

ability was estimated using an oxidative browning assay or a sprouting test. Sections from mid-winter collected scions were cooled at different rates to -30°C or -35°C and transferred to the vapor phase over liquid nitrogen. Sections were warmed at $+4^{\circ}\text{C}$ and held for 24 h before testing viability. Some lines were processed after several months of storage at -3.5°C . Although viability after cryopreservation occurred with a cooling rate of $1^{\circ}\text{C}/\text{h}$, slower cooling ($5^{\circ}\text{C}/\text{day}$) was beneficial for many accessions. In tests with a limited number of lines, cooling rates $\geq 10^{\circ}\text{C}/\text{h}$ to -30°C caused injury to buds and cambium. Scions stored for up to 8 months could survive cryoexposure. Scions from three lines tested survived three cycles of cooling from $+4^{\circ}\text{C}$ to LN. Extent of acclimation affected results. With non-desiccated sections cryogenic survival of 'Golden Delicious' differed over years, but this has also occurred with the procedure that uses a desiccation step. It is not expected that this method is generally applicable to more tender species of *Malus* or other fruit genera, but the method has been successful with many lines of *M. × domestica*, a fairly cold hardy taxa, and with some other cold hardy *Malus* species. Grafting tests are needed to confirm the usefulness of the method.

173 Morphological and Phenological Variation in World Collections of Velvetleaf (*Abutilon theophrasti*)

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Our lab characterized the growth and development of 83 velvetleaf accessions, collected from locations in Asia, India, Europe, Eastern Africa and North America, to test the hypothesis that two biotypes ("crop" and "weedy") exist and are easily differentiated. Measurements taken to gauge morphological and phenological variability include: initial seed weight, stem height at 3, 7, and 11 weeks, leaf size at 3, 7, and 11 weeks, stem and petiole color, time to flowering, time to first capsule maturity, stem height at flowering, height to first mature capsule, basal stem diameter, number of capsules, and capsule size and color. Analyses indicate that accessions producing yellow-colored seed capsules were taller, produced fewer nodes, and were longer-lived than their brown-colored counterparts. This finding supports previous assertions that the yellow-colored varieties were originally selected for use as a fiber crop: i.e., increased stem yield resulted in longer lengths of lignified tissue. The accessions producing brown-colored capsules exhibited greater reproductive output, as measured by the number of capsules and the number of seed-containing valves per capsule, a desirable trait for weedy species. Using capsule color as an independent variable, Discriminant Analysis was able to correctly classify 96% of the observations by the remaining characters, further affirming that the yellow- and brown-capsuled accessions varied, significantly, with respect to their morphology and phenology. Velvetleaf is believed to have originated in China, where it was eventually domesticated. Early records suggest that velvetleaf, a noxious weed in modern agricultural production, was introduced to colonial America to serve as a fiber source for the burgeoning rope-making industry.

174 Seed Technology in Plant Germplasm Conservation

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In plant germplasm conservation, "orthodox" seed (i.e. seed that survives drying down to low moisture content) is the most suitable propagule for long-term storage. In general, high quality seeds of around 5% seed moisture content can be stored for 5–15 years at 2°C and 15–50 years at -18°C . Globally, there are some 1,300 genebanks and 6.1 million accessions of food and industrial crops in conservation. When collecting and conserving plant germplasm, seed science and technology have to be applied during germplasm collection; seed regeneration—germination, seedling establishment, flower synchronization, pollination, harvesting, drying, processing and packaging; seed storage and

conservation; characterization and evaluation; and finally, distribution. Some of the seed science knowledge and technology skills encompass seed sampling strategy, sample size, seed health, germination and vigor testing, dormancy breaking, scarification, stratification, vernalization, photoperiod treatment, isolation and pollination techniques, harvesting, threshing, drying, hermetic packaging, storage facility design, etc. The goal is to produce seed lots that fulfill the required genetic, physical, physiological and health quality. A summary was presented to relate germplasm conservation activities to seed science and technology. Some of the seed production, processing and testing equipment used were highlighted. Seed research in germplasm conservation is therefore crucial to streamline the operation and management of a genebank to make it more cost effective and attractive for funding.

175 Introducing Cereus into an Arid Region as a New Fruit Crop

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One of the major steps in responding to imminent water shortages in the Middle East is improving water use efficiency. Drought-resistant crops would be an effective technology to curb rising demands of water. Columnar Cactus species characteristics fit with most of the requirements of a drought tolerant crop with very high water-use efficiency. Cereus cacti have physiological and morphological methods of exploiting environments that would soon desiccate other plants. Four Cereus species were introduced into UAE deserts and could be ideal for establishing crop plantations in the arid environment. The introduced fruiting cacti are *Cereus hexagonus*, *C. pachanoi*, *C. peruvianus*, and *C. validus*. Plants were propagated by cuttings in the greenhouse. Cuttings developed roots within 2*8211;4 weeks of planting. The propagated plants were acclimatized and transplanted into the field in the desert. *C. peruvianus* was the most promising in the new environment in terms of its high adaptability and healthy growth in the new environment. *C. pachanoi* grew very fast, averaging up to a fifteen centimeter a month of new growth. *C. pachanoi* was recommended as a rootstock for other species. *C. validus* could not survive the new environment.

176 In Vitro Multiplication of Brazilian Ginseng (*Pfaffia* spp.) for In Vitro Conservation Purposes

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Brazilian ginseng (*Pfaffia* sp.) is largely known as having anabolic, analgesic, anticancerous, anti-inflammatory, antileukemic properties, and more. Embrapa Genetic Resources and Biotechnology is the major Conservation Center in Brazil. This species could only be stored under in vitro conditions. There are more than two hundred native accessions collected from different locations in the country. So far very few works are found in the literature and there is no specific protocol for in vitro conservation. The aim of this study was to test five different accessions from in vitro collection under one specific nutrient medium. The accessions were catalogued as 2205-12; 2202-04; 2209-11; 2209-10 and 2205-21. One-bud microcutting was inoculated on a MS nutrient medium without growth regulators and added with vitamins, myo-inositol ($100\text{ mg}\cdot\text{L}^{-1}$), sucrose ($30\text{ mg}\cdot\text{L}^{-1}$) and agar ($6\text{ mg}\cdot\text{L}^{-1}$). The pH was adjusted to 5.7 before the agar addition. Each treatment was replicated 7 (seven) times and each plot consisted of six test tubes with 5-mL solution. The trial was replicated twice. The evaluations were performed once weekly where the shoot growth was taken along with the number of buds and roots formed. The highest shoot growth were obtained for the accessions 2205-12 and 2209-10. Accession 2209-11 had an intermediate shoot growth and number of buds, but had the highest number of roots per shoot (4.27) compared to 2.14 and 3.75 for accessions 2205-21 and 2209-10, respectively. The highest rate of multiplication was achieved for accessions 2205-12 (4.49) and 2202-04 (4.46) as compared to 3.60 for accession 2205-21. It was clearly shown that accession 2205-21 is a recalcitrant one as in vitro multiplication is concerned. All the accessions rooted in this medium.