EFFECTS OF VESICULAR-ARBUSCULAR MYCORRHIZAE AND SEED SOURCE ON GROWTH OF NURSERY-GROWN JUGLANS NIGRA L. SEEDLINGS

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Abstract.--Measurements taken during the nursery phase of this experiment indicate that inoculation of black walnut with Glomus spp. stimulates height growth of seedlings. Moreover, the degree of stimulation was found to vary considerably depending on host genotype and in some instances inoculation appeared to inhibit growth. The host genotype X fungal genotype interaction was highly significant for height growth (p>.01). Inoculation treatments had a significant effect on seedling top weight, although there was no significant interaction between genotype and mycorrhizal symbiont. Caliper growth, number of first order laterals > 2mm, and root volumes were not affected by mycorrhizal inoculation. These early results indicate that proper matching of host and symbiont is important and can result in the improvement of bare-root seedling quality. Field trials are now underway to determine if nursery inoculation is beneficial to seedlings following outplanting.

MATERIALS AND METHODS:

A randomnized split-plot design was used in this experiment. The main plots were mycorrhizal fungi inoculation treatments (Glomus intraradicies, Glomus etunicatum, and non-inoculated) with black walnut genotypes (11 genotypes) as the sub-plots. The experiment was replicated 3 times. For each main plot, fungal inoculum in a sterile sand carrier (obtained from NPI Inc., Salt Lake City, Utah) was spread evenly in fumigated nursery beds on April 30, 1988 and then incorporated to a depth of 6" with a walk-behind front-tine tiller. The tiller and other equipment and clothing were disinfested using a 10% clorox solution before continuing to the next plot. A 10 ft. buffer zone separated each main plot to prevent cross contamination of mycorrhizal fungi. Nuts were planted on 4" X 4" spacings. Seed sources were separated within a plot by wooden lathe to insure genotype identification. The seedlings received water under standard operational procedures at the George 0. White state nursery in Licking, MO. Seedlings received foliar application of urea 6 weeks following germination. Seedlings were lifted December 20, 1988 and sorted according to genotype and analyzed for height, caliper, and number of first order lateral roots > 2 mm. Data was analyzed using analysis of variance and Least Significant Differences (LSD).

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RESULTS:

Main-plot treatments resulted in significantly greater height depending on the specific black walnut provenance. Rankings of seed source height growth was not consistent across mycorrhizal treatments (Table 1). For example, seed source 4 (52.53 cm) ranked first in the G. etunicatum treatment and eighth in the G. intraradicies treatment. Seven provenances were found in which Glomus spp. had a significant effect on height growth (Table 1).

Table 1.--Height response (cm) of 11 black walnut genotypes to mycorrhizal inoculation.

	Treatment					
Provenance	Control		G.etunicatum		G.intraradicies	
2	(6)	45.02	(7)	44.79	(10)	42.25
3	(2)	51.44	(6)	44.96	(3)	52.42
4	(9)	40.13	(1)	52.53	(8)	47.84
5	(3)	51.00	(5)	44.98	(2)	54.89
6	(8)	42.62	(10)	40.95	(5)	51.64
7	(7)	44.29	(2)	50.57	(6)	51.58
8	(1)	53.47	(9)	43.50	(4)	52.26
9	(4)	45.40	(8)	44.48	(11)	41.44
10	(11)	33.18	(3)	49.56	(9)	42.32
11	(5)	45.30	(4)	46.16	(1)	58.28
12	(10)	38.91	(11)	40.47	(7)	50.75

LSD (among treatment : provenance) = 9.66 (comparisons within a row)
LSD (among provenance : treatment) = 9.40 (comparisons within a **column)**
 # in ( ) indicates rank within the treatment

Only in the case of provenance 8 was there a significant negative effect of treatment with Glomus mycorrhizal fungi. G. etunicatum significantly decreased height growth for this particular seed source.

Caliper, number of first order lateral roots > 2mm and root volumes were also analyzed in this study, but no significant responses were found for these variables. Mycorrhizal treatments significantly affected top weight although genotype X mycorrhizal interaction was not significant for this variable.

CONCLUSION:

Properly matching black walnut genotype and mycorrhizal symbiont can result in taller seedlings after one growing season in the nursery bed. The mycorrhizae X genotype relationship which resulted in taller seedlings did not significantly increase caliper growth and number of first order lateral roots > 2mm. Field experiments are now established to assess the effect of beneficial mycorrhizae X genotype associations on early growth of black walnut.