5 to 28 days at the three-foot depth before irrigations were necessary, according to plant symptoms. Generally, the gypsum electrical resistance block readings at the one- and two-foot depth were nil and decreased, at the three-foot depth, to between 40 and 100 (indicating 60% to 80% of available water at the three-foot depth used) prior to irrigations.

Acala 4-42 cotton grown under a range of irrigation and nitrogen fertilization rates in 1960 and 1961 produced comparable yields and plant growth characteristics both years. Deltapine Smooth Leaf did not react to the treatments in the same manner as did Acala 4-42.

Petiole analysis revealed that when the nitrogen fertility status of Acala 4-42 is adequate for maximum yields (see heavy line, Figure 3), irrigation, according to tensiometer recordings or excessive irrigations, produces such rank cotton with large amounts of boll rot, that the yields are lower than those obtained under nitrogen deficiency. Stressing Acala 4-42 for water prior to the first irrigation further depresses the yield when petiole NO_3-N levels are above the minimum levels.

Lint yield is the best when adequate nitrogen and water are applied to Acala 4-42, but some lodging results. However, DPL given an abundant amount of both water and nitrogen also grew more rank, but boll rot was not severe and yields were not depressed. Additional water above the amount indicated by plant symptom was neither harmful nor beneficial. Similarly, nitrogen above that which resulted in adequate petiole NO_3-N levels did not increase yields significantly.

Comparison of lodging, boll rot and yields of the two varieties shows that lodging, alone, is not bad. With Acala 4-42, lodging is so closely associated with boll rot that lodging appears to reduce yields. This association does not hold true for DPL. Boll rot alone does not account for the depressed yields because Deltapine Smooth Leaf performed better than Acala 4-42 under all conditions tested, and required less strict attention to irrigation and nitrogen fertilizer than did Acala 4-42 for maximum lint yields.

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PESTICIDE RESISTANCE IN CITRUS MITE CONTROL

LONG TERM PESTICIDE programs including alternation, combination, or succession of pesticides cannot be undertaken by arbitrarily selecting those which are chemically different. Advance knowledge that the effects of the toxicants involved are not correlated is also essential.

Substitution of one pesticide for another, as resistance develops, is complicated by studies on cross-resistance showing that the use of one pesticide may induce resistance to other toxicants whether or not they are closely related chemically. Studies indicate that mites differ from houseflies in their resistance patterns. There is a marked cross tolerance in houseflies to closely related C-H (chlorinated-hydrocarbon) compounds but not to the OP (organic phosphate insecticides. Housefly strains selected with OP insecticides routinely develop high levels of resistance to C-H insecticides, even though the resistance to the selecting OP compound may be slight.

Mite strains, however, when selected with C-H acaricides were resistant only to very closely related compounds, but were cross resistant to many OP compounds even though there was no evidence of resistance to the C-H acaricide used in the selections. Mite strains selected with OP acaricides were highly resistant to most of the available OP type acaricides.

Studies of citrus mites indicate certain resistance similarities, as well as differences, in response of *P. citri* and *T. pacificus* to repeated selections with an acaricide. *T. pacificus* developed resistance to Aramite in the laboratory in 15 selections, whereas 21 field applications have not measurably changed the susceptibility of *P. citri* to this acaricide. Selections with demeton-parathion compounds induced varying degrees of cross resistance to other OP compounds.

All pest problems should be considered in selecting a treatment program. Insecticides or fungicides with some toxicity to mites may serve as selecting agents in developing cross resistance to more effective acaricides. Parathion, used in some California citrus districts for control of scale insects, has induced resistance to Delnav, ethion, Trithion and other more effective acaricides against the mite species, *P. citri.*

Two possible solutions to the problem of mite resistance might be (1) the discovery of effective acaricides to which mites are unable to develop resistance or (2) the development of negatively correlated acaricides (when an insect strain resistant to one acaricide is also abnormally susceptible to another). Acaricides in the first group include 2-cyclohexyl-4, 6-dimetrophenol and its dicyclohexylamine salt which have both been used for many years in Florida and California for mite control with no apparent resistance development. Citrus red mite populations have remained as susceptible as ever to Aramite and are equally susceptible to the related compound OW-9, (2-2-(*p-tert.* butylphenoxy)-isopropoxy isopropyl 2-chloroethyl sulfite.

Negatively correlated acaricides have been found for *P. citri* but it has not been determined whether the use of such compounds will rapidly return the resistant strain to its original susceptibility.—*R. L. Jeppson, Entomologist, Experiment Station, University of California, Riverside.*

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