

ratio (1:3) for this variety. There does not appear to be any correlation between yield of seed and length of time that a bee stayed per bloom, since Yellow Sweet Spanish was highest in yield but lowest in bee visitation time. Yet, Australian Brown gave a high seed yield despite a low bee visitation per head, which may have been due to the long length of time that bees remained on the heads. Red Wetherfield also resulted in a high seed yield, but had both high numbers of visiting bees and a high time per visitation.

Thrips, pink root

Thrips populations were never very high and did not appear to influence yields, but were significantly lower in numbers on Red Wetherfield (25.2 average number of thrips per head) and Yellow Sweet Spanish (28.5). Pink root was of extremely low incidence in Yellow Sweet Spanish (5.3 average number of heads lost per replicate because of pink root), but was not significantly lower than for Australian Brown (14.5

heads lost). All other varieties had high plant mortality and head losses due to pink root disease, but only sound heads were considered for all bee counts and yield data. Australian Brown had the smallest seed, while all the other varieties were larger seeded and equal.

Viability tests conducted on dry, unsoaked seed were low, and indicated that Yellow Sweet Spanish had the least viable seed (49 viable seeds per 100). Seed yield for the latter variety may have been of somewhat less significance compared with the others, if only the good viable seed had been weighed, after being soaked in water to eliminate the poor light seed.

Isolated hybrids

The 1972 data (see table) show a positive correlation between onion seed hybrid varieties, honeybee visitation, and seed set. The MS Code 2 (PC 712732) onion strain had a significantly higher number (11.8 average number of bees per 20 heads) and ratio of honeybees

per head during bloom (1:1.7), plus a significant increase in seed yield (2.27 gm per head) over that obtained from the other strains (1.10 gm for PP Code 4 and .99 gm for MS Code 6). The results showed that the onion hybrid having the greatest attractiveness to honeybees produced the highest seed yield, when a PP was present. There was an inherent difference between hybrid varieties with respect to attractiveness to honeybees. This research also indicated that new hybrids could be tested for yield potential and attractiveness to honeybees in isolated onion plantings interplanted with a pollen parent.

Elmer C. Carlson is Specialist, Department of Entomology, University of California, Davis. Assisting this study were John Campbell, Nurseryman at Davis, and James Harrington and Jasper Laraway, Department of Vegetable Crops, U.C., Davis. Onion seeds and bulbs were obtained from Ferry Morse and Asgro Seed Companies.

NAA SPROUT INHIBITION

shown in olives, pomegranates, prunes, plums, and walnuts

J. H. LARUE • G. S. SIBBETT • M. S. BAILEY
L. B. FITCH • J. T. YEAGER • M. GERDTS

SEVERAL FRUIT CROPS grown in California's San Joaquin and Sacramento Valleys have annual problems of profuse sprout and sucker growth from the trunk, crown, and roots close to the tree base. These sprouts become very competitive and eventually disrupt growth and tree shape. Sprouts interfere with cultural and harvest operations and thus reduce yields and fruit quality.

To prevent these problems fruit growers currently remove sprouts either by hand rubbing or pruning at least once each year. The operation is difficult and expensive. In addition, pruning near or below the soil surface provides entrance sites for disease infections. Crown gall (a bacterial disease) of plum and peach can often be traced to sprout removal operations.

Application of an ethyl ester formulation of NAA to tree sprouts and suckers at rates of .5% to 1% solution resulted in growth suppression on olives, pomegranates, prunes, plums and walnuts.

Rootstock sprouting is also a problem in nursery operations. Again, removal of unwanted, competitive growth is expensive and time consuming, and a faster, simpler and less costly method is desired.

Recent investigations and reports have shown two formulations of naphthalene acetic acid, or NAA (ethyl ester 72-A112 and sodium salt 72-A96), are effective in suppressing sprouts when applied as sprays to the trunk and crown

area. In 1973, Tulare County and U.C. Davis tests were conducted to evaluate NAA on olive, pomegranate, plum and prune (Marianna 2624 rootstock) in orchard situations and black walnut (*Juglans hindsii*) rootstock in the nursery. The two formulations were compared as a spray treatment at 50 gals per acre and as a hand "paint-on" application, with 50% latex paint added to the solution. Sprout length at application time varied with the crop.

At Davis, applications were made to root sprouts cut back to two inches. In one Tulare County plum test, sprouts were cut back to the tree base or ground level before treatment. Sprouts were not cut in the other Tulare County tests, and sprout lengths at treatment were: olives, 1-18 inches; pomegranates, 3-9 inches; plums, 3-12 inches; and walnuts, 1 inch

or less. Trials were randomized and replicated four times in Tulare County and seven times at U.C. Davis. At the end of a specified period, live sprouts were counted in the pomegranate, plum, and walnut plots. Olive trees were rated on a 1-to-5 value scale based upon the percent of sprouts killed and prunes on a 0-to-3 scale.

Both formulations of NAA killed established sprouts and reduced surviving sprouts below untreated control levels. In all tests, except the pre-treatment "sprout-cut" experiment in plums, the 72-A112 formulation was superior to the 72-A96 formulation.

The addition of latex paint enhanced

NAA performance slightly but was not of major benefit. On olives the untreated trees rated 1.0 (no sprout control) compared to an average 3.8 rating for trees treated with .5% solution of 72-A112 and a 4.5 average rating for trees treated with 1% solution. Olives, pomegranates, plums and walnuts treated with .5% solution of 72-A112 had 20-25% the number of regrowth suckers of untreated trees, while 1% solution applications reduced the number of regrowth suckers to 10% of untreated trees. Sucker regrowth length on prunes varied from 40.8-53.6 cm on untreated trees compared to .3-2.0 cm on 1% solution 72-A112 treated trees.

This progress report indicates that

NAA sprays inhibit and reduce sprout growth in some tree crops and that it has considerable commercial potential. Further investigations on timing, repeated treatments, and rates are warranted. NAA is not registered for this use on these crops, and is not recommended at this time by the University of California.

J. H. LaRue and G. S. Sibbett are Farm Advisors and M. S. Bailey is Field Assistant in Tulare County. L. B. Fitch is Farm Advisor in Sutter County. J. T. Yeager is Extension Pomology Research Associate, U.C., Davis, and M. Gerdt is Pomology Specialist, San Joaquin Valley Research and Extension Center, Parlier.

RESEARCH BRIEFS

Short Reports on Current Research in Agricultural Sciences

BIOLOGICAL CONTROL OF SNAILS

Pilot experiments are in progress to ascertain the feasibility of controlling the brown garden snail, *Helix aspersa*, with another introduced snail species, *Rumina decollata*. Repeated observations in private gardens strongly indicate that *R. decollata* tends to displace *H. aspersa*. *R. decollata* feeds omnivorously but is considerably more reluctant to attack living plant tissue than is *H. aspersa*. Further, *Rumina* attacks and devours *Helix*. The tree-climbing habit of *Helix* is well known, but in California *Rumina* rarely has been seen away from the ground. Testing in citrus groves is planned for 1974-75.—*T. W. Fisher, Dept. of Entomology, Riverside.*

FOLIAR-APPLIED NITROGEN FOR CITRUS FERTILIZATION

FIFTY-SIX "experiment years" of orange, lemon, and grapefruit data show that, pound-for-pound, foliar-applied nitrogen (urea, containing less than 0.25% biuret) was as effective as soil-applied nitrogen (from urea, ammonium nitrate, calcium nitrate, or anhydrous ammonia) for fruit production. However, while one annual soil application supplied adequate

nitrogen, three to six or more foliar sprays annually were required. The total yearly amount of nitrogen applied per tree to the foliage depended upon tree size, foliage density, spray solution concentration, and the number of sprays per year.

Fruit produced per lb of applied nitrogen varied from 97 to 484 lbs. At or near the maximum nutritionally-attainable yield, from 11 to 75% of the applied nitrogen was removed from the orchard in the fruit. The pounds of nitrogen per 1000 lbs of fresh fruit varied from 1.15 to 1.73, and increased with increasing nitrogen rates.—*Tom W. Embleton and Winston W. Jones, Dept. of Plant Sciences, U.C., Riverside.*

SOIL SCIENCES, UCR

(continued from page 3)

prepare for new citrus plantings on old citrus land.

In response to the change in research emphasis from alkali reclamation and soil chemistry to nutritional research, the department's name changed from Agricultural Chemistry to Soils and Plant Nutrition during the 1940s. Somewhat later a Riverside unit of UC's Division of Irrigation and Soils was consolidated with this department. Sterling J. Richards, a soil physicist concerned with soil moisture, irrigation, and soil physics research, headed the group. He and his colleagues, L. H. Stolzy, J. Letey, and others made strong contributions in irrigation control methods, use of tensiometers for guiding irrigation, use of neutron equipment to measure soil moisture, evaluation of the oxygen status of soils, soil aeration in

relation to crop growth, biological activities, and other problems.

The third period began with the arrival of N. T. Coleman to head the establishment of a full academic and graduate teaching program at Riverside. While salinity, citrus nutrition, soil physics, fluorine air pollution research, and numerous other activities continued, Coleman and his colleagues initiated much new and basic research on clay mineralogy, ion exchange phenomena, and phosphorus and trace element chemistry.

In the fourth period, Coleman moved into campus administration and Dr. P. F. Pratt was appointed chairman. Pratt greatly broadened research in environmental pollution, involving agricultural wastes (especially manure), nitrate movement, underground water contamination, degradation of pesticides, accumulation and fate of trace elements in soils, surveys of trace elements in irrigation water, and a long list of other problems (in addition to teaching). Participants in these studies, and other research, include: F. T. Bingham, G. R. Bradford, A. L. Page, L. J. Lund, W. J. Farmer, D. D. Focht, and their assistants.

A long series of investigations on the iron nutrition of citrus and other plants by E. F. Wallihan and his assistants has elucidated the role of excess soil moisture, oxygen, soil temperature, and other soil variables as affecting iron deficiency. He also developed leaf analysis standards for iron in citrus leaves and other plants.

Homer D. Chapman, Professor and Chemist (Emeritus), was Chairman of the Department of Soils and Plant Nutrition, 1938 to 1961.