EFFECT OF FESCUE ON BLACK WALNUT GROWTH

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Differences in tree growth in relation to the occurrence of tall fescue (*Festuca arundinacea* Schreb.) have been noted in progeny tests in the Indiana-Purdue Black Walnut Tree Improvement Program. Grasses are known to have an adverse effect on tree growth (*7, 10*). Harris (*5*) found that tall fescue decreased both height and stem circumference growth of magnolia. Removal of fescue (no ground cover) growing under walnut trees has been shown to increase diameter growth and nut yield of walnut trees 10 to 12 years old (*6*). A black walnut (*Juglans nigra* L.) progeny test in Parke County, Ind., was well suited to analyze the effect of fescue on the growth of young black walnut. The objective of the analysis was to determine the effect of tall fescue on the growth, form, and survival of planted black walnut seedlings in contrast to seedlings growing in a natural, uncontrolled ground cover of forbs.

Materials and Methods

The progeny test was started in the spring of 1971, on land owned by Pierson-Hollowell Veneer Company in Parke County, Ind. (*1*). The planting site was an old field bottomland site. The soil is Eel silt loam, a nearly level, moderately coarse textured, and moderately well drained soil of alluvial origin. The progeny test design was randomized complete block with three replications containing two five-tree row plots for each of 10 families.

Fescue was well established in part of the plantation at the time of planting. Solid fescue ground cover existed on half of two replications and one fourth of the third (figs. 1 and 2). The remainder of the planting had a dense ground cover of approximately 70 percent forbs, 20 percent mixed grasses, and a few small clumps of bramble and woody vegetation (fig. 3). For the first 2 years after outplanting, herbicide, simazine, and atrazine, were sprayed to control weeds in a 4-foot diameter circle around each tree.

Soil samples were taken from both the fescue and non-fescue areas to test for differences in soil characteristics. Four samples per block per treatment were pooled and analyzed for physical and chemical characteristics.

Different families were in the fescue within a replication; therefore, it was impossible to analyze by replication. The first two replications were pooled for the sake of analysis. To ensure nearly equal genetic material in both conditions, only families represented in both the fescue and non-fescue areas were analyzed, resulting in nine families being included. Each tree was measured for height, diameter at breast height (d.b.h.), and sweep.

Figure 1.—*A clump of fescue showing the seedheads and density of foliage.*

Sweep is the greatest distance from the stem to an imaginary line running perpendicular from the ground to the tip of the tree. This is then divided by the tree height to give sweep-per-foot, which is an indicator of form. Survival was also tallied. Volume was calculated using an equation developed at Purdue for young black walnut (12).

A two-way factorial analysis of variance was conducted for each variable. The main factors were family and condition (fescue or non-fescue).

Results and Discussion

Soil.—Soil analysis showed that all physical characteristics were the same for the fescue and non-fescue areas. With respect to chemical properties, the soils were essentially identical for calcium, magnesium, and nitrogen. However, phosphorus and potassium levels were highly variable. Phosphorus averaged 73 and 144 lbs per acre on the fescue and non-fescue areas respectively, while potassium averaged 222 and 330 lbs per acre. These amounts are all below the optimum levels of 200 and 400 lbs per acre; therefore an effect can be expected.

These nutrient differences may be due to a mycorrhizal association. Fescue is known to be frequently and heavily infected by vesicular-arbuscular mycorrhiza (*9*). Mycorrhiza infections also greatly increase the infected plant's ability to absorb both phosphorus (*5*) and potassium (*10*). The. fescue had probably already reduced the levels of P and K at the time of planting and it has probably had an advantage over the walnut in nutrient absorption due to the mycorrhiza (*2*). This condition could result in poorer growing conditions for the walnut.

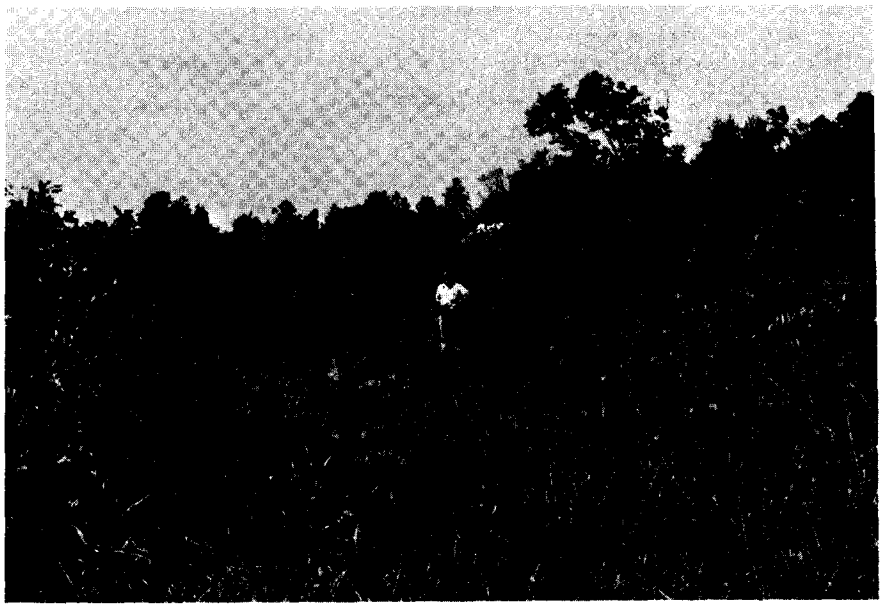

Figure 2.—*Fescue groundcover in part of the planting.*

Tree growth.—Fescue had a highly significant effect (? = 0.001) on height, sweep, diameter, and volume but did not influence survival. The change in sweep was probably not directly due to the condition but to the vigor of the seedling, which was highly affected by the presence of fescue. The respective means for each characteristic are listed in table 1. Without fescue the height almost doubled and diameter tripled (fig. 4). The volume out of the fescue was nearly five times greater than in the fescue.

A family *x* condition interaction may also exist. The analysis indicates a significant interaction for height and diameter. Graphs of the averages for these traits (fig. 5) show that the best families out of the fescue are not the best in fescue. This shows that selection and testing should be conducted under the conditions to be encountered in later plantations. Sound cultural practices (e.g. fescue control) are also necessary for the full realization of the genetic potential of improved material.

The data indicate that black walnut growth is greatly reduced by fescue when compared to a

naturally occurring mixed ground cover. Fescue is a very deep rooted grass that forms dense root masses (13). Therefore it competes directly with walnut for both moisture and nutrients. The previously mentioned possibility of mycorrhizal associations would also increase fescue's competitiveness.

Therefore, tall fescue is not a desirable cover crop in black walnut plantations and should be controlled before and during plantation establishment.

Figure 3.—*Understory vegetation in the non-fescue area.*

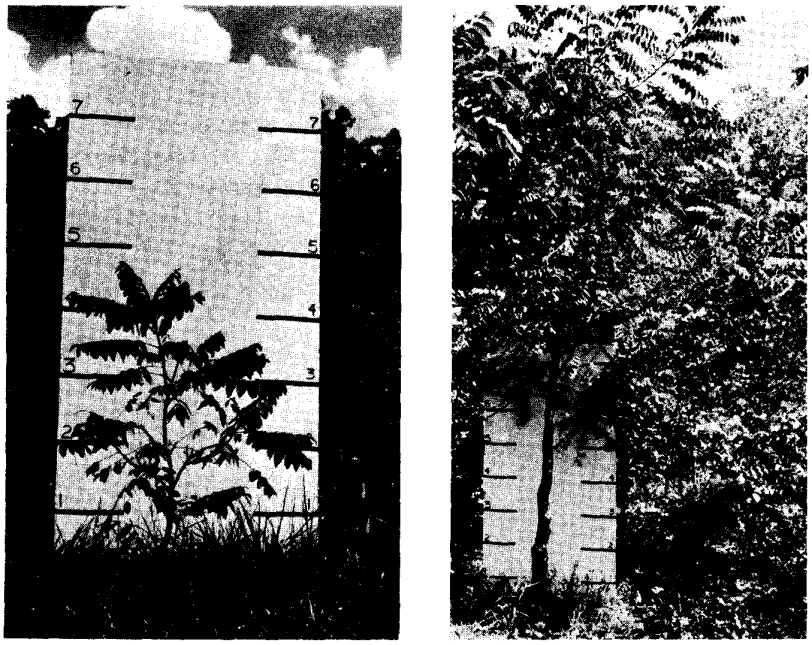

Figure 4.—*Two trees from same block and family: Left, one in the fescue area; right, one in the non-fescue area.*

Table 1.—*Averages of variables on the fescue and non-fescue areas*

Variable	Condition		
	Fescue present	Fescue absent	Improvement
			percent
Height (feet)	5.99	10.48	75.0
Sweep (feet)	0.15	0.09	46.7
DBH (inches)	0.53	1.57	196.2
Volume (cubic feet)	0.0271	0.1323	388.2
Survival (percent)	78.5	79.1	Not significant

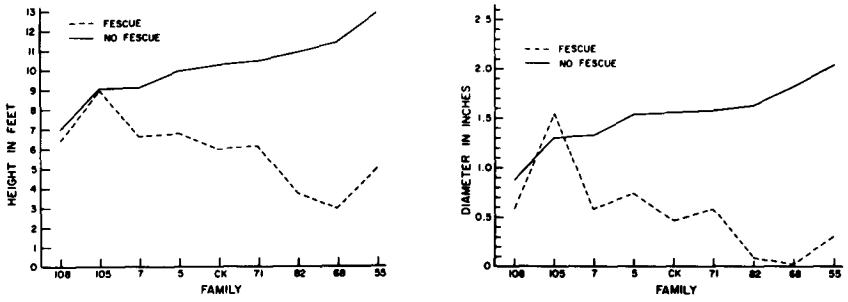

Figure 5.—*Height and diameter of fescue and non-fescue families.*

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