

Title: California’s “Clean Seed” Sweetpotato Program.

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Summary: For nearly 40 years, UCCE has used advanced laboratory techniques in conjunction with traditional selection methods to produce pathogen-free and true-to-type sweetpotato seedstock. The “clean seed” program has resulted in significant yield and quality improvements for the industry as a whole, and the effort continues with the varieties important in today’s marketplace. Furthermore, the program serves as a model for the use of meristem culture by foundation sweetpotato programs in other states.

Other summary: California’s “clean” sweetpotato seed program began in the 1960’s in response to russet crack disease, which is caused by a strain of sweetpotato feathery mottle virus. At the time, it was well known in the industry that “new” seedstock was required to prevent this disease and “variety decline,” which was the gradual loss of yield that occurred for many varieties. To address this problem, in 1961 Farm Advisor Bob Scheuerman and Extension Specialist Dennis Hall began testing a process called meristem-tip culture on sweetpotatoes to make clean seed. By 1966, enough plant material using this process had been developed that Scheuerman and Hall could conduct large-scale field tests. The results showed a significant yield increase using virus-tested plants. Furthermore, there was a substantial decrease in the number of cull potatoes as a result of russet crack. California growers continue to utilize this technology for both older and newly developed varieties. Foundation Plant Services (FPS), located on the University of California Davis campus, performs the process. The use of virus-tested seed is one of the reasons for the substantial yield increases that have occurred in the last 30 years. In 1967, average yields were 5.0 tons/A; in 2009, average yields were 16.3 tons/A. The use and acceptance by the industry in California as well as other states demonstrates how UCCE research and extension programs can have long standing positive impact for the industry as a whole. Consumers throughout California and the U.S. have also benefited, as the clean seed program gives them a more consistent, high quality sweetpotato that is significantly less likely to have internal defects.

Sweetpotatoes are a vegetative propagated crop. Roots are sprouted, and these sprouts are transplanted to the field to produce more roots. True seeds are not used in commercial production because sweetpotatoes rarely flower and are never true-to-type. An unfortunate consequence of not using true seed, however, is that viruses can accumulate in the plants, greatly diminishing both yield and quality.

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Figure 1. Sweetpotatoes will flower in response to certain environmental conditions, but the seed is frequently sterile.

Specialist Dennis Hall began testing a process called meristem-tip culture on sweetpotatoes to make clean seed.

The procedure developed then is still in use today to provide growers with high quality seedstock. Meristem-tip culture involves aseptically removing the meristem (usually 0.5 mm long) from an apical or lateral bud of shoots produced in a greenhouse from a sprouted root. The meristems are placed in test tubes and grown out on synthetic nutrient agar to produce a new plant. After 3 – 4 months in culture, the plant is transplanted in the greenhouse and grown out for virus testing. To determine if the meristem-generated plants are free of virus, it is grafted onto an indicator plant (Brazilian morning glory). If the indicator plant shows no disease symptoms, then the sweetpotato plant is assumed to be virus-free, or “clean.” At this point, it can be propagated through cuttings and grown to produce roots for variety evaluation.

By 1966, enough plant material using this process had been developed that Scheuerman and Hall could conduct large-scale field tests. The results showed a significant yield increase using virus-tested plants as compared to plants that had not gone through meristem culture. Furthermore, there was a substantial decrease in the number of cull potatoes as a result of russet crack.

Since these early tests, the benefits of virus-tested material have been well recognized in California and other states. Beginning in the mid 1990’s, Louisiana and North Carolina dropped their traditional seed programs and began producing virus-tested material in greenhouses for their farmers based on the clean seed program developed by UCCE.

Most growers in California use virus-tested seed for at least part of their production, especially for the susceptible cultivars Beauregard and O’Henry. Foundation Plant Services (FPS), located on the University of California Davis campus, performs the process. They provide plants to growers who are members of the Sweetpotato Council of California for a minimal fee of \$1.25 per plant. The use of virus-tested seed is one of the reasons for the substantial yield increases that have occurred in the last 30 years. In 1967, average yields were 5.0 tons/A. In 2009, average yields were 16.3 tons/A.



Figure 2. Sweetpotato meristem growing in a test tube - the start of the virus testing process.

UC Cooperative Extension continues to test and promote the sweetpotato clean seed program. Trials conducted in Merced County in 1999 – 2001 showed improved yield, shape, and color in five commercial varieties from using virus-tested plants. More recent testing with the new varieties *Murasaki-29* and *L-04-175* gave similar results. The use and acceptance by the industry in California as well as other states demonstrates how UCCE research and extension programs can have long standing positive impact for the industry as a whole. Consumers throughout California and the West have also benefited, as the clean seed program gives them a more consistent, high quality sweetpotato that is significantly less likely to have internal defects.