



AGRIBUSINESS & AGRICULTURE TECHNOLOGY

FEEDING THE WORLD

The world population was 7.7 billion in 2019 and is expected to grow to 9.7 billion by 2050¹. Food and water security are central to supporting a growing population and providing a healthy quality of life in America and across the world.

Arizona contributes significantly to the nation's and world's food chain, exporting \$1.7 billion in agricultural goods in 2017². Arizona has built upon the state's long history of Native American agriculture and technical innovation to grow food and raise livestock in even the most arid conditions. The state's tribal nations continue to contribute to the local and state food supply as over half of the state's food producers are on reservations³.

Today, Arizona's farms and ranches generate \$23.3 billion for the state's economy and create 138,000 jobs⁴. Arizona's farmers and ranchers contribute to a variety of the nation's commodities exports and are helping meet expanding global food needs. The state's exports include milk and other dairy products, eggs, beef, leafy greens, citrus, cotton and grains. Additionally, Arizona has a robust specialty crop industry including wineries and tree nut orchards throughout the state.

1 https://population.un.org/wpp/Publications/Files/WPP2019_Highlights.pdf

2 <https://ustr.gov/map/state-benefits/az>

3 <https://indiancountrytoday.com/culture/usda-reports-arizona-has-the-largest-concentration-of-indian-farms>

4 https://agriculture.az.gov/sites/default/files/AZDA_GuideToAZAg_2018.pdf

Arizona’s agriculture industry is a mix of small and large farmers and specialty and annual crops. The diversity of Arizona’s agriculture industry is supported by state and regional trade associations, which are critical to educating residents and policy makers of the role farmers and ranchers play in contributing to state, national and global food supplies⁵. These organizations also provide critical education and training opportunities for Arizona’s farmers and ranchers to ensure the state stays on the cutting-edge of food production and water and land conservation.

PRECISION AGRICULTURE

Global food challenges represent an opportunity for innovation and economic growth and the need for nutritious food can only be met by responsible land stewardship and increasing agricultural efficiency. Precision agriculture represents the future of the agriculture industry and allows farmers to meet growing global food needs. Precision agriculture, precision farming and site specific management are all terms for data pertaining to a particular site to manage inputs during the planning and production processes on a farm⁷. Through such technologies as GPS (Global Positioning System), GIS (Geographic Information Systems), VRT (Variable Rate Technologies) and yield mapping, food producers are better able to better navigate their fields, understand existing and future soil conditions and irrigate their land with less water.

Table 1: 2017 Arizona Commodities by Sales⁶

Commodity	Sales (In Thousands)
Crops	\$2,094,218
Grains, oilseeds, dry beans, dry peas	\$157,833
Tobacco	—
Cotton and cottonseed	\$184,002
Vegetables, melons, potatoes, sweet potatoes	\$1,009,125
Fruits, tree nuts, berries	(D)
Nursery, greenhouse, floriculture, sod	\$195,925
Cultivated Christmas trees, short rotation woody crops	(D)
Other crops and hay	\$401,709
Livestock, poultry, and products	\$1,757,790
Poultry and eggs	(D)
Cattle and calves	\$641,182
Milk from cows	\$856,376
Hogs and pigs	(D)
Sheep, goats, wool, mohair, milk	\$8,911
Horses, ponies, mules, burros, donkeys	\$32,934
Aquaculture	(D)
Other animals and animal products	\$5,510
Total	\$3,852,008

(D) Withheld to avoid disclosing data for individual operations.

5 https://agriculture.az.gov/sites/default/files/AZDA_GuideToAZAg_2018.pdf

6 2017 is the most recent data provided by the U.S. Department of Agriculture for commodity sales by state: https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Arizona/cp99004.pdf

7 http://lubbock.tamu.edu/files/2011/10/precisionfarm_1.pdf



Agricultural operators in Maricopa and throughout Arizona already leverage the cost savings and efficiency benefits derived from precision agricultural technologies. From Amigo Farms⁸ in Yuma, Arizona to Santa Rosa Produce⁹ right here in Maricopa, these farms are integrating GPS-enabled tractors and crop monitoring technologies to ensure they manage their resources while still producing high quality produce and vegetables for consumption.

AGRIBUSINESS COMPANIES IN ARIZONA

Agribusiness seeks to capitalize on market opportunities for more efficient food production and apply innovations in information technology and agricultural sciences. Arizona demonstrates the best in agriculture and innovation to support the agribusiness industry. The state's arid climate and natural resource characteristics compel private companies, local and state governments and universities to continue to innovate, making invaluable contributions to the food chain and water sustainability.

Arizona directly supports over 2,000 jobs¹⁰ in the agricultural and forestry industries and over 30,000 jobs¹¹ in computer systems design. This combination of existing firms and jobs are key ingredients to the agribusiness industry. Firms like CropTrak¹², Botanisol¹³ Analytics and Heliae¹⁴ already realize the innovative opportunities in Arizona. These companies are leveraging IT solutions to create sustainable agricultural operations. Local and state governments support these firms because they are providing critical solutions to maintain the state's food and water supplies.

Global companies also realize the potential Arizona has to drive innovation in agriculture. Bayer Crop Science invested \$100 million in a greenhouse research facility in nearby Marana, Arizona in 2020¹⁵. This greenhouse facility partners researchers and growers to improve efficiencies in corn growth by leveraging advancements in data science, automation and seed chipping technologies. While corn is traditionally grown in the Midwest, Bayer leverages the number of sunshine days in Arizona to increase the number of harvests per year. This greenhouse facility is one of Bayer's largest research investments in decades and positions Arizona at the center of innovation in corn growth¹⁶.

8 <http://www.amigofarms.com/>

9 <https://santarosaproduce.com/>

10 2019 County Business Patterns, NAICS Code 11

11 2019 County Business Patterns, NAICS Code 5415

12 <https://icroptrak.com/about/>

13 <https://bsol.io/#technology>

14 <https://heliae.com/about/>

15 <https://media.bayer.com/baynews/baynews.nsf/id/Bayer-advance-sustainable-agricultural-solutions-utilizing-innovative-greenhouses-Marana-Arizona>

16 <https://www.azcentral.com/story/money/business/tech/2020/03/09/bayer-crop-science-division-high-tech-greenhouse-corn-seeds-marana-arizona/4945369002/>

Arizona small businesses also are engaged in the agribusiness industry. The state's small businesses have 62 Small Business Innovation Research (SBIR) awards from the USDA. SBIR awards support efforts to transition research into new companies. Current USDA SBIR awards are focused on renewable energy, autonomous aerial surveys and indoor growing systems¹⁷. These awards spur new firms and drive innovation.

AGRICULTURE RESEARCH AND DEVELOPMENT IN ARIZONA

Arizona is on the cutting-edge of agribusiness with hundreds of millions of dollars in research awards. Research organizations in Arizona currently have over \$100 million in active research grants from the National Science Foundation's (NSF) Directorate of Biological Sciences¹⁸ (BIO). BIO funds the majority of basic research that supports the future of the agribusiness industry research within NSF with programs focused on ecosystems, molecular biology and biodiversity¹⁹.

The USDA National Institute of Food and Agriculture (NIFA) currently supports close to \$300 million in research awards in Arizona²⁰. NIFA is the federal government's premiere organization for agricultural research. Some of the Arizona research awards currently supported by NIFA include work on solar powered cells for indoor agriculture and sustainable food systems. These research programs will directly lead to necessary innovations in the agribusiness industry.

Arizona's universities have many innovative and highly-ranked colleges and research centers focused on driving innovation in agriculture. The University of Arizona's (UArizona) College of Agriculture and Life Sciences has over 20 undergraduate and 72 graduate degree programs, as well as continuing education programs related to water, desert horticulture, and controlled environment agriculture²¹. UArizona's Pest Management Center also delivers integrated solutions for urban and rural agriculture²². Arizona State University's (ASU) Center for Bioenergy and Photosynthesis conducts research related to the future of energy and sustainability²³. While Northern Arizona University (NAU) has research groups focused on specific agricultural products and species, like the Cottonwood Ecology Group²⁴.

The TERRA REF project is just one example of how Arizona's universities are expanding the boundaries of precision agriculture²⁵. Funded by the U.S. Department of Energy (DOE), UArizona is working with universities across the country to collect massive amounts of data using a robot in the Arizona desert. The robot scans two acres of sorghum, lettuce and wheat crops and collects data on the size, color and angle of each individual leaf²⁶. This data is then analyzed by researchers to determine the plant breeds that are most resilient and could survive in an increasingly warm climate. This work will inform the future of global agriculture and educate farmers on the crops that will be the most successful on their land.

17 https://www.sbir.gov/sbirsearch/award/all/?f%5B0%5D=im_field_agencies%3A105727&f%5B1%5D=im_field_state%3A105807

18 <https://www.nsf.gov/awardsearch/>

19 <https://www.nsf.gov/funding/programs.jsp?org=BIO>

20 https://portal.nifa.usda.gov/lmd4/recent_awards?report_title=Recent%20Awards&from_site=NIFA&search_label=Awards%20Listing

21 <https://studentexperience.cals.arizona.edu/majors>; <https://grad.arizona.edu/catalog/#college-of-agriculture-life-sciences>

22 <https://cals.arizona.edu/apmc/>

23 <https://bioenergy.asu.edu/>

24 <https://in.nau.edu/cottonwood-ecology-group/about/>

25 <http://www.pinalenergyllc.com/index.cfm?show=10&mid=13>

26 <https://www.wsj.com/articles/how-a-30-ton-robot-could-help-crops-withstand-climate-change-11597237276>



MARICOPA'S AGRICULTURE RESEARCH CENTERS

Maricopa is also home to two top tier agricultural research centers. The University of Arizona Maricopa Agricultural Center (MAC) is a 2,100-acre research farm within the College of Agricultural & Life Sciences for UArizona. MAC also has 15,000 square feet of greenhouse space and multiple meeting rooms to facilitate collaboration and partnerships with outside researchers and organizations. MAC's mission is to develop and deliver the best-integrated agricultural technologies for the challenges facing Arizona consumers and agricultural producers. MAC is focused on preserving Arizona's water, land and energy through innovations in digital agriculture, food security and sustainable food systems. MAC also supports extension outreach programs, such as Ag-Ventures, various university classes, Ag-Literacy for all age groups, Maricopa 4-H and Pinal County Masters Gardeners. MAC realizes the need for partnerships with the federal government and private sector to fulfill its mission and currently works with Case-IH, Raven Industries, Whitfill Nursery, Syngenta Seeds, Bayer Crop Science, Arizona Plant Breeders, Kimberly-Clark, Bridgestone Americas, MyLand, USDA and DOE.

MAC's research focuses on cotton, small grains, alfalfa and new specialty crops that could be used to provide fibers, oils and pharmaceuticals. Scientists are also pursuing projects related to irrigation, water quality and controlled environmental agriculture. As one of many examples, the cotton integrated pest management and cross-commodity efforts (vegetables, cotton and melons) in insect management have saved cotton growers in Arizona alone more than \$5 million over the last 22 years. In addition, MAC researchers have facilitated or are facilitating improvements to insect management (IPM) systems in Australian, Mexican and Brazilian cotton.

Also located in Maricopa is the USDA Arid Land Agricultural Research Center (ALARC) which is a 20-acre facility whose mission is to develop sustainable agricultural systems, protect natural resources and support rural communities in arid and semi-arid regions through interdisciplinary research. Research topics include crop and soil management, integrated pest management, insect and plant molecular biology, irrigation technology, remote and proximal sensing for crop production and improvement, water reuse, crop breeding and physiology and resilience to global climate change.

Recent research focus includes using phenotyping to accelerate the development of crops with improved tolerance to heat stress and drought, developing new industrial crops such as guayule, development and testing of new irrigation technologies for improved water use efficiency, reuse of reclaimed water for agriculture, gene discovery to identify new targets for pest control application and the development of integrated pest management systems for major pests of cotton and other arid-land crops.

ALARC employs 60 to 100 research and support staff, depending on the season, with all 21 scientists having doctorate degrees. Much of the research at these two state-of-the-art facilities is conducted collaboratively between ALARC and MAC with many other federal, state and industry scientists, and with agricultural producers. Both centers maintain partnerships with the private sector, which has led to the commercialization of innovative agricultural products and the launch a number of start-up companies.

THE FUTURE OF AGRICULTURE IS IN MARICOPA

Maricopa has a long history of agriculture with its land being used for cotton farming at the beginning of the 20th century²⁷. The land now incorporated into the city also supported cattle farming and other crop production throughout the last century. Maricopa's agricultural past and cutting-edge future is critical to the growth of the agribusiness industry. Maricopa's highly skilled workforce and proximity to educational institutions and research centers support innovation. Firms in Maricopa currently have access to the next generation workforce with more than 13,000 employees in computer and mathematical occupations being within a 30-minute drive of the city²⁸. Additionally, more than 13,000 people working in life, physical and social science occupations are within a 60-minute drive of Maricopa. Access to talent is the main factor in a growing industry and Maricopa has the right combination of education and skill for the agribusiness industry.

Maricopa's population has a median age of 33.6 and 25.3 percent of residents have a bachelor's or graduate degree²⁹. The city also combines the best in new infrastructure and undeveloped land. This combination of talent, infrastructure and land provides opportunities for innovative agricultural operations with access to regional and global markets.

Maricopa continues to be forward thinking to support business growth and provide the resources necessary for the agribusiness industry. Responsible use of water and land is critical to agribusiness and the city will continue to work with its utilities and property owners to be stewards of the environment. The city's elected officials are also intimately involved in economic growth and look forward to partnering with existing and new firms to drive innovation in the city.

HIGHLIGHTS OF MARICOPA AGRICULTURAL OPERATORS

- **Arizona Grain³⁰**: Located in Pinal County with strong Maricopa ties, Arizona Grain has a global reach, and provides animal feed, seed genetics and cereal grain marketing to customers in Arizona and around the world. Some of the company's seed products include durum, barley, alfalfa, sunflower, oats and Bermuda grass. The quality of Arizona Grain's desert durum is special with a dark color and high protein levels and gluten strength. These unique attributes are due to the warm temperatures during the last 60 days of growth³¹. This knowledge of Arizona's climate and the many seed varieties shows the expertise of Arizona Grain's staff which creates agricultural efficiency and provide the best possible products to their customers.

27 <https://www.maricopa-az.gov/our-city/history-of-maricopa>

28 ESRI, Estimates July 2021

29 ESRI, Estimates July 2021

30 <http://www.arizonagrains.com/>

31 <http://www.arizonagrains.com/index.cfm?show=10&mid=9>



Arizona Grain also has 10 million bushels of grain storage capacity enabling them to provide reliable, personalized service. Additionally, its leadership is active in Maricopa and Pinal County to ensure continued support of business growth and expansion.

- **Duncan Family Farms®, LLC³²:** Duncan Family Farms®, LLC (DFF), Certified Organic by CCOF, has seen great success in their expansive agricultural operations in Arizona. The company also has farms in California, Oregon and New York, and was an early entrant in growing organic greens, contracting, growing and delivering these items to some of the largest value-added processors in the world. DFF-grown crops are distributed as bagged salads by these food processors to the retail and food service industries in the U.S., Canada and the U.K. In Maricopa, Duncan Family Farms grow organic baby lettuces and greens, including kale and romaine.
- **Pinal Energy³³:** Pinal Energy is the first ethanol production facility built in Arizona and began production in 2007. Pinal Energy sources grain from both local and national growers and produces 50 million gallons of ethanol annually. This ethanol production is important in extending domestic fuel supplies and lessens the need for oil drilling. The introduction of ethanol into motor fuel blends is a critical source of renewable energy. The carbon dioxide emitted from vehicles using ethanol is offset by the carbon dioxide captured by the crops grown to produce ethanol. Pinal Energy realizes the importance of ethanol in domestic energy security and achieving more sustainable energy sources. Pinal Energy also ensures the two by-products of ethanol production – distiller’s grain and CO2 – are not wasted. The distiller’s grain is used by the local dairies and feedlots and CO2 is captured and recycled for use in Arizona’s soda and dry ice industries.
- **Santa Rosa Produce³⁴:** Santa Rosa Produce calls Maricopa home and is a leading melon producer and distributor. They use cutting-edge growing techniques and the sweetest seed varieties to deliver a high-quality product to their nationwide customers. They also use a state-of-the-art cooling facility and Arizona’s numerous microclimates to grow a variety of melons.
- **Desert Premium Farms³⁵:** Desert Premium Farms is a good example of how Arizona’s growers are applying precision agriculture technologies to produce crops. Desert Premium Farms uses cutting-edge tractors and land leveling technologies to plant their crops. These technologies enable staff to complete non automated tasks that still require human interaction. This combination of new technologies and staff expertise allow Desert Premium Farms to remain profitable and responsible stewards of their land.

32 <http://duncanfamilyfarms.com/>

33 <http://www.pinalenergyllc.com/index.cfm?show=10&mid=13>

34 <https://santarosaproduce.com/>

35 <https://www.bizjournals.com/phoenix/news/2018/10/18/from-self-driving-tractors-and-sustainable-methods.html>; <https://www.azfb.org/Article/Meet-Arizona-Agricultures-Boelts-Family>

ARIZONA AND MARICOPA ARE PREPARED FOR THE FUTURE

There is much discussion of Arizona's current drought and decreasing water levels in the Colorado River and Lake Mead, two major sources of water for the Western U.S., including Arizona. Arizona and Maricopa are renowned for their innovative and forward-looking approach to water conservation and reuse. From research programs focused on water conservation to private companies reducing water use, the state is working to secure its water future.

Arizona's private and philanthropic communities are already contributing to the state's water conservation efforts. In June 2021, the Environmental Defense Fund, Business for Water Stewardship and the National Audubon Society announced a \$38 million dollar investment to conserve nearly 49 billion gallons of water in Lake Mead³⁶. This investment is a combination of public, private and philanthropic funds and demonstrates commitment to water conservation to ensure Arizona's continued prosperity.

Climate change and the resulting impacts on rainfall and snow runoff are all impacting water levels of the Colorado River. The Colorado River basin provides water for Arizona, New Mexico, Colorado, Nevada and Wyoming³⁷. These states have long coordinated their use of the Colorado River and have prepared for potential shortages due to decreasing water levels. While Arizona's farmers will be impacted by shortages, the state has taken steps to work with agricultural firms to lessen their water use so they can remain profitable³⁸. The June 2021 announcement is an additional boon for the state's conservation efforts and will further sustain local and state agricultural firms.

In 1980, the Arizona legislature passed the seminal Groundwater Management Act. This legislation realized the need to responsibly utilize groundwater and created regulations and resulting best practices to ensure the continuation of irrigation agriculture in Arizona³⁹. The legislation also created water conservation programs for all groundwater users, including agricultural uses. Arizona's Department of Water Resources continues to see the conservation programs as their strongest tool to conserve water and are currently under their third management plan⁴⁰.

Maricopa is proud to receive the majority of its water from Global Water Resources⁴¹. Global Water has long realized the need for proper resource planning. Global Water utilizes a total water management approach and recycles over a billion gallons of water each year. They are able to achieve this astounding feat by treating and purifying wastewater to be reused as groundwater⁴². This total water management approach enables Maricopa's residents to use less water and for the city to extend its water supply.

36 [https://www.edf.org/media/major-corporations-and-foundations-commit-final-funding-close-gap-landmark-colorado-river#:~:text=\(PHOENIX%2C%20AZ%20%2D%20June%202022,project%20with%20the%20Colorado%20River](https://www.edf.org/media/major-corporations-and-foundations-commit-final-funding-close-gap-landmark-colorado-river#:~:text=(PHOENIX%2C%20AZ%20%2D%20June%202022,project%20with%20the%20Colorado%20River)

37 <https://www.azcentral.com/story/news/local/arizona-environment/2021/04/23/snow-and-shrinking-flows-colorado-river-shortage/7294203002/>

38 <https://apnews.com/article/colorado-river-arizona-financial-markets-business-environment-and-nature-e25726e07f3f0f5b88d683ff0772a7ab>

39 <https://new.azwater.gov/conservation/agriculture#:~:text=Irrigated%20agriculture%20is%20the%20largest,of%20the%20available%20water%20supply>

40 <https://new.azwater.gov/ama/ama-conservation>

41 <https://www.gwresources.com/>

42 <https://www.gwresources.com/total-water-management>