REACTION OF ALFALFA CULTIVARS TO THE ROOT LESION NEMATODE *PRATYLENCHUS PENETRANS*

S.L. Hafez[1], P. Sundararaj[1] and D. Miller[2]

[1] *Parma Research and Extension Center, 29603, U of I Lane, Parma, Idaho 83660, USA*
[2] *Senior Alfalfa Breeder, ABI Alfalfa, Nampa, ID 83653, USA*

Summary. Fourteen alfalfa cultivars were evaluated for their reaction to the root lesion nematode *Pratylenchus penetrans* in a glass-house. Significant differences were observed among the cultivars in shoot and root weight and nematode population densities. In the cvs ZC 9640A, ZG 9840, ZG 9941A, ZH 9930H and ZX 9959 the number of specimens of *P. penetrans* per root and gram of root was significantly less than in the susceptible control (cv. Baker) and similar to the resistant control (cv. MNGRN-16). Moreover, nematodes in the cv. ZX 9930H were significantly less than in the resistant control. Therefore, these cultivars can be considered resistant and useful to control *P. penetrans* in the Pacific North-west of the USA.

Key words: *Medicago sativa*, resistance.

Alfalfa (*Medicago sativa* L.), which is an essential fodder crop and source of protein, is susceptible to several species of plant parasitic nematodes (O'Bannon and Esser, 1988; Öztürk, and Enneli, 1995; Mani *et al*., 1997). As a result, yield potential and quality of the crop are significantly reduced. Among these nematode parasites, the root lesion nematode, *Pratylenchus penetrans* (Cobb) Filipjev *et* Schuurmans Stekhoven, is a major constraint in the production and productivity of the crop ((Hafez and Mousa, 1997). Several management practices, such as biological control (Samac and Kinkel, 2001), chemical control (Thompson and Willis, 1970; Thies *et al*., 1992), and late seeding into clean fallow (Thies, 1989), have been developed to control *P. penetrans* in the field. Exploitation of plant resistance is a non-chemical approach with good potential and a few commercial cultivars of alfalfa resistant to the *P. penetrans* have been developed (Hafez *et al*., 2000). Cultivars reported as resistant in a given location may not be resistant to lesion nematodes in another location. This may be attributed to many factors, such as differences in the species specificity and their virulence (Viglierchio, 1978). Although more studies have been carried out on nematodes and alfalfa (Christie and Townshend, 1992), limited information is available with respect to cultivars resistant to lesion nematodes. Previous studies indicated that a few alfalfa cultivars were resistant to *P. penetrans* and that others were tolerant and supported moderate numbers of nematodes without a reduction in shoot and root weights (Hafez *et al*., 2000). The current investigations were carried out to determine the reaction of selected alfalfa cultivars to *P. penetrans* under glass-house conditions.

MATERIALS AND METHODS

Fourteen new alfalfa cultivars were tested for their reaction to *Pratylenchus penetrans* in a glass-house maintained at 25-30 °C throughout the experiment. The cvs Baker and MNGRN-16 were used as susceptible and resistant control, respectively (Barnes *et al*., 1990). The cv. ZC 9842A had already been screened against *P. penetrans* by earlier workers (Hafez *et al*., 2000) but, in order to confirm its reaction to *P. penetrans*, the same cultivar was included in the current experiment. Plastic cones of 150 ml capacity were filled with sterilised soil (sand and silt, 1:1) and five seeds of each alfalfa cultivar were sown in each cone. After germination, seedlings were thinned to three per cone and inoculated with a population of *P. penetrans*, isolated from corn roots at Parma, Idaho, and reared on alfalfa callus culture (Krusberg, 1961), at the rate of 100 nematodes per container. Seven weeks after sowing, fertilizer (20-20-20) was applied and other standard cultural practices were carried out regularly. Fifteen weeks after sowing, plants were uprooted and nematode population densities in the entire root system and 500 cm^3 of soil were determined using the mistifier technique (Southey, 1970) and Cobb's decanting and sieving technique (Cobb, 1918), respectively. Data on dry weight of roots (after nematode extraction) and shoots were also recorded.

RESULTS AND DISCUSSION

Significant differences were observed between the susceptible (cv. Baker) and resistant (cv. MNGRN-16) controls and among the fourteen new cultivars in plant weights and nematode population densities. Root and

Table I. Dry shoot and root weights and mean nematode population densities of the alfalfa cultivars inoculated with *Pratylenchus penetrans* and harvested 15 weeks after sowing.

Alfalfa cultivar	Dry weight (g)		Nematode population density			
	Shoot	Root	Soil (per cone)	Per total root	Per g root	Total (soil+root)
Baker (Susceptible)	5.588 ab	3.80 bc	282 ab	114 b	31.6 a	396 ab
MNGRN – 16 (Resistant)	4.162 d	4.56 abc	194 cd	62 cde	14.6 bc	256 ef
Archer II	5.066 abcd	3.94 bc	190 cd	94 bcd	24.0 ab	284 def
ZC 9640A	5.872 ab	5.82 a	272 ab	34 ef	6.4 cd	306 cde
ZC 9842A	5.524 abc	3.96 bc	134 ef	108 bc	27.6 a	224 fg
ZC 9940A	5.492 abc	4.70 abc	290 ab	110 b	24.4 ab	400 a
ZC 9941A	5.386 abc	4.52 abc	278 ab	96 bcd	22.4 ab	374 abc
ZC9950A	5.752 ab	4.70 abc	302 a	106 bc	22.4 ab	408 a
ZG 9840	5.922 a	4.34 bc	112 ef	42 ef	10.4 cd	154 g
ZG 9941A	5.450 abc	5.20 ab	314 a	40 ef	7.8 cd	354 abcd
ZH 9841H	4.488 cd	3.68 c	88 f	88 bcd	25.0 ab	176 g
ZH 9930H	6.034 a	4.14 bc	264 ab	56 de	13.8 bc	320 bcde
ZX 9344	4.820 bcd	3.94 bc	298 ab	108 bc	27.8 a	406 a
ZX 9940A	5.534 abc	4.40 abc	152 de	8 f	2.0 d	160 g
ZX 9959A	5.186 abc	4.16 bc	282 ab	62 cde	15.2 bc	344 abcd
ZX9569A	5.898 ab	4.80 abc	240 bc	160 a	33.4 a	400 a

total nematode population densities revealed different reactions of the alfalfa cultivars to *P. penetrans*. In general, shoot and root dry weights of the different cultivars were rather similar and little greater than those of the susceptible control cv. Baker. However, the cv. ZH 9841H had a shoot dry weight less than that of cv. Baker and similar to that of the resistant control cv. MNGRN-16, and cv. ZC9640A had a root dry weight larger than that of the susceptible control but similar to that of many other cultivars, including the resistant control. More interesting are the data on nematode populations in the soil. They were much larger for the susceptible control cv. Baker than for the resistant control cv. MNGRN-16. Soil nematode density was least in the cones planted to cv. ZH 9841H and was significantly less than the two controls in the cones planted to cvs ZC 9842A, ZG 9840, and ZX 9940A. Moreover, the nematode population in the cones planted to Archer II was similar to that of the resistant control. In the roots, nematode densities were least in the cv. ZX 9940A. They were also less than those of the susceptible control, and similar to the resistant control, in the cvs ZG 9840, ZH 9930H, ZX 9959A, ZC 9640A and ZC 9640A.

Reduction of nematode population densities in the roots and increase in the shoot and root weights of the cultivars suggested the existence of a relationship between these two parameters. Ostrander *et al.* (1992) found that in the presence of *P. scribneri* there was a significant difference in root weight between susceptible and resistant alfalfa cultivars. Studies conducted by Nelson *et al.* (1985) confirmed the variability among alfalfa lines and progenies for resistance and susceptibility to *P. penetrans*. This agrees with the report of Hafez *et al.* (2000), who found tolerance in two cultivars, ZN 9541 and ZN 9651, to *P. penetrans*.

Thies *et al.* (1995) reported that when alfalfa populations selected for resistance to *P. penetrans* were compared with susceptible cultivars they showed greater stand density and fewer nematodes per gram fresh weight. Therefore, the cvs ZG 9840, ZH 9930H, ZX 9959A, ZC 9640A, ZC 9640A and ZX 9940A can be considered resistant, as the number of *P. penetrans* per gram of their roots (2-15.2) was less than in the susceptible control (31.6). The cv. ZX 9940A was the best overall.

The resistant cvs ZH 9930H and ZG 9840 also possess good agronomic traits, such as the greatest shoot dry weights, and therefore represent an additional option for *P. penetrans* control in the Pacific North-west of the USA.

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