trace minerals in the diet of livestock have helped cattlemen in various areas of the state. In some areas, excess molybdenum in the soil and forage can decrease livestock performance, but U.C. scientists have discovered that the effects of excess molybdenum can be overcome by giving animals intramuscular injections of copper glycinate.

In parts of Northern California, lack of selenium also decreases animal performance, causing a nutritional disease called white muscle disease. Researchers found that the problem could be corrected by treating animals with selenium and vitamin E.

Performance testing

Another major step in the progress of California's cattle industry was the advent of performance testing and the subsequent development of the California Beef Cattle Improvement Association (CBCIA). The U.C. Cooperative Extension Service helped establish the CBCIA in 1959 and has been an integral part of the organization since.

During the 1950's and early 1960's the widespread use of cattle performance testing helped the beef industry recover from selection trends that were resulting in development of small, compact animals that were plagued with serious incidences of dwarfism and were often inefficient feed converters at conventional slaughter weights. Within the last 10 to 15 years, selection for growth rate—variously labeled or measured as weaning weight, yearling weight, feedlot gain, WDA or gain-ability—has received major emphasis in CBCIA breeding programs. The result has been more efficient animals.

Probably the most serious problem that has always faced the cattle industry is fertility, but researchers are making progress in this area also. Larger calf crops are the result of numerous studies and field tests on semen quality of bulls and the practice of pregnancy testing cows. Ova transfer, estrus synchronization and increased twinning are other exciting areas U.C. animal scientists are investigating as potential solutions to the fertility problem.

Improved feeding efficiency—getting the maximum return for the investment in feed—has long been of concern to U.C. researchers. Fiber analysis of roughage has led to a more accurate evaluation of various roughages as feed. Researchers also found that finishing cattle on grass with only limited concentrate supplementation is feasible and economical. A new system for the evaluation of feedstuffs was developed in the 1960's. This system is useful for predicting animal response to a particular feeding regime or for determining balanced least-cost diets for beef production. Research on development of low quality roughages such as rice straw and other waste materials is showing that some of these materials, when used with proper treatment and supplementation, can be incorporated into the diet of cattle to help offset the surge in cattle feed prices.

Researchers also are working on ways to make feed more efficient once it is inside the cow by trying to inhibit the release of wasted energy in the form of methane gas inside the rumen and by protecting proteins from rumen microorganisms so they can reach the small intestine where they are absorbed to increase growth and productivity.

Several experiments—early castration, bulls vs. steers, Russian castration and short scrotum animals—have concentrated on harnessing the male hormone testosterone for more efficient beef production. Some of these practices have proved feasible, some have not. To date, none has received widespread acceptance because of marketing or other problems, but, as has been the case with other work, the research could be the framework for future beef management practices.

Carcass quality studies in relationship to rate of gain and federal grading standards are another integral part of U.C. animal science research. The work established that high-gaining cattle produce carcasses that cut out just as high or higher than carcasses of slower-gaining animals. Recent carcass evaluation research indicates that there is no correlation between actual age and bone maturity of young beef animals. Since federal beef grading standards are based on an assumed age-bone maturity relationship, the finding has helped promote proposed changes in these standards.

No one really knows for sure what the future holds for California's beef industry. But, if past performance is any indication, University of California animal scientists will continue to have an active role in shaping that future for the benefit of both the cattleman and the consumer of his products.

Gary Beall is Educational Communicator for Animal Sciences, University of California, Davis. Ruben Albaugh is Extension Livestock Specialist, U.C. Davis.

Control of LEMON TRUNK

MECHANICAL PRUNING of lemon trees leaves stubs around which buds sprout, producing vegetative growth which is usually unwanted. Hand pruning, which selectively removes unwanted limbs, does not cause as many buds to sprout, since pruning cuts are usually made at laterals. However, pruning of any kind causes a vegetative growth flush, and an immediate reduction in yield. On mature trees it would be of economic benefit on some occasions to stop, or at least reduce, this growth flush. Removal of trunk sprouts is important especially during the formative years, or if high scaffold limbs are desired.

Trunk sprouts of nine species of trees and shrubs have been controlled with several growth regulators including naphthaleneacetic acid (NAA). Sprouts from cut stumps of citrus have been prevented from growing for periods of up to one year using ethyl hydrogen 1-propylphosphonate and 1-propylphosphonic acid. The former was also applied in a formulation containing the ethyl ester of naphthaleneacetic acid (NAAEE). Ethyl hydrogen 1-propylphosphonate plus NAAEE and several other formulations of NAA have successfully retarded sprouting of shoots from the base of fig trees.

In 1970, tests with ethyl hydrogen 1-propylphosphonate on lemon trees which had been mechanically topped resulted in significant reduction in shoot regrowth. The application was made to young shoots when they were between 6 and 12 inches long.

In trials with a grape harvester modified to harvest hedge-row lemon trees, it was necessary to prune the skirts of the

SPROUTS

CITRUS TRUNK SPROUT INHIBITION, AFTER TREATMENT WITH EXPERIMENTAL GROWTH RETARDANTS

Row*	Chemical	Average no. sprouts per tree	M R R** .05	M R R** .01	Difference between averages
2	Check	4.11	c	b	
	NIA-10637 (10%)	1.44	ab	ab	2.67
3	Check	3.11	bc	ab	
	NIA-10656 (10%)	0.44	a	a	2.67
5	Check	8.33	d	c	
	NIA-10637 (5%) + NAAEE (1%)	1.89	abc	ab	6.44

* Each treatment replicated 9 times in each row.
** Multiple Range Ranking. Ranking is at the one and five% level; means are significantly different if they do not have a subscript letter in common.

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C. D. MC CARTY · ISAO IWAGAKI

hedge to a height of 24 inches to allow placement of the catching frame. Removal of the lower limbs and foliage stimulated new shoot growth, and pruning soon had to be repeated. This was time-consuming and costly. Consequently several growth regulators were tried in spot applications around the pruning cuts to prevent sprouting of latent buds.

Materials

Ethyl hydrogen 1-propylphosphonate (NIA-10637) and 1-propylphosphonic acid (NIA-10656) were each used as a 10% aerosol formulation in an asphaltic base. Ethyl hydrogen 1-propylphosphonate (NIA-10637) at a 5% concentration plus 1% naphthaleneacetic acid, ethyl ester (NAAEE) tree paint (aerosol spray) in an asphaltic base was also tried.

Tree skirts were pruned on July 21, 1972, and the pruning wounds and areas immediately adjacent to them were treated on August 4, 1972. The entire trunk area was not sprayed because it was feared that if the amount of material applied was too great it might affect other parts of the tree.

The test trees were Prior Lisbon lemon budded on *C. macrophylla* rootstock, planted in 1965. They were vigorous and in good condition when treated. The soil type was Sorrento silty clay loam of moderate permeability with a high water-holding capacity.

The experiment used three adjacent rows of 18 trees each. A different treatment was used on each row, and alternate trees were treated in each row, leaving every other tree as an untreated check. Counts on regrowth were made 14 months after treatment (table 1). For statistical analysis each of the three rows treated with a different growth retardant had its own check trees (replicated nine times within the row).

Results

There was a significant reduction in trunk sprouts between all three growth retardants and the corresponding checks. Differences between the three growth retardants were established. The few trunk sprouts that did appear in the treated areas were not normal. However, no adverse effects to either the canopy foliage or fruit were observed on any treated trees.

Treatment with these growth retardants would keep shoot growth at a low level, requiring less frequent removal of trunk sprouts. The catching frame could be placed under the tree with little interference from low sprouting shoots. These chemicals were applied on an experimental basis, are not registered for use as described in this article—and cannot be used for this purpose until approved by appropriate government agencies.

S. B. Boswell is Specialist, Department of Plant Sciences, and C. D. McCarty is Horticulture Technologist, University of California, Riverside. R. M. Burns is Farm Advisor, Ventura County. Isao Iwagaki was on leave from the research staff of the Shikoku Agricultural Experiment Station, Zentsuji, Japan. *C. B. Cree, Department of Plant Sciences, UCR, supplied the statistical analysis. Dr. I. A. Rammer of FMC, Niagara Chemical Division supplied the chemicals, and Kaiser-Aetna provided the trees and care of the orchard.*

Photo 1. Lemon tree trunk 14 months after trea ethyl hydrogen 1-propylyphosphonate plus 1% n acetic acid, ethyl ester tree paint (aerosol spray) i base.

Photo 2. Untreated trunk 14 months after being showing regrowth of sprouts.