Plant species responses

We compared botanical composition of seeded legumes and resident grasses and forbs for the three-year period immediately before the fertilization experiment and the three years of the experiment. In only one case was there a significant difference: an increase in legumes under the phosphorus-sulfur treatment in the first year. Under proper grazing management and with low to moderate applications of nitrogen (usually together with phosphorus and sulfur), early-season increases in both forage yield and quality are potentially possible without detrimental effects on the population of seeded legumes.

Conclusions

For the geographic area and soil and vegetation types represented in our study, plant and animal productivity may be enhanced by either of two fertilization strategies. The first, and probably preferable, is to introduce annual legumes, especially sub and rose clovers, and apply phosphorus and sulfur at levels sufficient to stimulate legume production and symbiotic nitrogen fixation. The second strategy is to apply moderate levels of nitrogen together with adequate levels of phosphorus and sulfur, which will both increase plant production and have a somewhat greater effect during the fall and winter. With either strategy, careful attention must be paid to management, since an effective stocking rate is critical to an efficient forage-to-animal conversion and to maintenance of botanical stability among forage plants.

Year-to-year variations in weather patterns, particularly rainfall, can have a marked effect on the economic outcome of fertilization. While weather is a major determinant of system productivity, it consists of variables over which we have no control.

Charles A. Raguse is Professor and Agronomist, Department of Agronomy and Range Science; John L. Hull is Specialist, Department of Animal Science; Melvin R. George is Range and Pasture Specialist, Cooperative Extension; James G. Morris is Professor and Nutritionist, Departments of Animal Science and Physiological Science; and Kenneth L. Taggard is Plant Ecologist and Staff Research Associate, Department of Agronomy and Range Science. All are with the University of California, Davis. *Appreciation is expressed to Superintendents Paul L. Rowell and John M. (Mike) Connor and members of the support staff at the UC Sierra Foothill Range Field Station, whose continued support and assistance made this study possible.*

Systemics prove impractical for control of eucalyptus borer

A. D. Ali ❑ J. Michael Henry ❑ Jacinto Garcia

The larva of the eucalyptus longhorn borer (right) creates extensive galleries in the cambium layer of a tree and can ultimately cause its death. The inch-long adult beetle, though observed feeding on the flowers of eucalyptus trees, apparently causes little direct damage to the trees.

Low response rate and high application costs make systemic insecticides a poor defense against longhorn borer

The eucalyptus longhorn borer was first discovered in California in October 1984 (*California Agriculture*, July-August 1986), and since then has spread to an area of about 9,600 square miles in six southern California counties: San Diego, Riverside, San Bernardino, Orange, Los Angeles, and Ventura. Because of its recent introduction and lack of natural enemies in California, there are few means available to contain the borer, *Phoracantha semipunctata* (Fab.). We investigated the effectiveness and economics of using systemic insecticides in a control strategy.

Two-phase experiment

The studies took place during the summer and fall of 1986 (phase I) and winter and spring of 1987 (phase II) in a heavily infested grove in Irvine, California. In each phase, two eucalyptus settings were selected: a woodlot and a windbreak. The woodlot species was river red gum, *Eucalyptus camaldulensis* Dehnhardt, and the windbreak species was blue gum, *E. globulus* Labill.

The experiment included five treatments: Acecap (97% technical Orthene [acephate]), Furadan 10G (carbofuran), DiSyston 8E (disulfoton), MetaSystox-R 2E (oxydemeton-methyl), and an untreated check. The experimental design was a randomized complete block with four replications in the woodlot and five in the windbreak during phase I, and four replications in both settings in phase II. The five treatments were assigned randomly to plots within each replication. Individual plots receiving a treatment contained four trees each. Average tree diameters (breast height) in inches were: phase I, woodlot, 9; windbreak, 19; and phase II, woodlot, 11; windbreak, 18.

Acecap capsules were inserted singly in holes made in the trunk 1 inch deep, spirally spaced 6 inches apart, beginning 12 inches above the ground. Furadan was applied in an 8-inch-deep trench circling the tree about 6 feet from the trunk; the application rate was 0.5 ounce per inch of trunk circumference (breast height). DiSyston and MetaSystox-R were injected into the soil 6 inches deep along the tree's drip line; application rates were 1 and 0.4 fluid ounces, respectively, per inch of trunk diameter (breast height) mixed with equal amounts of water.

Eucalyptus trees killed by the longhorn borer in a southern California windbreak.

During phase I, all plots were sprinkler-irrigated for 24 hours once a month between June and October to aid movement of insecticides into the trees. Rainfall during this phase totaled 1.3 inches. During phase II, rainfall totaling 4 inches was the only source of water.

Two observers rated trees according to the severity of eucalyptus longhorn borer damage and consequent tree vigor on a scale of 1 to 10, with 1 being healthy and 10 being dead. Phase I trees were rated on June 27, 1986, before treatment; then treatments were applied. Posttreatment ratings were taken on October 31, 1986, and again on May 18, 1987. Phase II trees were rated before treatment on January 15, 1987, after which treatments were applied. Posttreatment ratings were taken on May 18.

Results

Statistical analysis of the data for each phase (by analysis of variance) showed that treatment effects were not significantly different; therefore, no further mean separation was attempted. Even though some visual improvement in tree health was observed in phase I (table 1), the changes could not be attributed to the insecticide treatments because of the variability of the data.

None of the insecticides caused any apparent damage to the trees.

We determined application costs (labor, materials, and irrigation expenses) for both eucalyptus settings during both phases. During phase I, costs per tree were $7.74 for the woodlot and $11.09 for the windbreak. Application costs were lower during phase II—$6.03 per tree for the woodlot and $7.63 for the windbreak—because irrigation was not required.

Conclusions

Our results agree with those of previous studies, in which systemics have not provided adequate control of wood-boring insects. A 90 to 100 percent improvement in tree health is needed to justify the cost of pest control by public agencies. Even if the increase in tree health in this study could be attributed to the insecticide treatments, the greatest increase was only 24 percent, far below the improvement level deemed cost-effective. The poor response probably resulted from the fact that the systemic insecticides moved upward in the xylem with little or no movement back downward in the phloem, where the insect is found.

Based on the results of these studies and the high application costs per tree, we concluded that systemic insecticides—at least at present—are not a practical control option for reducing eucalyptus borer infestations. Researchers in the Department of Entomology, University of California, Riverside, are evaluating the feasibility of establishing natural enemies of the pest. If successful, this approach may prove to be the only long-term defense against the eucalyptus longhorn borer in California.

TABLE 1. Change in visual ratings of tree health after treatment with systemic insecticides and irrigation, Irvine, CA

	Change in tree health*		
	Phase I		Phase II
Treatment	Jun - Oct '86	Jun '86 - May '87	Jan - May '87
Woodlot:			
Acecap	+0.41	+1.00	−0.06
Furadan	−0.72	−0.19	−0.03
DiSyston	+0.25	+1.13	−0.22
MetaSystox-R	+0.13	+0.44	0
Check	+0.19	+0.38	−0.16
Windbreak:			
Acecap	+0.20	−0.25	+0.03
Furadan	+0.23	+0.03	+0.22
DiSyston	−0.13	−0.45	+0.47
MetaSystox-R	+0.28	0	+0.09
Check	+0.13	−0.25	+0.56

* Positive values indicate improvement, negative values indicate deterioration. Treatment values were not significantly different from the check ($P > 0.05$); therefore, treatments probably were not responsible for causing changes in tree health.

A. D. Ali is Extension Specialist, Department of Entomology, University of California, Riverside; J. Michael Henry is County Director and Farm Advisor, Cooperative Extension, Orange County; and Jacinto Garcia is Staff Research Associate, Cooperative Extension, UC Riverside. *This work was funded in part by a grant from the California Department of Forestry. Donations of insecticides by Creative Sales, Inc., FMC Corporation, and Mobay Chemical companies are gratefully acknowledged. Thanks also are given to the Irvine Company, Irvine, CA, for allowing access on their property to conduct these studies, and to Mark Nester for assisting in the field work. The authors also appreciate constructive comments by C.S. Koehler, T.D. Paine, and G.T. Scriven, and assistance in the statistical analysis by L. Yates.*