THE RELATIONSHIP BETWEEN FALL DORMANCY AND STAND PERSISTENCE IN ALFALFA VARIETIES

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ABSTRACT

Fall dormancy (FD) has long been recognized as the most important single factor determining the adaptation of alfalfa varieties. In general, more dormant varieties tend to have better winter hardiness and persistence than less dormant cultivars; however, they also have less vigor, less late summer and fall growth and lower forage yield potential than the less dormant types. Field studies were conducted in Wisconsin, Minnesota, Oklahoma, Idaho and California where the relationship between fall dormancy, forage yield and persistence were evaluated. New lines were identified that had less fall dormancy, accompanied by higher forage yield, and better persistence than would be predicted based on their fall dormancy ratings.

Key Words: Alfalfa, Medicago sativa L., fall dormancy, persistence, forage yield.

INTRODUCTION

Fall dormancy (FD) in alfalfa is a reduction in plant height in response to reductions in day length and temperature. Fall Dormancy continues to be one of the most important single traits in determining the adaptation of an alfalfa variety. Several plant growth factors are related to (FD) including general plant vigor, speed of recovery following harvest, dry matter production, stand persistence, reaction to some diseases and it possibly indirectly influences forage quality.

The terms fall dormancy and winterhardiness have been used interchangeably for years. In fact, until recently, most ratings for winterhardiness were not direct measures of winterhardiness, but estimates based solely on fall dormancy score. This practice was based on historical data showing a close relationship between the two traits. Beginning in the late 1980s many alfalfa breeders began searching for genotypes with an atypical relationship between fall dormancy and winterhardiness - plants with more winterhardiness than would be predicted by fall dormancy. At Forage Genetics this was done by selecting for rare late fall dormant types in long term stress nurseries in Wisconsin. Early results from such selection suggested that it was possible to change the relationship between these two traits (McCaslin et.al., 1990).

For many years it has been recognized that reduced levels of FD are generally associated with increased plant vigor, earlier maturity, increased rates of recovery following harvest,

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increased yield potential which is influenced by the increase in vigor and of course greater use of the longer growing season in southern latitudes. Unfortunately, reduced levels of FD are also known to be associated with negative factors such as lower levels of tolerance to freezing winter temperatures, water saturated soils in central California and possibly reduced stand life in general. Additionally, in central California increased winter growth associated with less fall dormant varieties possibly renders them more sensitive to Sclerotinia as the abundant foliage that is produced provides a favorable environment for development of the disease during wet winter months. Obviously, removal of this forage through some form of harvesting would greatly reduce this problem.

Significant changes are taking place regarding areas of adaptation for most FD classes. There are now varieties of FD 4 that have the winter hardiness more typical of FD 3 types; in the Sacramento Valley of California the varieties of choice 15-20 years ago were of fall dormancy groups 5-6 (Lahontan and Lahontan types). Today varieties of dormancy groups 6-7 seem to be favored. They have the increased vigor and yield associated with their respective FD groups and also have persistence equal or superior to the more dormant varieties used 20 years ago. Varieties with FD 6-7 and even 8-9 are performing well in areas of the Intermountain West that a few years ago were almost exclusively growing areas for FD 3-4 types. We are seeing varieties with FD 9 that are yielding and persisting well in the Central Valley of California and new FD 10 types are demonstrating improved forage yield and good persistence in the Imperial Valley.

The presentation which follows is a follow-up to a report given at last years California Symposium on changes in fall dormancy, persistence and forage yield in alfalfa.

PROCEDURES

Fall dormancy, winter survival, persistence and forage yield estimates were made under field conditions in Wisconsin, Minnesota, Idaho, Oklahoma and California (table 1).

RESULTS AND DISCUSSION

Field trials in Wisconsin indicate that the strong negative relationship between later fall growth and winter injury has been altered. New experimental varieties exhibited less winter injury and better persistence than would be predicted based on their fall growth habit.

Table 1. Fall dormancy, winter hardiness ratings, forage yield and % stand for alfalfa varieties averaged over five mid-west locations.

Variety	FD	WH[2]	Yield[3] year 1	Yield year 2	Yield year 3	% stand year 3
FG 3L19	3.5	1.9	105.8	110.6	114.1	87
FG 3L20	3.7	1.5	106.6	110.2	114.8	92
DK 127	3.0	2.3	102.8	103.1	103.2	79
Innovator+Z	2.9	2.7	96.5	95.2	96.6	80
Magnum IV	4.0	3.6	98.3	100.3	99.9	76
Rushmore	3.9	3.2	102.4	102.4	100.5	74
P.5312	3.3	2.9	99.8	97.9	99.8	72

[1]FD=Fall dormancy based on fall growth in October following transplanting to field in May 1995 (Wisconsin).
[2]WH=Winter hardiness based on plant survival May 1996 (Wisconsin). 1= best survival; 6= least.
[3] Yield expressed as % checks 5 location mean (locations W.Salem, Madison, Marshfield and Spencer,WI, and Owatonna, MN.

Table 2. Fall dormancy, winter hardiness ratings, regrowth and yield of alfalfa varieties averaged over three locations (Nampa, ID, West Salem, WI and Stillwater, OK).

Variety	FD[1]	WH[2]	Rgw[3]	Yield[4] WI	Yield ID	Yield OK	Yield avg
FG 5R80	5.8	2.8	8.2	105	100	101	102
FG 5R81	5.8	2.8	9.0	107	109	103	106
FG 5R82	4.8	3.2	8.9	112	104	104	107
Magnum IV	4.0	3.6	7.0	93	96	--	95
Rushmore	3.9	3.2	7.0	99	93	102	98
P.5454	4.0	3.1	6.7	98	95	97	97

[1] FD=Fall dormancy based on fall growth in October following transplanting to field in May 1995 (Wisconsin).
[2]WH=Winter hardiness based on plant survival May 1996 (Wisconsin). 1= best survival; 6=least.
[3]Rgw= Amount of regrowth 2 weeks after cutting 10 = most vigorous, 1 = least vigorous.
[4]Yield expressed as % checks

Significant changes are also taking place regarding the areas of adaptation for alfalfa in fall dormancy groups 6-9. Some FD 8, 9 and 10 varieties are demonstrating good performance in the Treasure Valley, Sacramento and Imperial Valleys (Tables 4-6).

Table 4. Fall Dormancy, percent stand and forage yield (DM T/A) of FD types 4-9 at Nampa, ID[1].

Variety	FD[2]	%Stand[3]	1998 Yield	95-98 Yield
UN 1718	8	83	7.14	32.41
Beacon	9	60	6.77	32.13
DK 189	8	55	6.38	30.68
WL 457	7	50	6.25	28.86
P. 5888	8	45	6.23	28.49
Tahoe	6	50	6.21	29.53
WL 516	8	53	6.09	29.27
Archer	5	50	6.06	27.50
P. 5683	7	55	6.05	28.07
P. 5715	8	45	5.97	28.61
Condor	8	43	5.54	27.03
Rushmore	4	50	5.36	26.56
CUF 101	9	30	4.88	24.62
mean		48	5.98	28.77
lsd .05		9	0.48	1.62
cv%		13%	6%	4%

[1] Trial seeded September, 1994.
[2] FD=Fall dormancy based on fall growth in October 1 = most dormant, 9 = least dormant.
[3] % Stand = Stand measurements taken May, 1998.

Table 5. Fall Dormancy (FD) and percent stand (April, 1998) at Stockton, CA. [1]

Variety	FD	% Stand
Beacon	9	78
Express	6	68
Kern	8	65
Coronado	9	63
P.5683	7	63
Tahoe	6	63
Class	3	55
DK 189	8	55
Sutter	7	53
P.5715	8	40
Pike	5	38
WL 516	8	38
WL 457	7	38
P.5888	8	35
Pierce	8	35
Condor	8	30
CUF 101	9	30
mean		54
lsd .05		23.4
cv%		31%

[1]Trials planted October, 1993.

Table 6. Yield (T/A) of FD types 8-10 in Imperial Valley and Central California

	Imperial Valley	Visalia
FD type	T/A 1995-96	T/A 1994-95
FD 10	24.7	18.9
FD 9 (new)	22.2	19.7
CUF 101	22.1	18.4
FD 8(new)	20.1	19.1
FD 6	16.6	18.4
FD 4	11.3	15.9
mean	19.4	18.2
lsd .05	1.9	0.95
cv %	7.2	3.7

In summary, traditional views of dormancy and adaptation of alfalfa varieties are changing. Less dormant types are showing greater stand persistence under a wider range of growing conditions than would have been expected in the past. This is true for both "dormant" and "non-dormant" alfalfa. Improved forage yield is often associated with the less dormant types. As part of our continuing genetic improvement program we are working to improve the forage quality of these higher yielding less dormant types.

McCaslin, M, D. Brown, H. Deery and D. Miller. 1990. Fall dormancy and winter survival - variation within and between populations. Report of the 32nd North American Alfalfa Improvement Conference - Pasco, Washington.