Development of New, Reliable, Vigorous, Clonal Rootstocks

John Preece, Research Leader, USDA, National Clonal Germplasm Repository
Deborah Golino, Director and Franklin Lewis, Technician, Foundation Plant Services, UC Davis
Florent Trouillas, Assistant Cooperative Extension Specialist, Department of Plant Pathology, KARE, UC Davis

INTRODUCTION

There is a need for new superior UCB-1 clonal rootstocks that are reliable and give rise to vigorous and high-yielding orchards. Because recent “off-types” have occurred in clonal UCB-1, collectively referred to as Pistachio Bushy Top Syndrome (PBST), a system is necessary where new, vigorous clones can be continuously released to replace older ones. This should be on a schedule that would eliminate or greatly reduce the chance of new, “off-types” showing up in orchards.

Once seedling pistachios become established in the greenhouse or field, they become infected with bacteria that live in the xylem (endophytes). The role of these endophytes, in the growth and health of the plant, is unknown; however, these bacteria will grow out of pistachio shoots and contaminate tissue cultures used for micropropagation of clonal rootstocks. Therefore, it is difficult to use material from proven trees in the field.

RESULTS

Seeds are free from endophytes, but overcoming dormancy requires moist, cool stratification. This causes microbial contamination of tissue cultures, making it necessary to use non-stratified, dry seeds. These seeds have a hard shell, and it is necessary to cut through the shell to expose the cotyledons for the seeds to germinate. This shell is too hard to cut through; it requires weakening. We found that it was necessary to soften the shell through acid scarification. UCB-1 seeds were placed in concentrated sulfuric acid (36 Normal), and required a 7-hour soak to weaken the shell in order to allow them to be easily cut.

The seeds are surface-sterilized during their 7 hours in the acid. This is followed by three 5-minute rinses in sterile deionized water. About a fourth to a third of the seed is excised opposite the hilum to avoid cutting the embryonic axis. This cut removes the sides of the cotyledons and allows germination of non-stratified seeds. This has resulted in about 100 new seedlings growing in culture. Other experiments are planned or underway to increase the efficiency of the process.

An effort was also made on established trees. From a planting of 1,200 nongrafted UCB-1 seedlings, after 4 years of growth measurements, the largest 3 trees were selected. In an effort to escape endophytes, apical meristematic regions were excised and placed in culture. These meristems have established in vitro, and as of yet, assays have shown no endophytes. There are more than 60 shoots from these meristems at this writing. This approach is superior to using seeds because it uses field performance data. However, seeds have great juvenility, and therefore typically have much better propagation vigor and are easier to multiply and root than more mature-sourced materials.

CONCLUSION AND APPLICATIONS

Research will continue to increase in vitro seed germination efficiency and to determine if endophyte-free cultures can be established from apical meristems.