NEW IDEAS FOR ARIZONA'S FARMERS

L. Ketchum

L. Ketchum

A. Fertig

L. Ketchum

One Irrigation Barley

The UA and the Agricultural Research Service of the USDA have been breeding barley for reduced water use since 1974. Barley lines have been developed that yield 2,000 to 3,000 pounds of grain per acre with a single irrigation near planting time filling the soil profile to a depth of four to six feet. The term "one-irrigation barley" has been given to lines developed by this program.

In April of 1987, a one-irrigation barley line named Seco was released from this barley breeding program by the Soil Conservation Service and the Agricultural Research Service of the USDA and the UA. Seco is intended as a soil conservation crop to control weeds and wind erosion on abandoned farmland, provide feed and forage for wildlife, and stabilize soils. One-irrigation barleys may be used in conventional agriculture as a source of green manure or as a rotational crop. One-irrigation barleys may provide a useful alternative to conventional crops or farming practices in the future in areas of rising water costs or mandated soil conservation programs.

One-irrigation barleys are successful with limited water availability due mainly to early maturity and deep rooting characteristics. One-irrigation barleys mature three to four weeks before full season cultivars, avoiding the warmer part of the growing season. These barleys can develop a root system to a depth of eight feet or more as opposed to barleys adapted to high-yielding conditions with root systems typically reaching a depth of five feet.

One-irrigation barley is grown with limited management inputs. An irrigation is applied near planting, wetting the soil to a depth of four to six feet. A nitrogen fertilizer application of approximately 50 to 100 pounds of nitrogen per acre is sufficient in most cases. Optimum planting dates are similar to that of current commercial barley cultivars. A seeding rate of 40 pounds of seed per acre is usually adequate with a well-prepared seedbed.

Dr. Mike Ottman
Dr. Tom Ramage
Plant Sciences

Alternative Crops

Pyrethrum: A Natural Insecticide

Pyrethrum extracts are basic ingredients of many insecticides. This combination of chemicals is obtained from dried flowers of a species of chrysanthemum native to Yugoslavia. In recent years, major production of this botanical insecticide has been in Kenya and Equador, and the U.S. has been importing in excess of $20 million worth of this product each year.

A plant breeding effort has been underway for several years to select and identify adapted clones of *Chrysanthemum cinerariafolium* as an alternative crop for Arizona. As a result of this breeding project, superior clones which are well adapted to Arizona agricultural conditions have now been identified. A new commercial effort is in a formative process to take advantage of this recently developed germplasm. Pyrethrum Limited has been formed this year with the goal of commercializing pyrethrum in the U.S. At present, the only other commercial acreage of pyrethrum in the U.S. is in Oregon.

Central to the development of this crop was breeding clones of pyrethrum which were amenable to being grown under desert conditions with irrigation, and which were adapted to commercial mechanized harvesting methods. The development of new germplasm, now being prepared for release, has been the outcome of this project. Present domestic stocks of pyrethrins, the chemical insecticides derived from the pyrethrum plant, are totally dependent upon foreign suppliers. The price has gone above $200 a pound for the purified product in recent years. A domestic supply of this critical insecticidal material could become an important future resource for the U.S.

In view of dramatically increased interest in environmentally safe pesticide development, the advent of a commercial pyrethrum production project is especially welcome, as one of the characteristics of the insecticidal chemicals from this plant is that they are relatively nontoxic to mammals. Pyrethrum extracts also do not persist in the environment as they are photochemically degraded to harmless compounds. With modern insecticide formulation technology and use of synergists, pyrethrum stands alone as the pesticide of choice for use in food manufacture and dairy barn fly control.

A ten acre commercial planting of pyrethrum is presently thriving with a significant harvest expected in the foreseeable future. Present research in the Department of Plant Sciences is aimed at the development of superior clones of pyrethrum by the use of tissue culture propagation methods. Development of superior clones via these laboratory selection techniques appears promising at this time.

Part of the continuing project will be development and testing of new mechanical equipment and techniques to effectively harvest flowers without the use of intensive hand labor. Presently, worldwide in excess of 25,000 tons of pyrethrum flowers are harvested annually by hand in Kenya, Tanzania and Equador. Application of mechanical harvesting techniques and intensive irrigation technology under Arizona conditions should provide a breakthrough technology for efficient production of this high value insecticide crop in the U.S.

Dr. R.G. McDaniel
Plant Sciences

Jojoba Harvesting Equipment

Prior to 1987, the majority of jojoba seed was harvested directly from the plants either by hand picking or by mechanical harvesters straddling the row. These harvesters used a combination of impact and vibration to dislodge the seed from the plants. The falling seed landed on a moveable surface which passed along the base of the plants and then directed the harvested crop onto a conveyor for transport to a storage bin. This type of mechanical harvesting system has several disadvantages. Adverse weather conditions and non-uniform crop maturity result in significant shattering losses. Relatively low harvest speeds, combined with complex and costly equipment, produce high harvesting costs.

During the 1986 harvest, increasing dissatisfaction with harvesting rates and efficiencies prompted the investigation of alternative methods. Harvesting seed after it has fallen to the ground appeared to be a viable alternative, with two scenarios possible. Either the seed could be allowed to mature and fall naturally, or it could be dislodged from the plants mechanically.

The development of a machine for harvesting jojoba seed from the soil surface began in 1986. A guayule seed harvester was modified to increase suction and to facilitate some cleaning of the seed. Two wands attached to suction pipes on the harvester were used to manually vacuum the seed around the base of the plants. The information gathered from the field trials led to the design of a prototype harvester which does not require manual operation of the wands. This machine, which was extensively tested in 1987, collected seed from half of two rows simultaneously. A combination of mechanical and pneumatic separation was used on the harvester to clean the soil, rock and other debris from the seed.

In addition to providing basic design criteria for the harvester, the 1986 trials indicated that two operations were required to prepare fields for jojoba ground harvesting. Trimming of the lower plant branches permits harvester access and improves operator visibility. Preparation of the soil surface by smoothing and rolling compacts the soil, thereby reducing the amount of soil and debris picked up. Improved harvester efficiency and increased field capacity are also brought about by these operations.

Redesign and fabrication of the second generation prototype harvester and the construction of a separate machine, using a different concept, are now underway. Extensive field trials are planned for both harvesters during the 1988 season. Design and fabrication of a prototype trimmer and a ground shaper are also underway.

Dr. Wayne Coates
Agricultural Engineering

Solving Jojoba's Frost Problem

Low temperature is the major climatic limitation for cultivation of jojoba in Arizona. Flower buds are present on jojoba plants during the winter, and if they are damaged by frost, the entire crop can be lost for the year. Severe damage has been experienced in one or more regions where jojoba is being cultivated in each of the last five years. Results of studies at UA research plots as well as on commercial fields during the past few years have provided encouraging evidence that this problem can be solved through altered cultural practices and/or through development of resistant cultivars.

In the long run, identifying or developing genetically resistant cultivars would be the most desirable solution to this problem. In research plots at Mesa, Maricopa, Yuma, Bakersfield and in Tucson, large differences have been repeatedly noticed in the amount of damage between different clones following frost episodes. Differences have been observed in young plant survival and damage to vegetative tissues as well as damage to flower buds. Studies have been conducted on the physiological difference between resistant and susceptible clones. Other studies are underway to evaluate the influence of various degrees of water stress on changes in frost resistance and other physiological traits of several selected clones.

Observations by many people indicate that flower buds which are beginning to come out of dormancy are much more susceptible to frost damage than are completely dormant buds. Australian researchers have recently developed a model to explain how flower bud development of jojoba is controlled during the fall and winter months and suggested efficient ways to select for genotypes in which buds remain in a frost resistant stage during the winter. Researchers are presently analyzing flower-bud development data collected over several years in UA research plots and relating it to the Australian model.

For existing plantings, cultural methods of controlling frost damage are needed. It was suggested many years ago that stressing plants going into winter would possibly increase resistance to frost. At the Overpass Farm in Tucson, this was observed, by chance, during the past two winters. In early 1986, the farm was being prepared for sale, and irrigation was stopped on a mature jojoba planting, however, the plants were allowed to remain. During the past two winters, little if any damage has occurred on plants in these fields. These same plants showed from moderate to severe damage in earlier winters when they were irrigated. Experiments are being conducted at Yuma and at the new Maricopa farm to study effects, in more detail, of water stress on frost tolerance of several selected clones in more detail.

Dr. David A. Palzkill
Plant Sciences

Domestic Natural Rubber Source

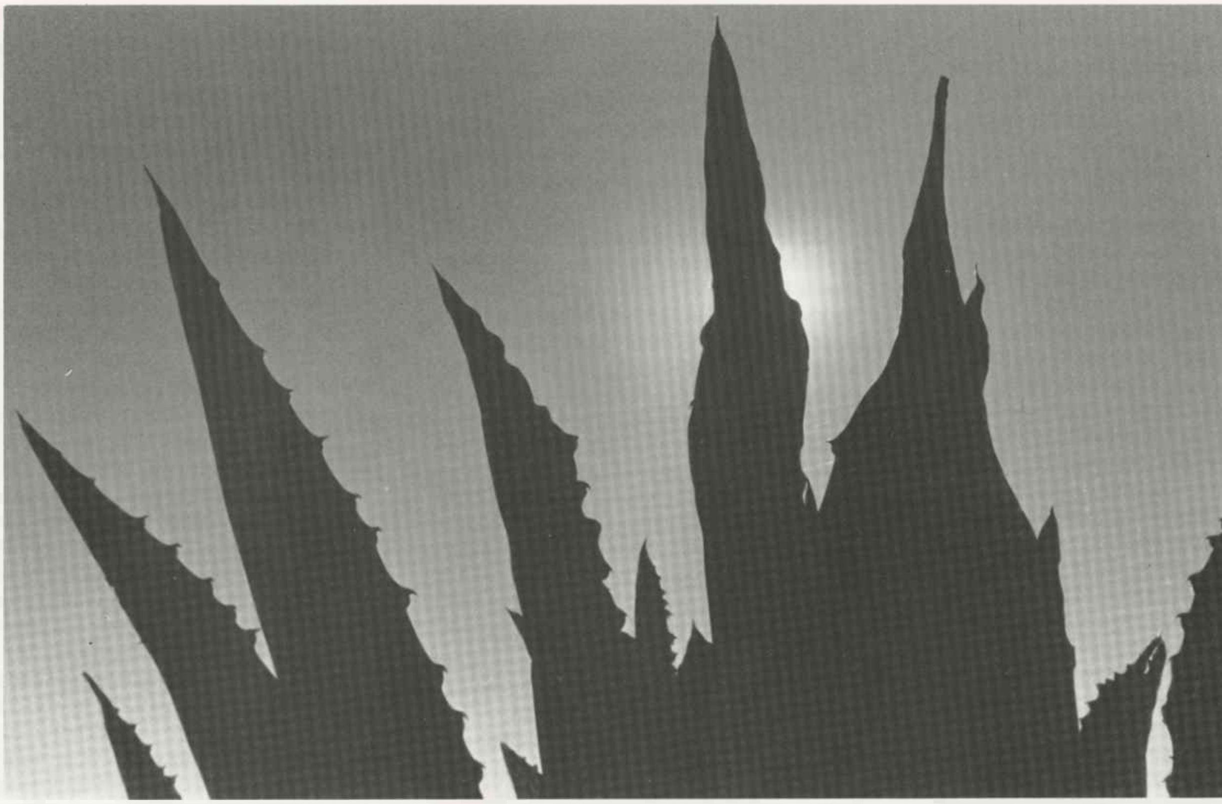
Guayule is one of several alternative crops with industrial potential under investigation at the Office of Arid Lands Studies (OALS). Of the 2,000 species of plants known to produce rubber, the two that are most significant economically are the rubber tree (*Hevea brasiliensis*), grown primarily in Southeast Asia, and guayule, a small desert shrub native to northeast Mexico and southwest Texas. Currently only *Hevea* rubber is produced commercially, and the United States imports 750,000 metric tons annually at a cost of almost $1 billion.

OALS, in cooperation with the U.S. Department of Agriculture and the Department of Defense, is participating in the Guayule Scale-Up Study, a feasibility study on the development of a domestic natural rubber industry. For this project, Firestone Tire and Rubber company has constructed a prototype guayule processing facility at the Gila River Indian Community, where 350–400 acres of guayule have been planted. These plants will provide feedstock for the new facility, as well as data on growing requirements, rubber content, and plant density effects. The role of OALS is to synthesize information contributed by researchers in government, industry and academia on the state-of-the-art of guayule production, and to develop a cost scenario for scaling up from the 150-ton-per-year prototype facility to a commercial one of at least 50,000 tons per year.

Guayule use has a long history in North and Central America. In the 1500s the conquering Spaniards discovered Aztecs, in what is now Mexico, playing with balls and using other products made of rubber extracted from guayule plants. In 1910 guayule production in the U.S. reached 21.5 million pounds, and it continued to be commercially produced until the late 1940s. During World War II, in response to a cut off of *Hevea* rubber supplies, the Emergency Rubber Project established more than 30,000 acres of guayule in the Southwest. When the war ended, guayule production stopped, partly because *Hevea* imports resumed and partly because of the assumption that the newly developed synthetic elastomers (derived from petrochemicals) would eventually replace natural rubber. The 1973 oil embargo helped to shake this assumption, as did studies indicating desirable properties of natural rubber that synthetics have not duplicated.

Thus, because of the unreliability of both *Hevea* and oil imports during times of national emergency, the critical need for a domestic rubber source was recognized. The report produced by OALS for the scale-up study will be used to determine the potential for developing guayule as a natural rubber industry in the Southwest.

Susan Fansler
Gene Wright
Arid Lands Studies



L. Ketchum

Editor
LYNN KETCHUM

Art Director
HECTOR GONZALEZ

Circulation Manager
ROBERT CASLER

Arizona Land and People (ISSN 0033-0744) is published quarterly by the Office of Agricultural Sciences Communications, College of Agriculture, The University of Arizona, Tucson, Arizona 85721. Second-class postage is paid at Tucson.

The College of Agriculture includes the School of Family and Consumer Resources, the School of Renewable Natural Resources, the Office of Arid Lands Studies, the Agricultural Experiment Station, Cooperative Extension and Instruction. It is an equal opportunity employer.

Subscriptions are free on request. Letters to the editor are welcome. Information in **Arizona Land and People** becomes public property upon publication. It may be reprinted provided that no commercial endorsement is implied. Please credit authors, photographers, this magazine and the university.