EFFECT OF TRANSPLANTING TOBACCO SEEDLINGS IN PEAT POTS ON PLANT VIGOR AND ON SUSCEPTIBILITY TO THIELAVIOPSIS ROOT ROT[1]

S.K. Gayed

Abstract

Seedlings of tobacco (Nicotiana tabacum cv. Hicks Broadleaf) grown in steam-sterilized soil were transplanted directly from the seedbed or in peat pots into a poorly drained field of Granby sandy loam that was heavily infested with Thielaviopsis basicola. Transplanting shock caused a marked delay in growth of transplants from the seedbed as compared with those in peat pots; four weeks after transplanting vigor was correlated with size of pot. However, at harvest there were no differences among treatments in yield or quality of tobacco or in damage from black root rot, indicating that resistance to the disease was not influenced by the relative vigor of the seedlings during the active phase of infection.

Introduction

Black root rot of tobacco caused by the soil-borne facultative parasite Thielaviopsis basicola (Berk. and Br.) Ferr. is a major disease of flue-cured tobacco in Ontario. Black necrotic lesions are formed on roots of infected plants and under severe conditions the plants are stunted resulting in a reduction of yield and quality. The disease is usually most severe in relatively fine-textured soils under poorly drained conditions.

Tobacco is commonly grown from seed in a 2-inch deep bed of steam-sterilized muck soil over coarse sand in an unheated greenhouse for 6-8 weeks prior to transplanting to the field. Transplants always suffer from shock due to root injury and to the sudden change of environment, resulting in a growth lag which lasts for several days. AS transplanting tobacco seedlings in peat pot eliminates root injury and decreases the severity of transplanting shock, it was thought that vigorously growing tobacco plants set out in peat pots might resist infection with black root rot.

The aim of the experiments reported here was to compare the subsequent vigor and susceptibility of seedbed and peat pot seedlings transplanted to a field highly infested with black root rot.

Materials and methods

Experiments were carried out in 1966 and 1967 in Granby sandy loam soil in a poorly drained field in which tobacco had been grown for more than 13 consecutive years. The soil and cultural conditions favored a high inoculum potential of T. basicola and severe root infection.

In both years, tobacco (Nicotiana tabacum L. cv. Hicks Broadleaf) seedlings were grown for 4 weeks in seedbeds before transplanting to peat pots. Three weeks later, potted and seedbed seedlings of the same age were transplanted to the field. Steam-sterilized muck was used as a growth medium in both the seedbeds and the peat pots. The experiment in 1966 was comprised of two unreplicated treatments, each consisting of three rows 42 inches apart with approximately 20 plants spaced 24 inches apart in each row. These plots received seedbed seedlings and seedlings raised in 1.75 inch peat pots. The experiment in 1967 was comprised of four treatments in triplicate with plants spaced 18 inches apart in rows 42 inches apart. The treatments consisted of seedlings raised in a seedbed or in 1.75, 2.25 or 3 inch peat pots. The size of these peat pots represents a volume of 1:2:4 respectively. Transplants were set in the field during early June in both years. Transplants from the seedbed and those in 1.75 inch pots were similar in size and were slightly smaller than those in the larger peat pots.

Relative growth in the field was rated 4, 6, and 8 weeks after transplanting in 1966 and 4 weeks after transplanting in 1967 using a scale of 1 to 10, where 10 represents best growth. The height of aerial growth 4 weeks after transplanting was measured only in 1967. Nine weeks after transplanting, leaves at the lower-most stem positions started to ripen and were harvested and flue-cured. In the succeeding 4 weeks the remaining leaves were similarly harvested and cured. The cured leaves were weighed to determine yield

[1] Contribution No. 70, Research Station, Canada Department of Agriculture, Delhi, Ontario.

in lb per acre and were graded (Ontario Farm Products Grades and Scale Act) to determine the grade index in cents per lb.

On completion of harvest the fourth, seventh, tenth, and sixteenth plants in each row were dug from the soil, and the roots were thoroughtly washed and rated for disease lesions using a scale of 0.5, with 0 representing no lesions and 5, complete covering of the root with lesions.

Results and discussion

In the 1966 experiment, the growth rate of tobacco plants raised from seedlings transplanted in 1.75 inch peat pots was greater than that of transplants from the seedbed. The difference in vigor was pronounced 4–6 weeks after transplanting but gradually decreased as the plants advanced towards maturity (Fig. 1). At the end of the season, the root lesion ratings of plants originating from the seedbed and from peat pot:. transplants were similar and averaged 2.7 on the 0–5 scale.

In the 1967 experiment, the growth of tobacco plants transplanted in peat pots was significantly greater 4 weeks after transplanting than the growth of those from the seedbed (Table 1). At this time plant vigor was greater in the larger peat pots and was almost twice that of plants transplanted from the seedbed. At harvest, however, there were no differences in the size of tobacco plants in any of the plots. Similarly, there were no significant differences in yield or quality among the treatments. This disparity in the relative growth of tobacco plants early in the season and at harvest indicates that the stresses to which seedbed

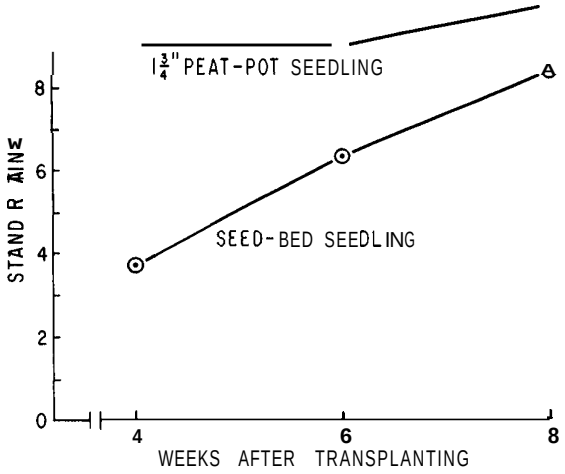

Figure 1. Rating of relative growth of tobacco plants in the field 4, 6, and 8 weeks after transplanting directly from the seedbed or in 1.75 inch peat pots, 1966 data. Stand rating 10 = best growth.

transplants had been subjected and which were responsible for a growth lag for several days in the field delayed the maturity of seedbed transplants. Therefore, the plants from the seedbed were still in the active growth phase while peat pot transplants were approaching maturity. Also there were no significant differences among the treatments in the disease lesion ratings, which in 1967 averaged 3.0 (Table 1).

In Ontario fields, the critical period for infection of tobacco by T. basicola begins at tranplanting and extends through June and early July. Th s observation is supported by evidence that younger tobacco plants are more susceptib e to the disease than older ones (5) and that low soil

Table 1. Relative growth in the field of transplants from the seedbed and from peat pots and the subsequent yield and grade index of cured leaves and incidence of black root rot lesions on the roots, 1967

Source of transplant	Rating* of relative growth July 7	Shoot length July 7 (inches)	Yield (lb/acre)	Grade index (cents/lb)	Root lesion rating†
1¾ inch peat pot	6.4	9.4	441	40.2	3.0
2¼ inch peat pot	7.3	10.6	362	39.4	3.0
3 inch peat pot	9.1	13.0	350	42.9	3.0
Seedbed	4.4	6.1	431	40.9	3.0
L.S.D. 0.05	0.45	1.45	N.S.	N.S.	N.S.
0.01	0.69	2.20			

* 1 = very poor growth; 10 = best growth.

† 0 = no lesions; 5 = lesions covering root surface

temperatures favor the development of the disease (4). In the present study, the more vigorous growth of peat pot transplants compared to those from the seedbed was apparent for up to 6 weeks after transplanting, the period during which most infections occur. However, the difference in early vigor was not reflected either in yield or in the root rot severity ratings of mature plants. Therefore, the general rule (2) that high host vigor usually increases host resistance to facultative parasites did not apply in this situation. Apparently the initially higher growth rate of seedlings in peat pots did not influence the chemical factor believed to be associated with resistance to black root rot of tobacco (1,3,6).

Acknowledgments

Thanks are due to Mr. D. A. Brown and Mr. G. Paloots for their technical assistance.

Literature cited

1. Gayed, S. K. 1969. The relation between tobacco leaf and root necrosis induced by Thielaviopsis basicola and its bearing on the nature of tobacco resistance to black root rot. Phytopathology 59:1596-1600.

2. Hart, H. 1949. Nature and variability of disease resistance in plants. Annu. Rev. Microbiol. 3:289-316.

3. Jewett, F. L. 1939. Relation of soil temperature and nutrition to the resistance of tobacco to Thielavia basicola. Bot. Gaz. 100:276-297.

4. Johnson, J., and R. E. Hartman. 1919. The influence of soil environment on root rot of tobacco. J. Agr. Res. 17:41-86.

5. Ohashi, Y., and T. Murai. 1961. Studies on black root rot resistance. 1. Varietal variation. 11. Relationship between resistance and stage of seedling. 111. Variation in pathogenicity. Rev. Appl. Mycol. 40:451 (Abstr.)

6. Steinberg, R. A. 1951. Amino acid toxicities of tobacco varieties differing in resistance to black root rot. Torrey Bot. Club Bull. 78:227-232.