ALFALFA DISEASES AND STEM NEMATODES: WHAT ARE THE EFFECTS OF EQUIPMENT AND VARIETIES

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ABSTRACT

Physical damage to alfalfa plants by machinery and/or grazing pressure appears to be an important factor in yield and stand reduction. Recent studies have demonstrated that there are significant varietal differences in yield and persistence when alfalfa varieties are subjected to normal farming practices. This reduction for the most part has been attributed to crown and root damage that is the result of farming and/or harvesting equipment. The recent development of "Grazing Tolerant" and more recently "Traffic Tolerant" alfalfa varieties has demonstrated that "real world" field selection for superior field tolerant plants can result in enhanced varietal performance. Much of this improvement may be attributed to genetic selection of plants better suited to withstand the rigors of actual production practices. Undoubtedly, some of these factors would include resistance to livestock grazing pressure and/or the effect of farm equipment on the health of the plants in the field.

Additional studies have shown that the spread of nematodes within and between alfalfa fields can be attributed in most cases to farm equipment. Studies have also shown that vascular root diseases may be more severe in the presence of nematodes. "Real world" field selection for nematode resistance may also enhance resistance to some vascular root diseases, since damage by nematodes to the exterior of the plant may provide an entrance wound for these diseases. This may result in the breakdown of the plant's resistant mechanism to these pathogens. Improved management and cultural practices, when combined with nematode resistant genetic lines**,** can be useful in limiting yield and stand reductions due to nematode damage.

Key words: Alfalfa, Grazing tolerance, Mechanical damage, Traffic Tolerance, Crown Rot, Nematodes, Alfalfa Diseases, Field Resistance, Equipment

EFFECT OF EQUIPMENT AND VARIETIES ON ALFALFA DISEASES

Alfalfa breeders, public and private, have done much work in the past 50 years to improve today's newest alfalfa cultivars. Resistant levels are continually improving for an expanding list of pests that limit yield, quality, and/or persistence. Much of the breeding work in the past, has been by direct selection for pest resistance in the greenhouse under artificial environments. This method has been very successful in improving cultivar resistant levels because large numbers of plants could be exposed to a pest in a controlled environment, and resistant plants could be easily identified.

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Improved genetic resistance by this method has greatly improved varietal performance in the field. Alfalfa breeders in recent years however, have learned that further selection for the pests, under "real world" field conditions may also further enhance the performance of new varieties. Genetic varietal resistance to various pests may be influenced by other factors that only occur under field conditions. These factors can include, livestock grazing (seasonal or yearlong), and mechanical damage from harvest equipment, as well as many other farming or management related practices. This equipment related damage may result in plant mortality as the result of disease complexes not normally selected for in conventional breeding programs The recent development of grazing tolerant and traffic tolerant varieties has demonstrated that "real world" field selection as an addition step in germplasm improvement may result in enhanced varietal performance in actual field production situations. One example is that physical damage to alfalfa crowns by machinery or grazing pressure appears to be an important factor in crown rot disease infection and eventual stand decline in alfalfa production fields. Advanced breeding lines of grazing and more recently traffic tolerant varieties have displayed increased Phoma crown rot resistance as result of this type of field selection. (Table 1). These new varieties have also shown increased yield and persistence in actual field conditions (Table 2 & 3). Advanced selection of germplasms in "real world" environments may be an additional means of increasing varietal pest resistance to diseases influenced by production rated factors. Germplasms subjected to this type of selection pressure have also displayed higher food reserves in the root (Total Non-Structural Carbohydrates), resulting in higher yields and persistence when compared to similar unselected populations (Table 4)[2].

EFFECTS OF EQUIPMENT AND VARIETIES ON NEMATODE DAMAGE

It is well documented that extent and severity of nematode damage in the field can be influenced by many factors besides just a varieties genetic resistance to a specific nematode. The spread and distribution of nematodes throughout a field or from field to field is generally the result of mechanical movement by farming equipment and/or irrigation (Figure 1 & 2). Without the aid of external forces, Nematodes can only move 1-2 inches in the soil within a year's time.

This is evidenced by the small circular stunting patterns seen in the field because of the initial infestation. Cultivation, mechanical movement of equipment, and/or water movement through those infested circles often results in a streaking pattern of nematode damage radiating from the original nematode source. Thus spreading the nematode throughout the field.

Table 1. Increased Crown Rot Resistance (Due to Selection for Mechanical damage to Crown?)

	Phoma Crown Rot Res.
ABI Experimental	84
ABI Experimental	80
Amerigraze 401+Z	61
Alfagraze	60
Affinity+Z	35
Vernal	30

Increasing Cycles of Selection for grazing and/or traffic tolerance

Table 2.

University of Wisconsin – Arlington Research Station 3-Year Results

Variety	Brand	Annual Yield tons/acre
AMERISTAND 403T	Traffic Tolerant Variety	7.12
Variety 1	Non-Traffic Variety	6.96
Variety 2	Non-Traffic Variety	6.65
Variety 3	Non-Traffic Variety	6.62
Variety 4	Non-Traffic Variety	6.51
Variety 5	Non-Traffic Variety	6.45
Variety 6	Non-Traffic Variety	6.37
Variety 7	Non-Traffic Variety	6.22
Variety 8	Non-Traffic Variety	5.81
Variety 9	Non-Traffic Variety	5.53

In the first 3-year independent University study of yield under wheel traffic, AmeriStand 403T demonstrated exceptional yield and yield persistence. Data from this trial, seeded in 2000 by the University of Wisconsin at Arlington, also showed how AmeriStand 403T widened its yield advantage from year one to year two. In this trial, **AmeriStand 403T increased its annual yield advantage versus the average of all competitors by 20% (from 2000 to 2001)**. In our trial at Ames, IA, AmeriStand 403T increased its annual yield advantage by 29% (from 2000 to 2001). Traffic on first year stands can cause very large yield reductions in conventional varieties.

Table 3. More persistence under any kind of traffic

AmeriStand 403T Traffic Tested™ genetics yield more under any type of traffic. Following are results from a 3-year study conducted by Iowa State University that show the superior plant health and persistence of AmeriStand 403T. Intensive grazing is even more abusive on alfalfa stands than wheel traffic. In test after test, we have seen how our Traffic Tested genetics outperform conventional varieties.

Iowa State University Animal Traffic Trial - % initial stand after 3 years of intensive grazing					
Rhodes, Marshall County, Rhodes Research Farm - Planted 14 April 2000; 4 x 5 Lattice, 6 reps					
		% Stand			
Entry	**Brand**	**10/3/2000**	**10/3/2001**	**10/15/2002**	**% Initial**
AmeriStand 403T	**America's Alfalfa**	**96**	**76**	**45**	**47**
5454	Pioneer	95	51	11	12
WL 323	WL Alfalfa	97	65	10	10
54Q53	Pioneer	100	62	8	8
Rebound 4.2	Croplan Genetics	96	62	6	7
Magnum V	Dairyland Seed	96	65	7	7
GH 757	Golden Harvest	100	58	7	7

Table 4. **More energy for yield and persistence**

Univ. of MN – Root Energy Comparisons – 3 Year Averages (TNC = total nonstructural carbohydrates)		
Variety	**Avg. % TNC**	**AmeriStand 403T % Root Energy Advantage**
AmeriStand 403T	**22.3**	
Pioneer 54Q53	19.82	13%
Magnum V	15.40	45%
FQ 315	13.79	62%
WL 323	13.74	63%
Geneva	12.60	77%
Rebound 4.2	12.07	84%
Pioneer 5454	12.05	84%
DK 140	10.99	103%
GH 757	10.58	110%
More root energy means more fuel for re-growth after cutting and winter survival.		

Figure 1: *Initial Circle Pattern of Nematodes in hay field.*

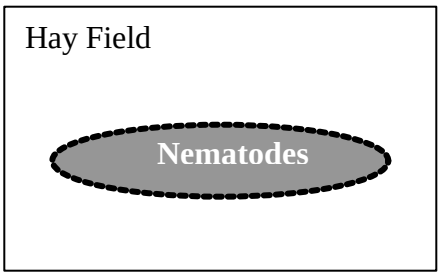
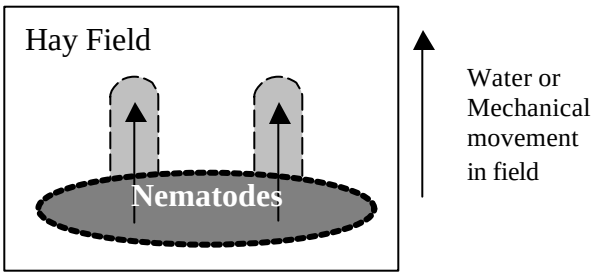


Figure 2: *Irrigation or Mechanical movement of Nematodes.*



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