ARIZONA AGRICULTURE'S NEWEST CHALLENGE

Urban Horticulture

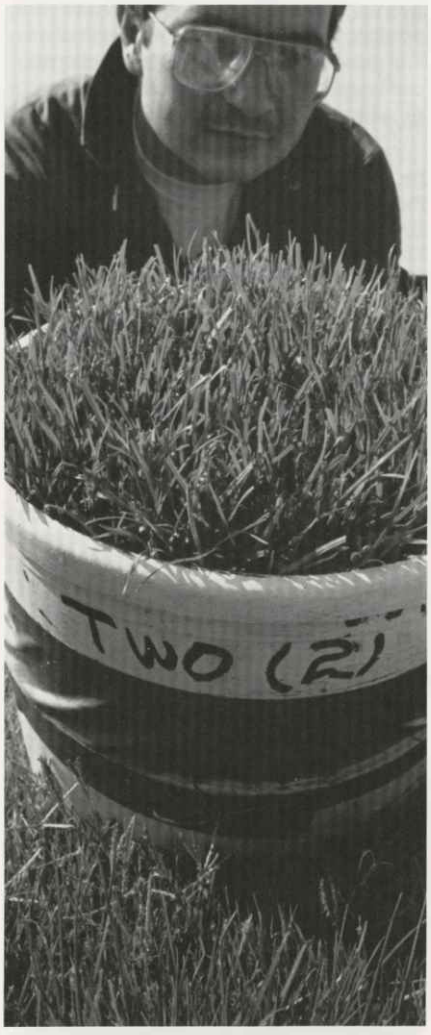
Urban horticulture concerns the turfgrass and landscape industries in Arizona. These industries are growing in stature, as most newcomers to the state settle in the Phoenix or Tucson metropolitan areas. These clientele seek functional landscapes for their residences as well as outdoor recreation activities. These areas include golf courses, parks, football, baseball, soccer and other field games requiring turf. Both the turf and landscape commodities encompass both production and ongoing maintenance budgets which contribute greatly to the State's economy.

Turf

The majority of "high value" turf in the state is concerned with golf courses. There are approximately 200 golf courses in the State, which total conservatively 23,000 acres. The mean annual budget for an 18 hole golf course is $600,000; ($300,000 in payroll and benefits, and $300,000 in equipment costs and commodity maintenance). An 18 hole course averages 118 acres of turf. Areas include 18 acres of driving range and tees. Average fairway size is 3.2 acres, with 600 square feet greens and 4,000 square feet per tee section.

Labor hours incurred on an average 18 hole course are 18,800/year full time and 3,000/year part time. Courses spend an average of $50,000 in new equipment (capital expenditures) $23,000 in irrigation system renovations, and $27,000 in course repair and construction, independent of normal maintenance. More than $22 million was spent on turfgrass equipment in 1987, and more than $6 million in fertilizer alone.

Turfgrass revenue is big business. There are more than 4.8 million rounds of golf played in the state each year. Approximately 2.4 million rounds are played on resort or private courses, which average $42 per round. This equals $100 million in green fees for resort/private courses. The remaining 50 percent of the public, semi-private clubs have an average fee of $15 per round. This equals an additional $36 million in greens fees.



L. Ketchum

Arizona has approximately 200 golf courses. As of 1984 the breakdown was 53 (9 hole), 126 (18 hole), 6 (27 hole), 8 (36 hole), and 2 (54) hole courses.

The Arizona sod industry consists of approximately six major sod growers, producing 1,500 acres of turf. Revenue is more than $13 million annually.

Commercial lawn and home lawn care figures are not presented here.

The issues which confront the turfgrass industry include the following water use issues: availability, amount, qualtiy, cost and potential ground water contamination. Water costs can vary ten-fold due to issues such as water rights, pumping costs, effluent water costs and availability. Also, specialized management programs need to be devised due to Arizona's unique soil and atmospheric conditions. Eradication of the White Amur fish as a biological control of aquatic weeds is also a key concern.

Nursery Industry

The following figures were calculated from a 1983 industry survey. Over 950 firms are engaged in the nursery business. These included florists, nursery and garden centers, field growers, rose growers, landscape operators, Christmas tree growers and nursery sections of regional and national chain stores. Employment was 7,700 persons in 1983. Payroll was $65 million. Total reported sales for the Arizona nursery industry was more than $324 million. Estimated sales tax revenue from the industry was $20 million in 1983.

Nursery industry concerns include education for qualified pesticide applicators and technical workers. A shortage of students in undergraduate programs exists, and management production positions are often filled by out-of-state candidates. Also, the salary status for graduating seniors is low. This makes attractions of talented personnel difficult.

Neither the turf nor landscape industry have adequate allied technical production support, such as pathology laboratories and tissue analysis facilities available.

Increased efforts in applied research, extension and teaching are necessary to assist these industries and provide them with quality personnel necessary to meet the production and maintenance challenges while using less available resources.

Dr. David M. Kopec
Dr. Charles Sacamano
Plant Sciences

URBAN HORTICULTURE

Cuphea—A New Ornamental Plant

The genus *Cuphea* is comprised of about 260 species which are native to the tropical and subtropical areas of North and South America. Among the different species are found a remarkable amount of variability for growth habit and flower size, shape and color. Several species have had minor usage as ornamentals and bedding plants in the South. However, in Arizona, our initial trials showed that these species were not well adapted to our hot summer temperatures.

Research within the UA Plant Sciences Department has emphasized germplasm enhancement through interspecific hybridization as a means of combining favorable traits from different species. This has the potential of releasing new genetic variability by recombining the genetic material from the divergent parents. This new variability then becomes the basis from which selections are made for specific horticultural uses.

Eight *Cuphea* species have been successfully used in forming interspecific hybrids. The vegetative growth habit varies considerably among these species, six of which are annuals and two are perennials. The flower colors range from white to magenta, with many pink, red and purple variations. Most flowers have six petals, two dorsal and four ventral, of the same color, but one species has only the two dorsal petals projecting from a colored calyx tube and another species has large purple dorsal petals and narrow white ventral petals.

Eleven of the eighteen interspecific hybrids which we produced are sterile. Sterile hybrids are easily propagated by cuttings and flower profusely over long periods of time. The flowers are morphologically distinct from the parents and are often bicolor.

Seven hybrids exhibit a relatively high degree of fertility. They were all produced from reciprocal crosses between different accessions of two morphologically distinct parental species. *C. llavea* is a semiwoody perennial with only two dorsal petals on a long calyx tube. *C. procumbens* is a herbaceous annual with a complete complement of six petals. Segregating populations of several of these hybrids have been grown at Ames, Iowa; Corvallis, Oregon; and Tifton, Georgia. A wide range of plant characteristics segregated genetically, including variable expression of perenniality, determinant flowering and seed shattering. One hybrid from this cross is of particular interest. This hybrid is perennial, produces red flowers on an erect semiwoody stem, and cuttings root easily. This plant has flowered profusely in the field throughout two growing seasons, even during the summer in Phoenix.

Our work has shown that interspecific hybrids between Cuphea species can produce new combination of flower colors and growth habits from which selections can be made for plants adapted to Arizona's growing conditions.

Dr. Dennis T. Ray
Plant Sciences
Dr. Anson E. Thompson
Plant Sciences and
the U.S. Water Conservation Laboratory

Turfgrass Water Conservation

Parks, golf courses, baseball, football and soccer fields (and some back yards) would be different places if it were not for turfgrasses. In a desert area, even the best adapted turfgrasses require water. Turfgrass water conservation is the major area of research in the turfgrass program. Several approaches to water conservation are being evaluated to promote water conservation of turfs. Experiments are underway which deal with actual water use of grasses, using antitranspirants which may reduce water loss from turfs and evaluation of new grasses for both standard utility and low maintenance use areas.

The vast majority of water used by turfgrass plants is for transpiration (evaporation of water from leaf surfaces). This is necessary to lower leaf temperatures so that photosynthesis can take place. Experiments are underway by Harold Kelly, a graduate student in Turfgrass Science to detect turfgrass water stress by measuring turfgrass temperatures using a hand held temperature sensing device. Stressed plants have elevated canopy temperatures as soil moisture decreases. Unstressed plants have cool temperatures (cooler than the air itself), because they can maintain adequate transpiration to reduce the heat load of the turf. Currently, pre-determined stress levels are being tested to trigger turfgrass irrigations. Stress models developed for other crops using this method are not suitable for turfgrasses, therefore extra research is necessary for turfs.

Every day, the atmospheric demand for water loss from turfgrass areas can be derived from weather station data. This demand is compared to actual turf water use to determine the relationship between the values calculated by the weather station information. The weather network AZMET, was devised and implemented by Dr. Paul Brown, Extension Biometeorologist, who works closely with the turfgrass research team. The conservation potential of the AZMET program is great, since water use values can be obtained daily on a variety of crops, including turf.

Antitranspirants (chemicals which decrease water loss from plants) are being tested for application on turfgrasses. An ideal antitranspirant would reduce water use and not have damaging effects to turf or the environment. Dr. Charles Mancino has worked with several antitranspirants on both rye and Bermuda grasses. A management program incorporating the most promising methods will help promote turfgrass water conservation.

Dr. David M. Kopec
Dr. Charles F. Mancino
Plant Sciences

Turf For Tomorrow

Maintaining attractive turf with minimal water is a major focus of UA turf scientists. Chemical antitranspirants, along with native grass species naturally able to withstand moisture stress, are water conservation avenues currently under investigation by the turfgrass science program.

Curly mesquite was acknowledged nearly a century ago by the USDA for turf potential in hot dry regions. Adaptation of curly mesquite to low maintenance turf situations in Arizona is one goal of our turfgrass research. This turfgrass possesses many characteristics of desirable turf such as relatively low stature, fine leaf texture, ability to spread vegetatively and drought tolerance.

Accessions of curly mesquite are being collected from rangeland throughout the central, eastern and south-southeastern portions of Arizona. Currently, variation

between accessions is being assessed with respect to stature, leaf texture, flowering and seed characteristics, and sod forming ability.

Curly mesquite displays interesting reproductive biology. Botanically, the flowering stalk is a spike, usually with seven spikelets. Female and male flower parts arise from separate parts within a spikelet. First, the female flowers emerge over five days, then after one week, male flowers emerge over the next 10 days.

Microscopic observations have shown a high chromosome number (72) which appears to be constant between accessions. However, chromosome behavior during meiosis does vary between accessions. Furthermore, preliminary results show that electrophoretic techniques may be useful in identifying genetic differences between plants separated geographically. This information, coupled with an understanding of the plants reproductive biology, will become increasingly important as breeding schemes are developed.

Mechanisms reducing seed germinability remain largely unknown. Further research efforts are focusing on understanding and improving seed formation, germination and viability. This will greatly enhance the ease of establishment and commercialization of this grass in years to come.

Dr. Charles F. Mancino
A.E. Ralowicz
Dr. David M. Kopec
Plant Sciences

New Interior Landscape Plants

Few areas of agriculture have enjoyed rapid growth and expansion like that of the foliage plant industry over the past twenty years. Plants were once considered a luxury, an accessory, a nice touch to finish a building or room if there was money left over. Now plants are viewed as a necessity, a required part of any indoor setting where people live, work or play. In fact many interior spaces are now designed specifically to accommodate plants.

Rapid growth in the foliage industry has been accompanied by a strong demand for new plant species. There is a continual search for new, different and unusual types as well as for those that perform better in contemporary interior environments.

In response to the need for new interior landscape plants several collecting trips have been made to Nueva Galacia, a vast region of subtropical forests in western Mexico. A number of promising interiorscape candidates from Nueva Galacia are now being evaluated in UA greenhouses.

Three species of *Pedilanthus* show real potential as low light requiring interior plants. *Pedilanthus palmeri* has deep green foliage and attractive coral pink flowers. In one experiment this species was grown under fluorescent lights at a light intensity of only 30 micromoles per second per square meter for 16 hours per day. At the end of a four-month test period the test plants were judged to be of good salable quality.

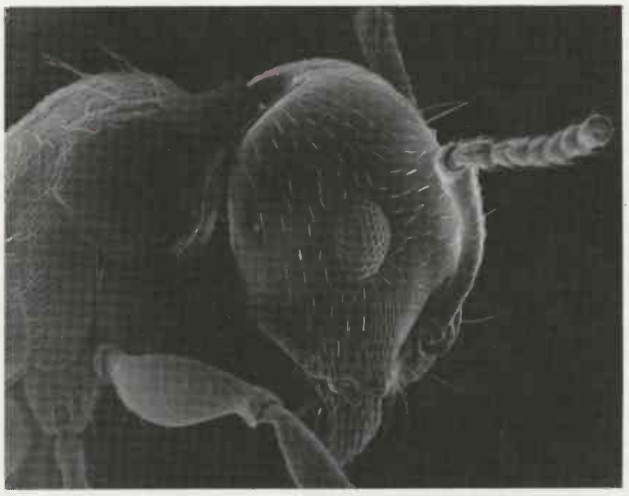
When *P. palmeri* is grown in a greenhouse with sunlight as the only source its flowering period extends from December into March. A series of photoperiod experiments has demonstrated that this is a short day plant which can be brought into flower at any time of year by controlling day length. Test plants that received 8- and 10-hour day lengths flowered within one month of the start of the experiment whereas plants receiving greater than 10-hour photoperiods never flowered.

Two other species of *Pedilanthus* are now being evaluated as interior landscape plants. *Pedilanthus calcaratus* grows as a single stemmed plant to four meters in height. Its thick bold textured foliage and small bright red flowers make it a unique and attractive small tree for interiorscape use. Another as yet unidentified *Pedilanthus* from higher elevation forests grows no more than 50 centimeters tall and displays its appealing slipper-shaped rose colored flowers in December and January.

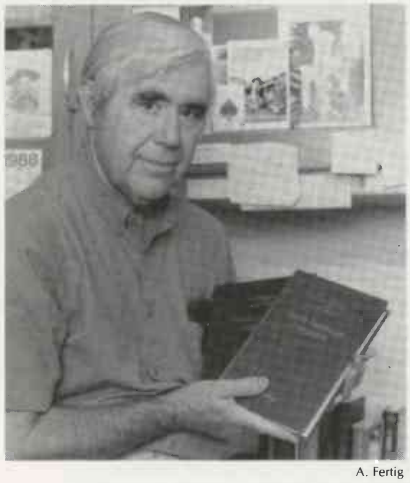
Other plants from Nueva Galacia which are currently being investigated include *Ardisia revoluta*, a small compact tree with glossy dark green leaves and clusters of tiny intensely fragrant white flowers and *Chusquea circinata*, a bamboo selected for its long trailing stems and delicate feathery foliage. The graceful cascading growth habit of this bamboo gives it great potential as an interior landscape plant for shopping center malls, banks, resorts, office buildings, restaurants and other large indoor spaces.

Dr. Charles Sacamano
Plant Sciences

L. Ketchum



D. Wheeler



A. Fertig

L. Ketchum