CONTROL OF TOBACCO MOSAIC VIRUS ON FLUE-CURED TOBACCO BY CROSS PROTECTION

By G. V. GOODING, JR.

Inoculation of Nicotiana tabacum L. cv., NC 2326 with a mild strain of tobacco mosaic virus (TMV) reduced yield losses caused by later inoculation with the common strain of TMV in a field test conducted in North Carolina. Yield reduction by treatment was: mild strain alone at transplanting, 8.0%; mild strain at transplanting followed by the common strain 24 days later, 12.3%; and common strain only, 24 days after transplanting, 27.7%.

INTRODUCTION

Infection of a plant with a mild strain of a virus will usually protect it from the effects of later inoculation with a severe strain of the same virus. This phenomenon is usually called cross protection but is also described as induced resistance. Cross protection has been used commercially in Europe to control tobacco mosaic virus on tomatoes (2, 7, 8). Tobacco, like tomatoes, would be amenable to inoculation with a mild strain of TMV in the plant bed to protect against later infection by more severe strains. Although discussed in an earlier publication (5), this approach has not been pursued in North Carolina for reasons given in the discussion section of this paper. Cross protection may now have application in some areas of the world, however, and remains a future possibility in the United States. For these reasons and because it was convenient to conduct a trial as part of another study (6), the effect of primary inoculation with a mild strain of TMV on later inoculation by the common strain was determined in 1979 at the Border Belt Tobacco Research Station, Whiteville, North Carolina.

MATERIALS AND METHODS

Virus isolates were a mild strain of TMV, Holme's masked strain obtained from T. T. Hebert, ATCC PV42 (1), and an isolated (NC40) of the common strain obtained from naturally infected tobacco (5). Inoculations were made with an airbrush (5) or by rubbing two leaves on each plant with a pad of cheesecloth soaked in juice from an infected plant diluted 1:10 in 0.01 M Na₂HPO₄ – KH₂PO₄ (pH 7.2) containing 0.1 g 600 mesh carborundum/100 ml of inoculum.
Treatments were 1) no virus, 2) inoculation at transplanting with the mild strain (airbrush), 3) inoculation at transplanting with the mild strain (airbrush) and 24 days later with the common strain (rubbing) and 4) inoculation with the common strain (rubbing) 24 days after transplanting. The experimental design was one row of 20 plants for each treatment randomized within a four-row block. Treatments were replicated 4 times.

Nicotiana tabacum L. cv. NC 2326, previously reported as one of the tobacco cultivars least tolerant to TMV (S), was used in this experiment. Usual cultural practices were followed as described elsewhere (6).

Data were collected on yield, value and disease severity based on visual symptoms. Estimates of disease severity were made using a scale of 0-3, where 0 = no symptoms and 3 = severe mosaic symptoms, at the early flowering stage of plant development.

RESULTS

The effect of the different treatments on yield and value is given in Table 1. Symptom severity (mean of 4 replications) was 1) Check - 0, 2) mild strain - 1.1, 3) mild strain followed by common strain 2.1 and 4) common strain 3.0.

DISCUSSION

Some degree of cross protection was expected. The reported data do, however, give an estimate of the magnitude of protection that could be expected under field conditions and an estimate of losses from the mild strain alone. Modification of the procedures used in this study could result in even greater protection. Inoculations with the common strain in these tests were done at the most critical time of secondary spread of TMV under natural conditions, i.e., at the last cultivation of the crop (5). Occasionally, however, extensive TMV infection occurs much earlier. Under these circumstances, a greater protective effect would be expected because yield reduction by the common strain of TMV is positively correlated with time of infection (3). The amount of inoculum of the common strain of TMV applied to plants previously inoculated with the mild strain was much greater than would be expected under natural conditions. Therefore, although no data were obtained, considerable infection of the "protected" plants probably occurred (4). Also, TMV strains that would provide more protection against the common strain than the one used in this study could probably be found in the natural population or induced by mutagenic agents (7, 8).

Although cross protection does have potential for reducing losses to TMV on tobacco, extreme caution should be exercised before its employment. Mild strains themselves may result in losses exceeding those caused by common strains where disease incidence is low. The mild strain selected should be tested for its reaction on other crops produced in the area because mild tobacco strains could be severe on other crops. Interactions between mild strains and other viruses in the geographic area of potential use should be considered and the potential for mutation of the mild to a severe strain either in tobacco or other hosts in which it might become established cannot be ignored.

Despite the potential for cross protection as a means of TMV control, there are no current plans to pursue this approach in North Carolina because effective control can be accomplished by the combined use of sanitation, weed eradication, rotation, and resistant cultivars.

LITERATURE CITED