have developed a method for evaluating low-temperature winter injury to alfalfa. Roots and crowns are evaluated as soon as the soil thaws out in the spring. Three criteria are used: bud vigor, root resistance to peeling, and root interior color. Bud vigor is rated from 1 (obviously dead, brown) to 4 (firm, white or pink). The root surface is scratched with a thumb nail and rated 1 (low), 2 (medium), or 3 (high) for resistance to bark peeling. Root interior color is rated from 1 (brown) to 3 (white or cream). A combination of the three criteria results in an estimation of winter injury due to low-temperatures.

Grasses are less susceptible to winter damage than alfalfa, but it is possible that there may be winter damage to grasses due to the ice storm, particularly with orchardgrass. The full extent of the perennial forage crop damage from the ice storm will not be fully realized until first harvest in late spring.

A SMALL GRAINS MANAGEMENT FIELD DAY has been scheduled for June 4, 1998 (9:30 am to noon) at Cornell's Musgrave Research Farm in Aurora. Please reserve this date on your calender and publicize the event in your extension newsletters, etc. This will be an informal meeting of persons involved in small grains production/processing/extension in New York State. All interested persons are welcome to attend. The focus of the meeting will be to view and discuss small grains management research in progress and its effect on future recommendations. We will apply for recertification credit for commercial pesticide applicators and certified crop advisors. As we plan for this event to meet the educational needs of New York's small grains industry, we welcome your suggestions for topics and speakers.

Calendar of Events

June 4	Small Grains Management Field Day, Aurora, NY
June 28 - July 1	Northeastern Branch ASA Annual Meeting, Amherst, MA
October 18-22	ASA, CSSA, SSSA Annual Meetings, Baltimore, MD
January 4-7	Northeastern Weed Science Society Annual Meeting, Cambridge, MA

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