



Northern NY Agricultural Development Program 2014-15 Project Report

Testing Alfalfa Cultivars and Germplasm for Winter Survival in Northern New York

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Background:

Winter survival is important for a perennial forage crop like alfalfa. Harsh winters typical of Northern New York (NNY) make winter survival as a trait in alfalfa cultivars essential. Loss of a high quality perennial crop from winterkill is an economic blow to producers where both time and money are lost to crop rotation and reestablishment costs. Some alfalfa cultivars have better winterhardiness than others and are better able to survive a truly harsh winter. However, alfalfa decline due to poor drainage and waterlogged soils will not be remedied by cultivars with superior winterhardiness.

Fall dormancy, measured as the amount of forage produced in the fall, has been used as a proxy for winter survival, such that cultivars that are more fall dormant and produce a lower amount of forage in the fall, have better winter survival. The fall dormancy rating scale is from 1 (dormant) to 9 (nondormant). The Cornell Integrated Field Crops Guide (<http://ipmguidelines.org/fieldcrops/>) generally states that alfalfa cultivars with fall dormancy ratings from 2 to 4 are well adapted to NYS climate.

Fall dormancy is a useful indicator of winter survival in a broad sense. However, forage breeders have been developing cultivars with more forage production in the fall that also claim to have improved winter survival. Genetic studies have shown that breeders should be able to develop alfalfa cultivars with both fall forage production and excellent winter survival (Castonguay et

al, 2006). Thus, cultivars that have fall dormancy ratings of 5 or 6 and have been bred for superior winter survival rating should be tested for survival in NNY.

Forage yield trials for alfalfa and other forages are planted by the Cornell Forage Breeding Project each year in New York State. Until 2003, all the cultivars entered were of fall dormancy 2, 3, or 4. Over the past 10 years, there has been a steady increase in the number of fall dormancy 5 cultivars entered in the trials (Figure 1).

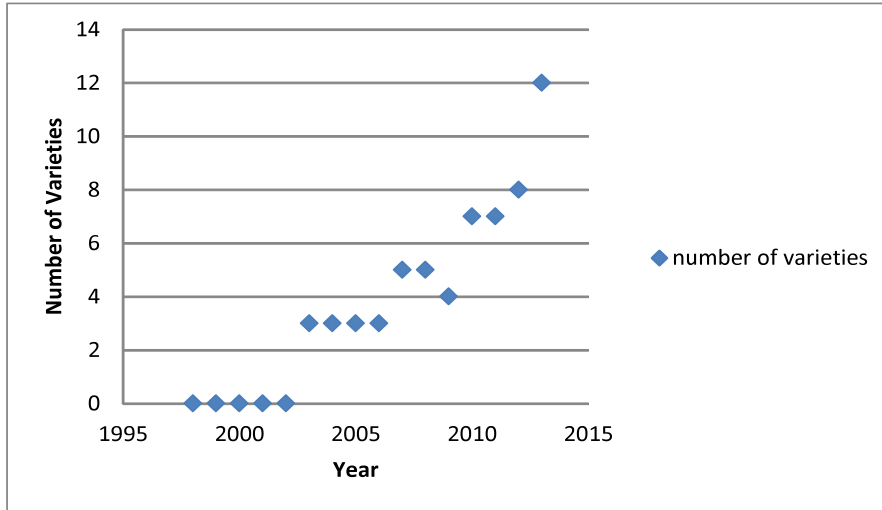


Figure 1: The number of alfalfa cultivars entered in the Cornell Forage Yield Trial program that are fall dormancy 5 cultivars for each year from 1998 and 2013.

The North American Alfalfa Improvement Conference has developed standardized tests for alfalfa that range from disease and pest resistance tests to agronomic tests like yield and fall dormancy (<http://www.naaic.org/resource/stdtests.php>). A test for winter survival was developed and has been used to describe alfalfa cultivars. Some tests are required by the National Alfalfa and Miscellaneous Legume Cultivar Review Board, but winter survival is not a required test. Thus, many cultivars are not rated for winter survival.

In Ithaca, we conducted the winter survival test for two winters (2001-2 and 2003-4). The test consists of planting replicated rows of alfalfa cultivars and germplasm along with rows of six check cultivars that range in winter survival from 1 (superior winter survival) to 6 (non-dormant). In the tests conducted in Ithaca, the check cultivars did not perform as expected so the data could not be used to assign winter survival ratings to the cultivars in the test. The check cultivars should increase in winter damage with almost no damage on the check cultivar 1 to dead plants for the check cultivar 6. A more northern location with more severe winters is needed to have a successful test of alfalfa winter survival. Furthermore it is important to develop confidence that the winter survival test is appropriate for NYS so that the winter survival ratings for cultivars are relevant to NNY conditions and useful for cultivar selection.

This grant report includes the results of the winter survival test that was planted Chazy in 2014 and the pre-winter plant counts for the 2015 planting at Chazy. The project will not be complete until the plants are rated in the spring of 2016.

Methods:

2014 Winter Survival Test:

The winter survival nursery planted in early June 2014 was evaluated on May 15, 2015. Each plant in four replicates of 27 rows of alfalfa populations or cultivars was given a visual rating from 1 to 5. The rating scale used was the scale described by North American Alfalfa Improvement Conference (<https://www.naaic.org/stdtests/wintersurvivalnew.pdf>).

RATING SCALE

1. No injury, plant has uniform, symmetrical appearance, all shoots are about equal in length
2. Some injury, the plant is symmetrical, but regrowth is slightly uneven
3. Significant injury, regrowth varies in length, reduced vigor
4. Severe injury, plant has sparse shoots, regrowth is very irregular, poor vigor
5. Dead plant

2015 Winter Survival Test:

For a second winter survival trial in 2015, a field at the W.H. Miner Agricultural Research Institute in Chazy, NY, was prepared for spring planting. In Ithaca at the greenhouses, seed of the six check cultivars, plus seed of 21 alfalfa populations/cultivars were prepared and planted so that there were at least 100 seedlings for each of the 27 populations/cultivars. In May, the seedlings were transported to Chazy and hand-planted into the field (Figure 1).



Figure 1: Transplanting the alfalfa nursery at Chazy in May 2015 to assess winter survival. Photo: R. Deubler.

The field was mowed, sprayed to control weeds and insects, and maintained throughout the year. The forage was cut on September 10 in order to provide the pre-winter stress. This project will not be complete until the plants are rated in the spring of 2016. The plant ratings are a number score for each plant in a row and the scale is from 1 (no injury) to 5 (dead).

Results:

NNY Trial Weather 2014-15 (Table 1)

From June 2014 to May 2015, there were two periods of time when it was likely that the weather negatively impacted plant growth and survival in the winter survival nursery. First, the alfalfa seedlings that were transplanted in early June did not grow as much as expected because from July to November the amount of precipitation was below normal. Secondly, the average winter temperatures were extremely low from January to March.

Table 1: Weather at Plattsburgh NY (~15 miles from Chazy) by month, June 2014 to May 2015, as a departure from normal.

Month	Year	Departure from Normal		Extreme Conditions
		Temp degrees F	PPT %	
June	2014	1 to 3	100 to 125	
July	2014	-1 to 1	75 to 100	
August	2014	-1 to 1	50 to 75	very
Sept.	2014	-1 to 1	50 to 75	dry
October	2014	3 to 5	75 to 100	
November	2014	-1 to 1	50 to 75	
December	2014	3 to 5	125-150	
January	2015	-5 to -3	100 to 125	
February	2015	-16 to -14	75 to 100	very
March	2015	-7 to -5	25 to 50	cold
April	2015	-3 to -1	75 to 100	
May	2015	5 to 7	75 to 100	

Winter Survival Nursery Planted in Spring 2014, Evaluated in Spring 2015

Of the 2687 plants in the alfalfa winter survival nursery, only 522 plants survived the winter of 2014-2015 (Table 2). Most of the plants transplanted in 2014 had died over the winter. For the plants that did survive, each one was given a rating from 1 to 4. Dead plants were rated 5.

For the plants that did survive, it is not clear whether they survived because they were more winter hardy than the other plants or if they survived because they happened to be planted in a part of the field that was more suitable for plant survival. Thus the data in Table 1 document the nursery results, but conclusions about winter survival ability among cultivars are not valid due to the extreme variability in the field and excessive plant death.

Winter Survival Nursery Planted in Spring 2015

The 2015 winter survival nursery was planted on May 14 and 15. The growing conditions were very good and the plants established well and grew quite tall. The nursery was cut on July 15 and again on September 10. The number of plants in each row were counted on November 16. All of the plants that were transplanted survived such that each row contained 25 plants. The nursery will be rated for winter survival in early to mid-May of 2016. The rating scale will be from 1 to 5 as described for the 2014 nursery.

Conclusions/Outcomes/Impacts:

Due to extremely cold weather conditions December 2014 to March 2015, the trial results were not useful for conclusions regarding winter survival of alfalfa cultivars in New York. The second trial in 2015 established well, and should result in information about alfalfa cultivars and winter survival that will be useful for all New York producers, but particularly for NNY producers. The ratings for the second trial will be taken in the late spring of 2016.

Table 2: Winter survival nursery planted at Chazy, June 2 and 3, 2014. Plant counts taken by M. Davis in November 2014. Plants were rated for survival in spring 2015.

Trial Entry	Seed Lot Number	Plant Count over reps 11/4/14	Plant Count over reps 5/15/15	Fall Dormancy	Winter Survival index	Winter Survival Category
ZG 9830	std check	100	14	2	1	Extremely winterhardy
5262	std check	100	22	2	2	Very winterhardy
WL325HQ	std check	100	35	3	3	Winterhardy
G-2852	std check	100	12	4	4	Moderately winterhardy
Archer	std check	98	16	5	5	Slightly winterhardy
Cuf 101	std check	100	0	9	6	Non-winterhardy
55Q27	NY13-55	97	16	5	unknown	
55V50	NY13-58	100	4	5	unknown	
FSG524	NY13-41	100	5	5	unknown	
WL363HQ	NY10-41	100	19	5	unknown	
Oneida Ultra	NY02-15	99	7	4	unknown	
Seedway 9558	NY08-20	100	36	3	unknown	
Vernal	NY09-45	100	13	2	2	
Ezra	NY09-41	96	16	3	unknown	
N-R-Gee	NY09-40	100	2	4	unknown	
Guardsman II	NY08-19	100	42	4	unknown	
ReGen	NY08-21	99	17	3	unknown	
Seedway 9558 SBR	NY13-46	100	34	4	unknown	
SW315LH	NY14-17	100	7	unknown	unknown	
NY1318 bulk	NY14-1	100	20	unknown	unknown	
NY1319 bulk	NY14-2	100	21	unknown	unknown	
NY1320 bulk	NY14-3	100	11	unknown	unknown	
NY1321 bulk	NY14-4	100	48	unknown	unknown	
NY1322 bulk	NY14-5	98	36	unknown	unknown	
NY1323 Bulk	NY14-6	100	26	unknown	unknown	
NY1324 bulk	NY14-7	100	22	unknown	unknown	
NY1325 bulk	NY14-8	100	12	unknown	unknown	

Table 3: Weather at Plattsburgh NY (~15 miles from Chazy) by month, May 2015 to February 2016 as a departure from normal.

Month	Year	Departure from Normal		Extreme Conditions
		Temp degrees F	PPT %	
May	2015	5 to 7	75 to 100	
June	2015	-3 to -1	>200	wet
July	2015	-1 to 1	100 to 125	
August	2015	1 to 3	75 to 100	
Sept.	2015	5 to 7	100 to 125	
October	2015	-3 to -1	75 to 100	
November	2015	3 to 5	75 to 100	
December	2015	12-14	150 to 200	very warm
January	2016	5 to 7	75 to 100	
February	2016	3 to 5	>200	wet



Figure 2: 2015 Alfalfa winter survival nursery, Chazy, NY, August 2015. Photo: J. Hansen

Outreach: The winter survival trial objective was discussed at the Cornell Cooperative Extension In-Service Meeting, November 3, 2015; results were not discussed because they did not improve understanding of alfalfa winter survival in NNY.

Next Steps: Additional winter survival nurseries need to be planted in NNY so results can guide producer’s alfalfa cultivar choices.

Acknowledgments: Cornell University Agricultural Experiment Station

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Literature Cited:

Castonguay, Y., Serge Laberge, E. Charles Brummer, Jeffery J. Volnec. 2006. Alfalfa Winter Hardiness: A Research Retrospective and Integrated Perspective. *Advances in Agronomy* 90:203-265.