

and Daane may be able to suggest other ways to keep the pest in check.

### ■ Farm advisor unravels oak mystery

Blue oaks on Kern County's foothill rangeland seemed to be vanishing, but livestock farm advisor Ralph Phillips suspects they were simply overlooked in a misunderstanding of oak tree biology.

A 1987 study revealed that, on average, an acre of Kern County rangeland had about 80 seedlings (less than 1 foot tall), 75 saplings (1 to 5 feet tall), but only 15 trees in the 5- to 10-foot-tall range. However, there were 85 trees per acre taller than 10 feet.

Perplexed by the small number of oaks 5 to 10 feet tall, Phillips undertook a study. In 1989, he marked 605 oak seedlings at three sites in Kern County to trace their survival, then recorded the exact height of each seedling (all under 1 foot tall). Phillips' study coincided with the 1986-1992 drought.

During the first 4 years, rodents killed 3% of the trees. The average height of the remaining seedlings actually fell three-quarters of an inch. The apex bud was present on virtually every seedling, indicating that grazing was not a factor.

"The oak is a unique tree," Phillips said. "The seedlings would send up a green shoot in the spring. By the end of summer, the shoots dried up and the leaves fell off. The next spring a new green shoot appeared. Moisture needed for growth was limited, so each new shoot was smaller than the previous year's shoot."

In 1990, Phillips began to research the age of his 605 trees. "We were very surprised to find that close to 20% of the seedlings (all under 1 foot tall) were over 10 years old," he said. "One tree less than 6 inches tall was over 25 years old."

Phillips thinks the small trees form a reservoir of oaks that grow tall only when conditions allow, such as when more water is available or a nearby mature oak dies.

— Editor



## Research update

# Economists calculate research payoff, effect of cuts

**A**gricultural research and development is the chief reason California farm output increased nearly 3-fold from 1949 to 1985, while inputs rose only 1.6-fold, says a new report from UC's Agricultural Issues Center.

*Valuing UC Agricultural Research and Extension* documents the role of research in California's economic growth, but cautions that the decline in public funds for research since 1991 may put the state's vibrant agricultural economy at risk.

The authors estimate that the average annual return on publicly funded agricultural research is about 20%, which compares favorably to the rates at which government could invest.

"On that basis, this has been a good investment for society," said Julian Alston, one of the study's authors. "However, this estimate is conservative compared with many studies indicating returns of 30 to 70% annually."

To compute the rate of return, the economists first compared the stream of yearly research benefits from 1949 through 1985 with the stream of research expenditures from 1914 to 1985. Because the study did not account for research benefits before 1949 and after 1985, the result — a 21.4% average annual return — was conservatively low.

"However, previous estimates may have understated costs by not allowing for the full cost to society of using tax revenues, and by excluding some associated overhead costs such as basic research," Alston said. "Also, benefits may have been overstated by disregarding effects of private research and government commodity programs."

Because not all productivity growth can be attributed to public sector research, the authors then supposed that half of the measured benefit

**Funding cuts to agricultural research will dull California agriculture's competitive edge, according to a new report by the Agricultural Issues Center at UC Davis.**

from research in every year was due to unmeasured factors such as private research and spill-in technology. They found the rate of return was reduced to 19.5 percent (when including research costs alone) and 17.1 percent (when using the sum of research and extension costs).

"The rate of return was quite insensitive to whether we cut the stream of benefits in half or included extension and research costs," Alston said. "The explanation is that annual benefits are very large relative to costs and accrue over a relatively brief period of years. Annual costs are much lower and take place over many more years."

In recent years, the annual flow of benefits from productivity growth since 1949 has been many times greater (about 50 times greater in 1985) than the annual flow of research costs, the authors observed.

"This fact alone would tend to support the view that agricultural R&D is a highly profitable investment," Alston noted.

The report details research costs and payoffs

to three leading California industries: dairy, wine and grape, and strawberry.

### Dairy

California's top farm income producer is the dairy industry, contributing 14% of the state's agricultural output.

- The state's milk production is worth \$2.5 billion annually while UC dairy research costs, including the veterinary school, are about \$5 million per year.

- In 1991, the average California dairy cow produced 18,623 pounds of milk — 30% more than the 14,376-pound U.S. average excluding California.

- UC researchers developed a technology, now in the patent stages, that removes the cho-



lesterol from milk fat with no effect on taste.

- UC Davis School of Veterinary Medicine developed a vaccine for *E. coli* mastitis. The vaccine saves California dairy operators an estimated \$17.1 million annually in milk saved and also means less use of antibiotics.

### Grapes and wine

- Average grape yield doubled between 1930 and 1990, largely due to UC field research that led to advances in pest control, pruning, trellising, irrigation and other viticultural practices. Winegrape acreage statewide has doubled in the last 20 years. Today California produces more than 90% of the nation's wine.

- UC enologists have improved wine quality through classification of yeasts, use of clarifying agents, control of wine spoilage bacteria, control of fermentation temperature, improvement of filtration and use of stabilizing agents.

- UC scientists have devised simple tests to help grape growers determine optimal harvest time, published refrigeration and stabilization guidelines, demonstrated the effect of wood barrels on quality and flavor, and evaluated chemicals available to wineries.

### Strawberries

- In 1991 more than 88% of California's strawberry acreage was planted to UC-developed varieties. Since 1945, UC has released a succession of 40 strawberry varieties, all tailored to specific California growing conditions.

- From 1956 to 1991, strawberry farm production value rose from \$1.8 million to \$493.3 million. Average yields rose from 3.1 tons to 26.8 tons per acre.

- UC experiments with drip irrigation on strawberries began in the 1960s. Today, 100% of the acreage is drip irrigated.

— Editor

Fig. 1. Benefits and costs over time for a research program.

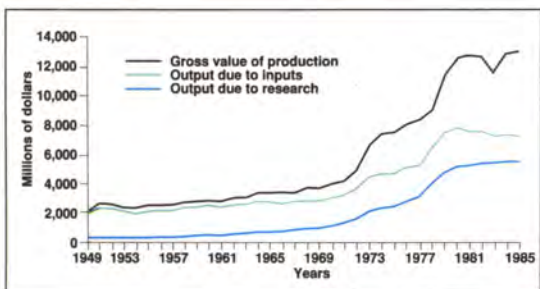
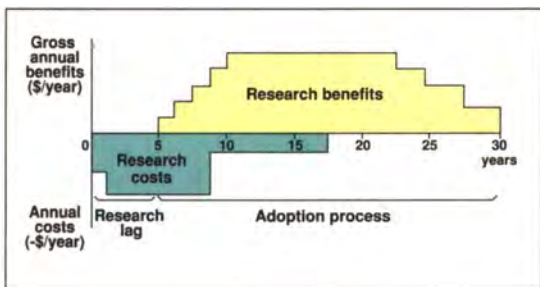


Fig. 2. Sources of growth in California output (nominal dollars).

Valuing UC Agricultural Research and Extension, by Julian M. Alston, associate professor of agricultural economics, UC Davis; Philip G. Pardey, associate professor of agricultural and applied economics, University of Minnesota; and Harold O. Carter, professor emeritus of agricultural economics, UC Davis, may be ordered from the Agricultural Issues Center, UC Davis, Davis, CA 95616.