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Water, Nitrogen and Varieties

in lower desert cotton production

Lint yields of Acala 4-42 are highest (despite some lodging) when plants receive only adequate supplies of nitrogen and water, according to Palo Verde Valley tests reported here. When the nitrogen fertility level is adequate for maximum yields, excessive irrigations can produce such rank cotton with large amounts of boll rot that resulting yields are lower than those obtained under nitrogen deficiency conditions. Deltapine Smooth Leaf variety also grew more rank when given extra amounts of both water and nitrogen, but boll rot was not severe and yields were not depressed. Deltapine Smooth Leaf performed better than Acala 4-42 under all conditions tested and required less strict attention to irigation and nitrogen fertilizer for maximum lint yields than Acala 4-42.

COTTON frequently grows rank and unproductive in the Palo Verde Valley. Both irrigation and fertilization practices contribute to the growth and fruiting behavior of cotton. How much each factor contributes to rankness and how each may be employed to control vegetative growth and still secure high lint yields were the questions of this study.

A nitrogen and irrigation experiment was carried out in 1960 to evaluate the interaction of four irrigation regimes and four nitrogen treatments. In 1961 a study was made involving four nitrogen levels, four irrigation treatments and two varieties.

The objectives were to determine which treatments produced the most machine-picked cotton and how each variable affected growth and productivity. The plot was replicated three times each year.

Irrigation treatments during the two-year testing period were classified as "early adequate," "late adequate," "early excessive" or "excessive." The first "early adequate" irrigation was applied when tensiometers read 30 centibars at the 6-inch soil depth. Subsequent irrigations were applied when the red color of the plant approached within three or four inches of the terminal bud on the main stem, and a few flowers began to appear in the upper branches.

The first "late adequate" irrigation was applied about two to four weeks after the early first irrigation—four weeks in 1961 and two weeks in 1960 (the normal range of first irrigations in the area). Subsequent irrigations were applied on the same basis as for the "early adequate" classification.

The "early excessive" treatment involved an early first irrigation and subsequent irrigation applied when tensiometers registered 60 to 80 centibars at the one-foot depth. The "late excessive" treatment involved a late first irrigation and subsequent irrigation applied as for the "early excessive" plots.

Penetration

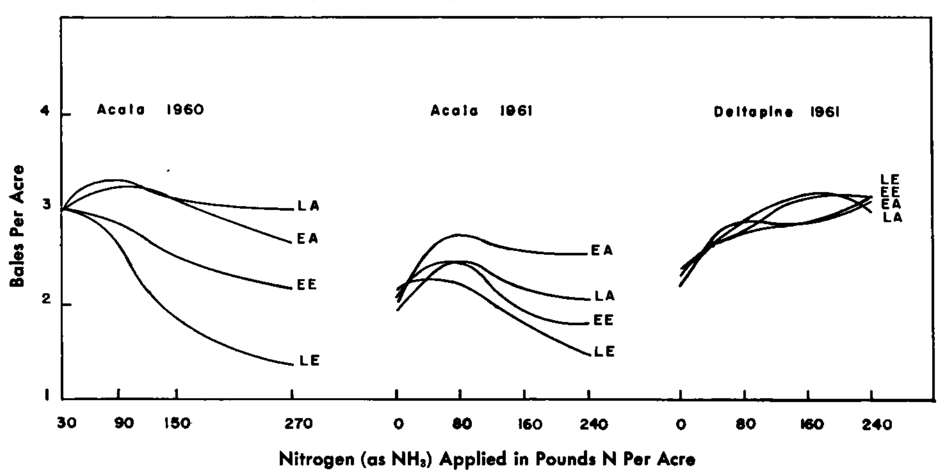
Each irrigation lasted from 15 to 30 hours to insure deep penetration. The soil was predominately Holtville clay loam (30 inches to sand), but with spots of Rositas sandy loam. All plots were bottom defoliated in 1960, but not in 1961.

The plant population was about 70,000 plants per acre. Boll rot, boll shedding, and lodging are associated with high nitrogen and water, most pronounced under high plant population. High population increases picker efficiency, however.

The plots were hand harvested in September, 1960 and machine harvested (John Deere, 2-row) in December. They were machine harvested once, in December, 1961. Small areas were hand gleaned to estimate picker efficiency both years.

Besides seasonal effects, yield differences for Acala 4-42 between the two years (as shown in Figure 1) may be

Figure 1. Cotton yields in bales per acre.



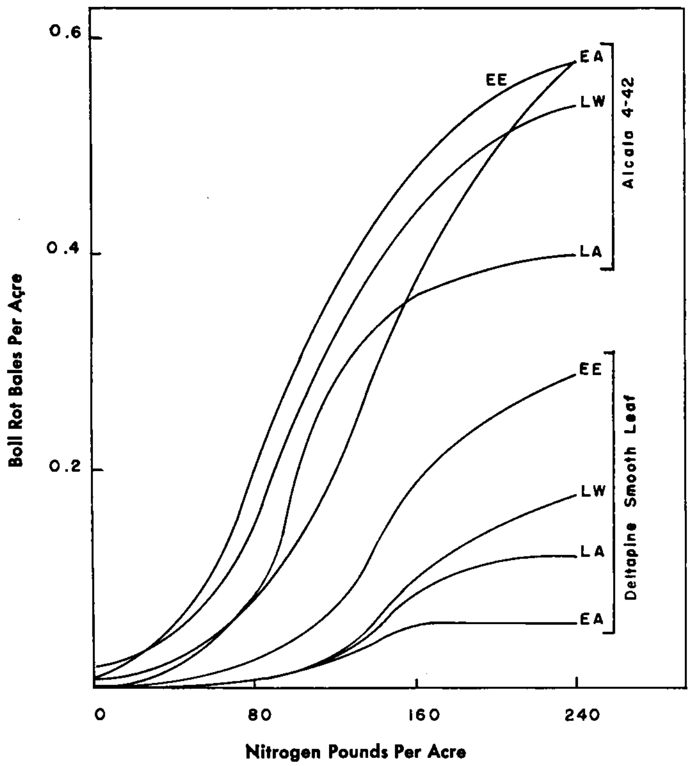


Figure 2. Boll rot in Acala 4-42 and Deltapine Smooth Leaf on 10/28/61.

partly due to different picking methods and bottom defoliation in 1960. Also the 1961 late first irrigation was later than the 1960 late first irrigation.

Relative yields were the same both years for Acala 4-42. Excessive or high nitrogen fertilizer rates, frequent irrigations, and a delayed first irrigation all contributed to rankness and reduced lint yields. A combination of two of these factors was necessary before yields dropped, and all three in combination reduced yields most.

At the lowest nitrogen rate, all irrigation treatments with Acala 4-42 produced the same yields. Irrigation starting dates, when subsequent irrigations were adequate, but not excessive, had little influence on yield in 1960, but seemed to influence yields half a bale in 1961. The dry plots yielded more at high than at low nitrogen rates, while the wet plots produced less under high than under low nitrogen fertilizer rates.

Irrigation

All irrigation treatments on Acala 4-42 produced the same yields at the lowest nitrogen rate. When subsequent irrigations were adequate but not excessive, irrigation starting dates had little influence on yield in 1960; but seemed to depress yields half a bale in 1961. The dry plots yielded more at high than at low nitrogen rates, while the wet plots produced less under high than under low nitrogen fertilizer rates.

Deltapine Smooth Leaf (DPL) yields increased, however, with each nitrogen increase up to 240 lbs. nitrogen per acre, and there was little difference among irrigation treatments.

These results are partly explained by the data in Tables 1 and 2, and Figure 2. As either nitrogen or irrigations increase, plant height, boll rot, and lodging increase in Acala 4-42. Although DPL lodged much worse than Acala 4-42 under all conditions, increasing amounts of nitrogen and water did not increase Deltapine Smooth Leaf plant height or boll rot as much as that of Acala 4-42. DPL grew between 36 and 59 inches high while Acala 4-42 ranged between 46 and 73 inches high. The effect of irrigation and fertilization treatments in 1961 on Acala 4-42 was similar to those in 1960.

TABLE 1. PLANT HEIGHT IN INCHES AND LODGING PER CENT OF ACALA 4-42 IN 1960

Irrigation	Nitrogen 30		90		150		270	
Early Adequate	44"	0%	44"	15%	60"	40%	65"	92%
Late Adequate	44	0	52	0	63	0	68	80
Early Excessive	53	0	57	10	68	40	72	75
Late Excessive	56	5	61	35	69	60	73	90

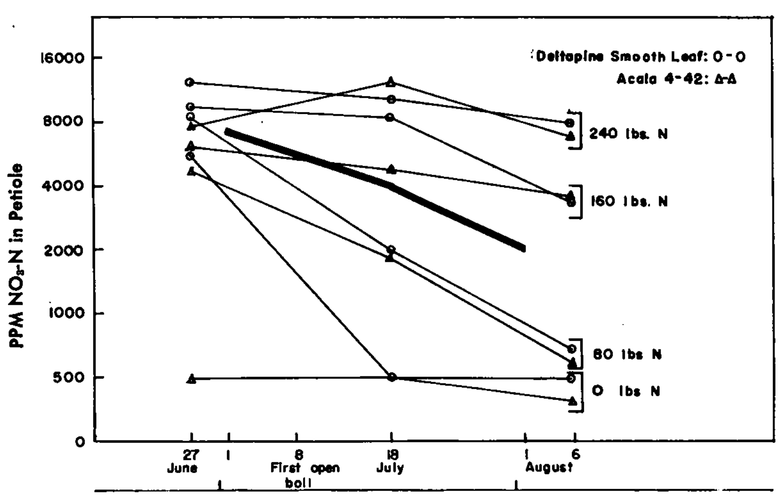
TABLE 2. PLANT LODGING PER CENT OF ACALA 4-42 AND DPL—1961

	Nitrogen							
	0	80	160	240	0	80	160	240
Irrigation	Acala 4-42				Deltapine smooth leaf			
Early/Adequate	15	12	10	31	20	28	50	70
Late/Adequate	12	5	42	48	28	30	38	60
Early/Excessive	19	10	42	63	19	32	43	68
Late/Excessive	7	17	65	100	24	29	50	100

Nitrate-nitrogen petiole analysis in 1961 revealed that the 0 and 80-pound nitrogen rates were below the recommended level for optimum growth (Figure 3). Higher rates furnished adequate nitrogen to the cotton plants. Maximum Acala 4-42 yields were produced on nitrogen-deficient cotton, whereas maximum DPL yields were produced when the petiole NO_3-N content remained above the critical levels. Both soil and petiole PO_4-P levels were very high and no phosphate fertilizer was added.

Gypsum electrical resistance blocks were useful in predicting irrigation needs in the adequate irrigation plots, but tensiometers were not. Tensiometer readings at the one foot depth were off scale from 14 to 33 days before irrigations were applied. Readings exceeded 80 centibars for

Figure 3. NO_3N content of Acala 4-42 and Deltapine Smooth Leaf cotton. Heavy line indicates minimum levels proposed by USDA Field Station personnel at Brawley and Shafter.



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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