SCIENCE & EDUCATION
Impact
Benefits from USDA/Land-Grant Partnership

Smart Farming

Information key to precision farming, Integrated Pest Management.

In today's agriculture, less is more. Technology and information provided by the Land-Grant/USDA partnership help farmers provide just what their crops and livestock need to thrive – no more, no less.

Payoff

- **Drop by drop.** In western Kansas, farmers irrigate an estimated 3 million acres of crops yearly, pumping water from underground resources, including the Ogallala Aquifer. From 1940 to 1980, the aquifer's water level declined nearly 10 feet per year, leaving some areas of western Kansas nearly depleted. Now **Kansas State** efforts are helping farmers adopt subsurface drip irrigation that applies water directly to the crop root zone. Farmers report a 50 percent reduction in irrigation water use and 10 to 20 bushel per acre increases in corn yields. In Canyon County, **Idaho**, where groundwater nitrate levels are on the rise, researchers demonstrated that sugar beets grown using less fertilizer and irrigation yielded 1.7 tons more per acre than beets produced using typical practices. Soil and shallow groundwater below the low-input research plots showed lower nitrate levels than under conventional plots. The reduced costs and increased yields brought in $94.11 more per acre. **Texas A&M** researchers showed that irrigating at less than the potential evapotranspiration (PET) rate could be more efficient, especially when plant diseases or insects are present. Irrigating at 75 percent of the PET rate could save farmers 200 billion gallons of water and $56 million in the Texas Panhandle's upper 21 counties.

- **Sensing your needs.** A crop sprayer developed by **Oklahoma State** researchers senses what a plant needs for fertility or pest control and sprays the proper amount of chemical on the spot. Licensed to Ntech Co., the GreenSeeker sprayer can change rates every two square feet. Preliminary studies on wheat showed that nitrogen use efficiency rose to 70 percent with the sprayer, 20 percent higher than normal. In **Georgia,** engineers are cooperating with Disney's Epcot Center and the U.S. Department of Energy in testing a multispectral imaging system to determine plant needs. The system can detect the nitrogen nutrient rate based on the brightness patterns in images of bush beans and measure zinc levels in bahia grass.

RESEARCH, EXTENSION AND EDUCATION AT WORK

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- **O! Weather, where art thou?** The best time to apply pesticides often depends on the weather, but the National Weather Service no longer provides such data. **Mississippi State** stepped in with weather data and a formula that uses heat unit accumulation data – instead of a calendar – to determine when cotton pesticide applications can end. About 55 percent of the Delta's 1 million cotton acres use the weather-based system, eliminating an average of 2.5 insecticide applications a year. Not only is that a boon to the environment, but the program saved farmers $30 an acre – which added up to $16 million in 2000. Similar programs in **Arizona** and **Florida** help farmers time pest control, irrigation and fertilizer applications.

- **We kick the tires for you.** At the Hammond Research Station operated by **Louisiana State**, researchers evaluate precision agricultural equipment and management practices. They developed a mechanically guided precision cultivation system that allows high-speed cultivation of small vegetable plants. When farmers cultivate, they don't need to rely as heavily on herbicides. Researchers also learned that belt-type precision vegetable seeders offer the best seed spacing for spherical seeds and that vacuum seeders handled odd-shaped seeds well but did not plant uniformly. This information helps growers select the best equipment and farming methods for their operations while reducing pesticide use and cost.

- **Going to great heights to save a crop. Virginia Tech** researchers are taking to the sky to apply precision pest management techniques. They constructed a remotely piloted aircraft with remote sensing cameras. The aircraft can access information from places difficult to scout, such as ravines and steep hillsides. Once commercialized, variations in plant coloration discovered by the system will serve as an early alert to farmers about a pest invasion so that they can apply pesticides only when needed.

- **Decisions, decisions.** As farmers explore new technologies, they need to assess what would work best on their farms. **Ohio State** agricultural engineers help farmers evaluate precision agriculture equipment including new auto-steer, real-time GPS guidance systems that measure within the inch, eliminating overlap or skips and leading to fewer inputs. To decide if the equipment is right for them, Ohio farmers get to test drive it at special events and receive advice to determine if the cost is worth the benefit. In **Kentucky,** agricultural engineers have tested and evaluated GPS receivers and yield monitors, developed new sensor technologies and low-cost remote sensing – important information to farmers as they adopt this technology. Kentucky is working with researchers at **Tennessee**, **Ohio State**, the **Idaho** National Engineering and Environmental Laboratory and the Oak Ridge National Laboratory.

- **Cotton pickin' bugs no more.** Cotton production accounts for about half of all insecticide use in the United States, but Land-Grant efforts are benefiting the farm economy and environment by reducing sprays. An integrated pest management program in **Arizona** implemented two new tools in 1996 and continued their use through 2001: insect growth regulators (effective against whiteflies) and Bt cotton (effective against pink bollworms). For silverleaf whitefly, the average number of chemical sprays dropped from about 3.6 sprays per season in 1990-1995 to about 1.2 in 1996-2001. That represents a 68 percent reduction and $62.4 million in savings. Two fewer sprays on average were needed to control pink bollworm, a 73 percent reduction representing a $34.2 million savings.

Cooperative State Research, Education, and Extension Service
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