Traditional Crops

Crop production in Arizona gives some of the highest yields in the world. Abundant sunshine, productive soils and the long growing season make this possible; the use of adapted crop varieties, tested production practices and effective pest control makes it happen. Water from irrigation instead of precipitation adds to the farmer's control over growing conditions, but also adds to his costs. The high production costs in the state increase the motivation to get top yields for maximum profit.

For decades, research has innovated production practices, and growers have adapted them, adopted them and added their own ideas. The Cooperative Extension Service has helped innovations spread quickly. So have market pressures: high yields are essential to Arizona growers because of the high cost of inputs. Our agriculture is energy-intensive, especially where it uses pumped groundwater, so inflation in energy hits hard.

Successful crop production in Arizona is a high-technology endeavor. The advancing sophistication that has kept Arizona growers at the forefront of scientific crop management can continue to keep agriculture strong here in the future. This continuing pattern of development also provides leadership for effective crop production in other irrigated arid lands around the world.

The needs of Americans and other people for farm products require that farmlands here and around the world maintain or increase productivity. In addition, Arizona lands offer unique products such as high-quality planting seed, extra long staple cotton, and fresh vegetables produced at times of the year when they are difficult to produce elsewhere in the country.

The stories of specific crops illustrate the advances being made in crop production technology in Arizona.

Cotton

In recent years, cotton has been grown on about half of Arizona's irrigated farmland (see Table 4, page 7). About nine-tenths of it is upland cotton. The rest is higher-value Pima cotton. The most successful growers start with one of the adapted and highly improved cotton varieties, carefully prepare a first-class seed bed, use high-quality planting seed and plant to a stand. They follow a strong pest-control program starting with preplant weed control techniques and often use systemic insecticides. They infuse water and nutrients based on careful monitoring and late season inputs based on the nature of the season. Picking is prompt. Essential to all of these steps are daily monitoring by an experienced manager capable of making on-the-spot decisions, the use of special resource personnel, and planning for the years ahead through use of improved field layout, crop rotations and manure.

Arizona's cotton yields per acre, double the national average, have changed little in the past 25 years. Advances in production techniques have focused on controlling the input costs. Current research points toward a shorter season and added efficiencies, especially in pest control and water use.

Several lines of research aim at making short-season cotton more profitable. Stopping cotton growth early and harvesting by September 15 can reduce water use by six to 12 inches per acre compared to current practices. The short-season system also eliminates three to five insecticide applications and sharply reduces overwintering populations of pink bollworm and tobacco budworm, the crop's most damaging pests. Short-season practices already can be seriously considered for about 10 percent of the Arizona crop. The major obstacle is that cotton profitability jumps when favorable late-season growing conditions occur and are turned to an advantage.

Two factors are likely to accelerate the shift to short-season cotton in coming years: One is that researchers are improving production methods for short-season cotton and breeding improved short-season varieties. Progress in the development of hybrid cottons makes successes in the breeding work likely. The second factor favoring a shorter season is that costs of late-season inputs are apt to escalate faster than the value of added late-season yields.

Short-season cotton also brings the prospect of planting cotton as a double-crop following small grains, lettuce, sugarbeets or other crops. This would add to the efficiencies because cotton's strong taproot can reach residual soil moisture and nutrients that have moved below the root zone of the winter crop, and because fixed costs such as land and some machinery can be spread over two crops instead of one.

The types of irrigation efficiencies described in the preceding article can be applied to many crops, but cotton's high acreage makes it the most important crop in total savings possible. For a 650,000-acre cotton crop, it is estimated that 400,000 acres could benefit from improved field layout to shorten the runs of water or from improved leveling, or both. While no specific figures are available, these physical improvements to fields may increase irrigation efficiency by up to one acre-foot of water per acre of cotton. Sprinkler irrigation systems have immediate-use prospects for cotton. Drip or trickle systems, though they offer even greater efficiency of water application, are still uneconomical due to their high initial costs.

Small Grains

Arizona wheat and barley growers have fine-tuned their production system, shifting in the past decade from grain types destined for animal feeds to those used for human consumption. This has been made possible by the introductions of short-strawed desert durum wheats and high-quality bread wheats that are highly productive, responsive to management and exportable at a good profit margin. While barley is more salt-tolerant and fits a special place in many rotations, its acreage dropped steadily in the 1970s.

The durum wheats require careful management of nitrogen and water inputs in order to produce top quality food grain. Specific requirements depend on soil type, and guidelines for decision-making have been based on research. Efficient production makes use of an adapted variety responsive to management and early planting at low rates to minimize fertilizer needs. Traditional spring wheats are grown as winter wheats at the lower elevations of Arizona. Growing them when temperatures are cooler makes water use more efficient by avoiding much of the summer period of high evaporation losses.

Development of a fully compatible rotation system for small grains and cotton for use on an every-year basis would rank as a major breakthrough for Arizona farmers. The Arizona Agricultural Experiment Station is near that goal in its small-grain research program. What is needed is a small-grain variety which can grow between cotton harvesting and cotton planting time and which can produce economically on low inputs. Years of breeding have produced Barley Selection E-5. It fits these needs closely enough to indicate they can be met fully in the foreseeable future.

Barley Selection E-5, grown without added nitrogen and with only 13 inches of added water, yielded 30 percent more grain in one test than popular varieties Gus and Arivat grown under the same conditions. The test variety also matured a full week before the conventional ones. That 30 percent difference amounted to 1,082 pounds of barley per acre. At about six cents per pound for barley, that would make E-5 worth $65 more than the older varieties for each acre grown under those low-input conditions. The goal is a barley for double cropping with cotton. Even at this stage of research, that $65 per acre for just one-tenth of a 650,000-acre state cotton crop could represent $4 million for the growers, if other factors were unchanged.

Sorghum and Corn

Grain from sorghum has been well adapted for Arizona conditions and is an important local input for the feeding of cattle. Our total sorghum acreage has been giving way to the higher value cotton, but sorghum is still a key component of Arizona agriculture because of its drought-tolerance and its adaptability to soils that are marginal for other conventional crops. Yields on such marginal lands have shown a steady increase for three decades. This is due to the use of improved hybrids, effective weed control, proper fertilization and judicious use of water.

Continuing research is improving sorghum varieties and production practices for specific sections of Arizona. The Yuma area, for example, needs a summer crop to complement its winter crops. Sorghum may fill this need if improvements in disease resistance and stress tolerance are

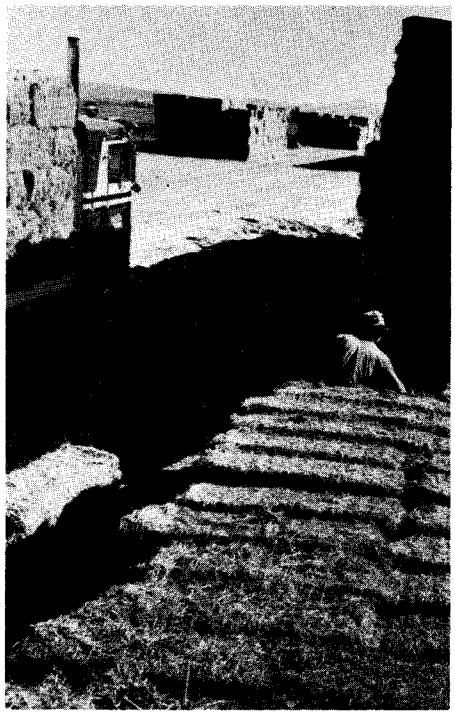
successful. Elsewhere, areas that get some rains in July, August and September may benefit from progress on a short-season, low-input sorghum variety. Improved selections using only one irrigation (at planting) have yielded 40 to 70 percent as much grain as fully irrigated varieties, depending on the amount of rain. This practice makes a crop possible where irrigation water is scarce or expensive.

Corn has adapted remarkably to the middle elevations of Arizona. Its new popularity among Cochise County farmers has tripled Arizona grain corn acreage since 1970. Principal factors in the success of corn production have been the introduction of locally adapted hybrids and the transfer and modification of sophisticated production technology from other areas where corn is grown. Especially important are the improved weed control and harvesting techniques. Narrow-row plantings, disease and insect resistant varieties, and proper fertilization and irrigation techniques have also been significant factors.

Alfalfa

Alfalfa's initial success in Arizona followed introduction of non-dormant varieties quite different from types grown in the Midwest. Its acreage in the state has stayed near 200,000 for 30 years, but yields have more than doubled during that time. Alfalfa is a key feed source for our dairy and beef cattle, horses, and other livestock. California dairies also use much Arizona alfalfa.

The alfalfa plant improves soil structure, aeration and drainage, and adds organic matter and nitrogen to the soil. The crop is favored for a rotation with cotton since cotton may produce an extra half bale or more per acre in the first year following alfalfa.



Arizona's alfalfa yields per acre have become the highest in the world while water application rates have been reduced through an understanding of when irrigation is most beneficial. Plant breeding has been a key to increasing and sustaining high yields. Development of high-yielding varieties resistant to insects, diseases and nematodes has allowed the continued improvement of this crop in Arizona. Also of great importance has been the development of stand-establishment and management procedures that allow full stands to thrive for several years.

Research in 1979 and 1980 points to new ways of improving alfalfa yields either generally or in specific cases. New findings suggest that fertilization with potassium, and sometimes magnesium, may result in higher yields and more nutritious forage. Breeding results show that improved root systems and multi-leaflet leaves are hereditary traits and can be incorporated into new varieties. The same is true for tolerance to salt or heat.

Vegetables

The Arizona vegetable industry is characterized by production of fresh vegetables during the "off season" for distant markets. To market vegetables at specific times when production is down elsewhere, Arizona growers must manipulate growing schedules. This means that vegetables often must be grown under climatic conditions that are less than ideal. For example, lettuce must be planted in late summer when heat hinders the plants' early survival. The quality and quantity of irrigation for vegetables is also a critical concern. The perishability of

vegetables that must be shipped long distances adds more complexity to this dynamic industry.

Research on bed shapes and water movement has revealed ways to reduce salt problems in lettuce and get uniform, early growth in lettuce and cantaloupes. Irrigation studies have led to improved efficiency and shown that overwatering reduces vegetable yield and quality. Recommendations for using essential inorganic fertilizers have been refined. A tissue-analysis technique now allows more precise fertilization during the growing season.

Work continues on breeding, evaluating and adapting new varieties and new hybrids of vegetables for Arizona. New lettuce varieties that extend harvest seasons allow production in new places, such as the Willcox area. Potato and carrot varieties adapted to Arizona conditions have been introduced. Cucumbers do not tolerate hot desert conditions as well as melons do, but considerable progress has been made in breeding a variety of melon that bears a fruit closely resembling a cucumber.

To keep Arizona vegetable growers competitive, new lettuce varieties are being developed that keep longer after harvest, especially when chopped for the wholesale trade. New packaging and shipping methods for lettuce and cantaloupes have reduced damage losses by millions of dollars. Use of plant growth regulators and new single-seedling planting techniques may improve early survival and growth for vegetables. Efforts to improve harvesting efficiency are also promising. Drip, sprinkler and dead-level irrigation systems are under study for various vegetables.

Seed Industry

Arizona's low humidity, control of water and other growing conditions favor the production of high-quality planting seed for many types of crops. Acreage for growing certified seed increased fourfold from 1969 to 1979, to more than 70,000 acres. Already the state produces a large portion of the cotton planting seed for the entire Cotton Belt. Information now available will allow expansion of this industry, and research should lay the basis for continued expansion. A shift to seed production will mean effective use of our unique production conditions. It will also provide growers with more profitable opportunities, since planting seed commands premium prices. Besides cotton, certified seed production in the state already includes small grains, alfalfa, sorghum, vegetables and other crops.

In spite of the great technological advances that have been made in Arizona crop production, continuing the success of growing traditional crops depends on development of even more advanced techniques, and on their rapid adoption by farmers. This is because technology is advancing in other agricultural regions and we must stay competitive. In Arizona, we must obtain the greatest possible efficiency in the use of our precious water.