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## THE CASE OF THE MISSING TAP ROOT<sup>1</sup>

By R. P. Moore<sup>2</sup>

This might well be called the case of the cotton plant with the missing tap root.

It describes a condition in cotton fields which has troubled many growers and which apparently has been responsible for poor stands, stunted plants, and low yields of cotton.

In North Carolina and other cotton production areas, cotton plants may appear to be very susceptible to drouth. These plants frequently possess shallow-spreading root systems, with almost no tap roots; and the shallow roots are frequently injured by close cultivation. Apparently the tap roots stop growing in the seedling stage before the seedling's root extends downward more than approximately 3 inches.

### No General Pattern

Observers have found no general pattern in the extent and distribution of cotton plants with missing taproots. There may be many in one part of a field and few or none in another. One field may show the plants, the next field may have very few.

Attempts in North Carolina to relate the condition to fertilizer and insect injury soon indicated that other factors might be involved.

Some good possible explanations for this abnormal root condition have been uncovered. Early studies at the North Carolina Experiment Station, for example, revealed that the seedling root tip, which is a region of cell division, frequently died or became inactive. Other parts of the seedling remained alive.

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In some seedlings, the tip never starts to grow during germination. In other seedlings, the tip starts growth, but dies or becomes diseased within a few days.

Aged or weak lots of seed, it was noted, even under the most favorable germination conditions, produced a much higher percentage of seedlings with a damaged root tip than did seed in which the quality had been protected by proper harvest and storage.

Germination of seed at temperatures of 55 to 70° F., or the exposure of young seedlings to these below-optimum temperatures for a few days, greatly increased the amount of root tip injury. Aged or low-quality seed showed the greatest extent of injury.

Later studies confirm that the root tip is relatively sensitive to **injury** from a number of adverse conditions. These include: (1) exposure to low or high temperature, (2) lack of moisture in the seedbed at the time of planting or immediately after the seed started to germinate, (3) too much water about the seed or young seedling, (4) inadequate aeration about the germinating seed, (5) diseases, (6) fertilizer contact, (7) excessive fungicide, etc.

Low-quality seed tends to make these adverse conditions more serious. High quality seed lessens their importance.

Seedlings with dead or inactive primary roots emerged and developed very slowly, say North Carolina scientists. Lateral roots developed in these seedlings from a rather restricted zone near the base of the structure between root and attachments of seed leaves. Frequently, one or more lateral roots emerged through the dead tip area, but these roots never acquire the characteristics of a tap root.

### Seed Quality Vital

In view of the information we now have, one can look for a fairly high percentage of seedling plants with missing tap roots following the planting of low-quality seed. Such plants are more likely to appear following adverse weather conditions which result in delayed and spotted emergence. Where original stands are thin, these late-emerging, abnormal seedlings are likely to be left to mature a crop.

This type of seedling is slow in emerging and sluggish in its early growth. Mortality might be expected to be high. For that reason, the percentage of mature plants with missing tap roots would be somewhat unpredictable in different areas of a given field.

Growers probably cannot write off the case of the missing tap root as entirely closed. However, they can lessen its seriousness by using the best quality seed available and by making use of planting methods which offset some of the adverse conditions which encourage this type of damage to cotton plants.