Characterization of a Certified Alfalfa Cultivar: Importance and Evaluation of Fall Dormancy

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ABSTRACT

Certified alfalfa cultivars must go through rigorous evaluation during development. Documentation of characteristics such as fall dormancy, disease and insect resistance and pedigree is required to insure trueness of type. Each of these evaluations must by conducted according to standard testing procedures. These criteria are determined by the National Alfalfa Variety Review Board, and they are constantly under review. One trait that is currently being reviewed is fall dormancy. This past year the check cultivars were replaced because of concerns about the consistency of their performance. We are currently evaluating the new check cultivars to determine their performance across the very diverse production environments in California.

Index words: Alfalfa, Lucerne, Medicago sativa L., fall dormancy, natural plant height, adaptation, check cultivars

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Fall dormancy is defined as the reduction in growth during the fall that is associated with reducing daylength (photoperiod) and temperature. Alfalfa scientists generally agree that fall dormancy is the most important single factor in determining the adaptation of an alfalfa cultivar. For many years fall dormancy trials have been conducted at the University of Minnesota. Alfalfa breeders from throughout the world enter experimental materials in these trials to determine fall dormancy.

Evaluation procedure: Fall dormancy trials at the University of California, are established in single row plots on 30" centers. Each plot is 25' in length separated by a 5' alley. Individual plants within a plot are 18" apart. Seeding occurs on approximately May 1, except at Imperial where seeding occurs about March 20. When plants reach the second or third trifoliolate leaf stage the plot is thinned to the spacing above. Watering is adequate for a forage production field. The first clipping, if taken, should occur between July 1 and July 15 (no data are to be taken at this time). The plot will remain well watered and weed and rodent free until: September. 7, Tulelake; October 3, Davis; October 23, Imperial . On these

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respective dates, the study is uniformly clipped to 5 cm (2"). Irrigation continues in amounts appropriate for forage production. Three and one-half weeks after clipping individual plants are evaluated for fall growth on a 1 to "n" scale. Each increment in the scale is equal to 2 inches of growth, measured as natural plant height (NPH). Natural plant height takes into account both the length of the stem and the angle at which it is growing. Average scores are reported relative to the check cultivar.

Need to evaluate fall dormancy in multiple environments: In recent years it has become increasingly clear that all cultivars do not respond to daylength and temperature changes in the same manner (Table 1). Data obtained at Davis show that the average cultivar scores an average of two scoring classes shorter when evaluated in October than when evaluated in September. However, cultivars like CUF101 and Lahontan change much more than the average, and cultivars like Mesilla and Ranger respond much less than the average cultivar. This has the effect of reducing the difference between cultivars and may change the ranking of cultivars. The dormancy group to which a new cultivar is assigned is determined is based on its ranking relative to the check cultivars. Thus these data suggest that the dormancy group that a cultivar is assigned could be highly dependent on the time of year that the trial is evaluated.

Table Fall dormancy scores of standard check cultivars on two different dates when evaluated at the University of California, Davis.

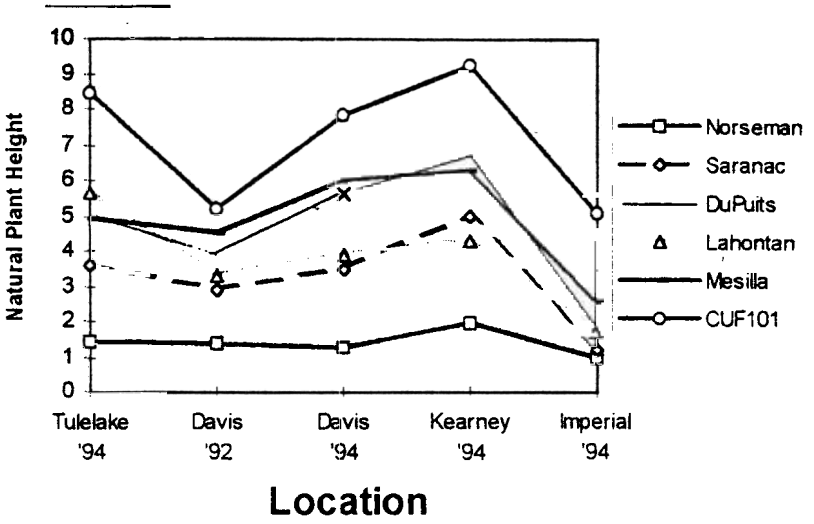
	Time of evaluation		
Check Cultivar	September	October	Difference
	---------- Score -		----- -----
Norseman (1)*	2.3		1.2
Vernal (2)	5.1	4.0	1.1
Ranger (3)	5.5	4.8	0.7
Saranac (4)	6.2	4.4	1.8
Lahontan (6)	8.1	5.0	3.1
Mesilla (7)	8.3	7.8	0.5
Moapa 69 (8)	9.9	7.7	2.2
CUF101 (9)	12.4	8.9	3.5
LSD 0.05	1.74	0.48	
CV(%)	15.5	11.0	

* values in parentheses indicated the dormancy class of the check cultivar

Dormancy trials conducted at the University of Minnesota, and other locations, seed to control the impact of the environment by conducting the evaluations according to the same protocol every year. That is, the trials were clipped around the beginning of September each year and scored in 25 to 30 days.

None the less, Minnesota offesr only one environment for evaluation. We have also determined that even when evaluation is conduced at the same time every year, differences exist among cultivars in their response to the conditions that exist across a series of locations (Figure 1).

Figure Relative fall dormancy ranking of selected check cultivars when evaluated at different locations in California.



These differences in fall dormancy response can lead to classifications that are appropriate in one environment that are not appropriate in another environment. Evaluation of fall dormancy in a single year and/or a single location has led to misclassification of some cultivars. These misclassifications are rarely major errors. The problems arise in trying to distinguish among similar dormancy groups. However, under the right set of circumstances these differences can have undesirable consequences such as winter kill or lack of production when growers purchase a cultivar that claims to be in a dormancy group that later turns out to be incorrect - at least in that location.

Evaluation of fall dormancy in a single year and or a single location, such as Minnesota, has in the past led to misclassification of some cultivars. These misclassifications can lead to winter kill or lack of production when growers purchase a cultivar that claims to be in a dormancy group that later turns out to be incorrect - at least in that location.

Additionally in recent years, it has been observed in both public and private fall dormancy trials that the "old" standard check cultivars (Norseman (1), Vernal (2), Ranger (3), Saranac (4), DuPuits (5), Lahontan (6), Mesilla (7), Moapa 69 (8), and CUF101 (9) have been producing inconsistent data from year to year and location to location. This past year, a new set of check cultivars was adopted with three different cultivars representing each fall dormancy group, but again these were based primarily on data produced in the Midwest. Such data may or may not be predictive of fall growth characteristics in California. All

commercially available cultivars will be assigned to a fall dormancy group based on their performance relative to these check cultivars. Often this assignment will be based on a single (one year one location) test. Furthermore, this test is not conducted in one standard location for all cultivars.

To alleviate this problem, we have initiated a program to evaluate fall dormancy at three locations in California (Intermountain Research and Extension Center, Tulelake, CA - 41°53'N, Mean Temp. 44.2°F; the Agronomy and Range Science Field Research Facility Davis, CA - 38°32'N., Mean Temp. 60.3°F; and the Desert Research and Extension Center, Imperial , CA - 32°48'N, Mean Temp.72.7° F)., Davis, Imperial). The significance of these evaluations from an academic perspective is limited to determining the consistency of fall dormancy rating of a diverse set of standard check cultivars that are used throughout the United States, but that have not been rigorously evaluated in a widely diverse set of environments. First year testing of these new cultivars indicates that the list of cultivars may again need modification (Table 2).

The significance of this test to the growers in California is that fall dormancy is the single most important factor influencing adaptation - and from that perspective, can have dramatic impact on production. When coupled with the results of cultivar trials, and published pest and disease reactions, this information can be extremely valuable in choosing among potential cultivars for a particular production area.

It must be emphasized that while the test is not perfect and some misclassifications do occur, these misclassifications are rarely major. The consequences of ignoring the fall dormancy of a cultivar is far greater than the potential for damage resulting from miss classification. Furthermore reliable information on both fall dormancy and pest and disease reaction is only available when purchasing seed of a certified cultivar.

Table 2. Preliminary Fall dormancy scores for new standard check cultivars evaluated at Davis and Imperial California for one year.

Fall Dormancy Group	Old Check Cultivar	New Check Cultivars	Location	
			Davis	Imperial
			--- Score ---	
9	CUF101	5929	5.62	6.05
		Mecca	5.60	6.51
		CUF101	5.36	6.10
8	Moapa69	Yolo	5.13	--
		Maricopa	5.07	4.16
		WL 525 HQ	5.05	5.03
		Pierce	5.02	5.14
		5715	4.48	4.62
7	Mesilla	Dona Ana	4.65	4.14
		Sutter	4.15	3.71
6	Lahontan	ABI 700	4.31	3.50
		Meteor	3.64	2.12
5	DuPuits	Pike	4.21	3.03
		Archer	3.94	3.61
		Belmont	3.06	2.77
4	Saranac	Saranac	2.97	2.68
		Cutter	3.34	2.86
		Legend2.86	1.83	
3	Ranger	5246	3.24	1.75
		Oneida VR	2.92	2.22
		Ranger	2.68	1.46
2	Vernal	526	2.94	1.50
		Vernal	2.67	1.52
		Profit	2.66	1.54
	Norseman	Maverick	1.49	1.33
		Beaver	1.46	1.33
		Norseman	1.21	1.17
		$LSD_{0.05}$ =	0.63	0.75
		CV%	11.2	14.3