MISSISSIPPI STATE UNIVERSITY EXTENSION

Sweetpotato Storage Root Initiation

Sweetpotato yields are ultimately determined by the number of sweetpotato plants per acre, the number of storage roots per plant, and the size of each storage root at harvest. Under commercial production conditions, fields with identical plant densities that remain in the field for the same time may have drastically different yields. This is likely due to factors that affect storage root initiation and development.

Unlike the bulking of sweetpotato storage roots in the last third of the growing season, sweetpotato root number is determined early in the production cycle. Current research has found that environmental and cultural conditions during the first 2 weeks to 30 days after transplanting are critical in deciding the number of storage roots initiated per plant. In the production environment, every season is different and unique. This publication provides a brief introduction to maximizing storage root initiation.

Sweetpotato Roots

Each *node* of a sweetpotato slip contains 4 to 10 preformed roots (*primordia*) (Figure 1) that have the potential to form *adventitious roots* (Figure 2). These adventitious roots, along with those produced from callus tissue on the cut end of a sweetpotato slip, form the entire root system of the sweetpotato plant. Adventitious roots begin to grow in as little as 24 hours after transplanting if soil moisture and temperature conditions are adequate.

An adventitious root can become one of three different types of roots (Figures 3 and 4). Under ideal growing conditions, adventitious roots become *storage roots*. However, if adventitious roots are damaged at or before planting, *fibrous roots* are generated, and these will not become storage roots. In addition, adverse or unfavorable environmental conditions shortly after transplanting may result in *pencil root* production (thin, elongated roots measuring less than four-fifths of an inch wide at maturity). To maximize marketable yields, it is important to achieve the greatest possible number of storage roots.

Figure 1. Sweetpotato roots begin as preformed root primordia, which are white bumps located at nodes along the stem of the sweetpotato. Photo by Stephen Meyers, Purdue University.

Figure 2. Under ideal conditions, roots begin to grow in as little as 24 hours after transplanting sweetpotato slips. Photo by Stephen Meyers, Purdue University.

Slip Size

Sweetpotato slips 10 to 12 inches long with a stem diameter of one-fourth of an inch or greater make the best planting material. Slips this size increase the number of nodes that can be buried below the soil surface and provide the plant with a needed initial source of energy for root production.

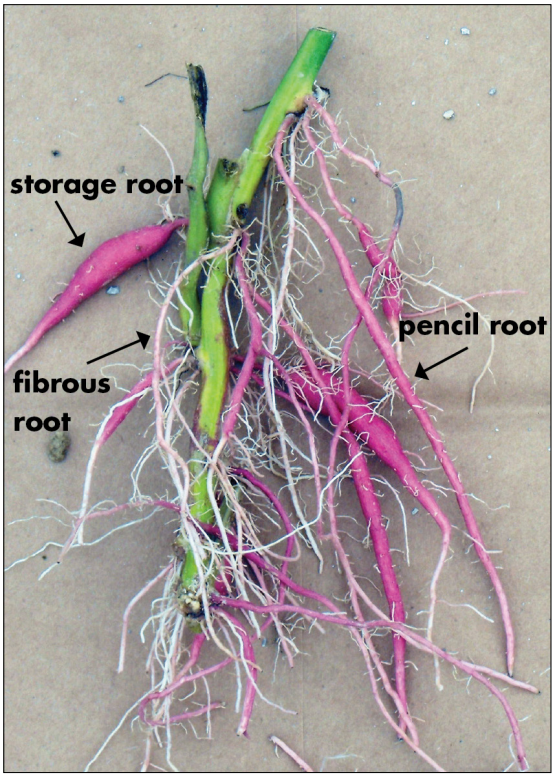

Figure 3. Root set can be visually determined in as little as 30 days after transplanting. Pencil and potential storage roots are pigmented, and storage roots have begun to enlarge. Fibrous roots remain mostly white. Photo by Ramón A. Arancibia, Virginia Tech.

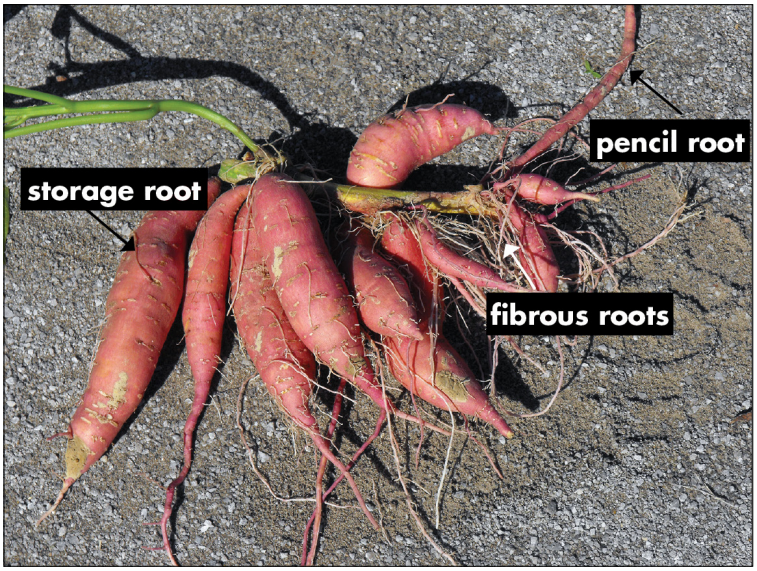

Figure 4. Sweetpotato roots at harvest can easily be identified as either fibrous, pencil, or storage roots. Photo by Ramón A. Arancibia, Virginia Tech.

Soil Moisture

Evenly moist soil provides the best environment for storage root initiation and development. Wet soils are detrimental to both root development and growth. Low soil moisture levels (those approaching the wilting point) within the first 2 weeks after transplanting contribute to increased pencil root development and misshapen storage roots.

You can determine soil moisture with soil moisture probes that will measure the percent of water in a soil (by volume). However, the simplest way to determine soil moisture is to use the USDA "feel and appearance" method. Moderately coarse and medium-textured soils with adequate moisture should form a tight ball when squeezed in the palm of your hand. If the soil can only be formed into a loose ball, it is not moist enough. If water squeezes out of the soil ball, it is too moist.

Soil and Air Temperatures

Soil and air temperatures play an important role in storage root initiation and crop development. Research conducted at Mississippi State University indicates that sweetpotato slips transplanted when daytime high air temperatures are 85 to 89 degrees and nighttime low temperatures are in the lower 70s will have quicker root initiation, a profuse root system, and rapid growth. Daytime/nighttime temperatures greater than 104/90 degrees or less than 77/63 degrees can be detrimental to storage root initiation.

Nitrogen

A moderate amount of nitrogen is required for adventitious roots to develop properly into sweetpotato storage roots. However, developing adventitious roots will not "seek out" nitrogen, so placement of nitrogen is important. Nitrogen fertility management will depend on existing soil nitrogen levels, but 30 to 40 pounds of supplemental nitrogen per acre is generally optimal in Mississippi.

Broadcast preplant nitrogen before forming rows, and incorporate it evenly throughout the hipped row. This maximizes contact with developing roots. Excessive soil nitrogen concentration has been associated with increased pencil root production and contributes to increased foliar growth and reduced root yields.

Planting Depth

Research shows that increasing slip planting depth directly increases yields. Maximum yields are observed at a planting depth of at least 5 inches. There are several reasons increased planting depth increases yield. Deeper slip planting allows more nodes to be underground. This increases the potential number of storage roots that can be produced from each plant. Deeper planting generally provides developing roots with a more stable environment. Soil temperature and moisture nearer to the soil surface can be highly variable, while those at greater depths are more constant.

Storage Root Initiation and Days until Harvest

Increasing the number of sweetpotato storage roots per plant will often increase the days until harvest. Because the developing plant must spread its resources among more storage roots, each individual storage root requires more time to reach USDA No. 1 size. In the "bulking" stage of sweetpotato development, carbohydrates from the foliage are moved into the roots. At the same time, storage roots take up water from the soil. Under dry conditions, this bulking process is slowed. To limit the influence of the increased days until harvest when transplanting conditions are ideal for storage root initiation, consider the following:

- Increased plant spacing will help to decrease the days until harvest. Overall, increased plant spacing can reduce per-acre yield and should not be practiced on every acre.
- If weather conditions during the season are similar, be prepared to harvest fields with fewer storage roots per plant sooner.

While you can't control every aspect of the production environment, following these guidelines can optimize storage root initiation:

- Select slips 10 to 12 inches long.
- Maintain optimal soil moisture before and after transplanting.
- Avoid excessive nitrogen application.
- Avoid planting slips into cool, wet soils or hot, dry soils.
- Plant slips at least 5 inches deep.

Key Words

node: The portion of a stem where leaves attach.

root primordia: Bumps located at nodes that become roots under ideal conditions.

adventitious root: Root that forms from non-root tissues, such as a root that forms along a stem.

storage root: Root greater than four-fifths of an inch in diameter at harvest.

fibrous root: Thin (less than one-fifth inch in diameter), non-thickened root.

pencil root: Slightly thickened (one-fifth to four-fifths of an inch in diameter), elongated root.

slip: A vine tip cutting used as the starting material for sweetpotato production.

Publication 2809 (POD-11-23)

By **Mark W. Shankle**, PhD, Research Professor, Pontotoc Ridge-Flatwoods Branch Experiment Station; **Lorin M. Harvey**, PhD, Assistant Professor, Pontotoc Ridge-Flatwoods Branch Experiment Station; and **K. Raja Reddy**, PhD, Research Professor, Plant and Soil Sciences.

Produced by Agricultural Communications.

Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914. ANGUS L. CATCHOT JR., Director