

Cotton Fertilization Trials

fertilizer sources, rates, and application studied for effects on yield, fiber, and quality in San Joaquin areas

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Fertilization is an important factor in profitable cotton production in California.

The first fertilizer trials of a series of field experiments revealed that cotton yields are determined more directly by the available nitrogen supply than by any other controllable fertility factor.

Field experiments conducted during 1951 on some major cotton-producing soils indicate that fertilizer which supplies between 50 and 100 pounds nitrogen may appreciably increase cotton yields without any other mineral fertilizer. Productivity on certain soils is increased by supplementing nitrogen with phosphate fertilizer. Most soils appear to be adequately supplied with potash.

The proper kind and amount of all the plant foods, together with adequate soil moisture, air and root space are essential for optimum crop yields. Fertilizer requirements for best cotton production vary from field to field because of differences in the physical and chemical make-up of the soil. The original soil fertility, crop rotations, past fertilizer history and soil management practices are some factors affecting fertilizer requirements.

A summary of average seed cotton yields obtained from five field experiments using various rates of nitrogen with phosphate and potash fertilizer is shown in the accompanying table. These preliminary results, not intended as specific

fertilizer recommendations, report the trends obtained during the 1951 crop year.

Acala 4-42 cotton was grown in all these tests. Soils used for continuous cotton production were planted to cotton and the fertilizers were side-dressed while the plants were in the two-leaf stage. The fertilizers were placed in bands about 6" each side of the row and at a depth 3" to 5" below where the seed was planted. A randomized block design, with all treatments replicated five times, was used in each of these experiments. All plots were treated according to the cultural practices common to the district. Two pickings were made by mechanical harvester for the seed cotton yields.

Fertilizers affected seed cotton yields at all the experimental sites. The greatest response was from nitrogen fertilization, where each increment generally increased the actual seed cotton yields. Analyses of the harvest records indicate that only the increase obtained from 50 pounds nitrogen is significantly better than other treatments, except on the San Emigdio soil series, where each level of nitrogen and the nitrogen-phosphorus combinations significantly increased yields.

Nitrogen

Nitrogen is the most important single fertilizer element affecting cotton produc-

tion. Per unit of plant food, it returns greater economic gain than any other fertilizer element. In some instances both nitrogen and phosphorus are essential for optimum yields. These are often not the most economical yield increases. Most California soils except those in alfalfa or pasture rotation lack sufficient nitrogen for best cotton production. Nitrogen fertilization will increase yields under these conditions whether phosphates are deficient or not.

Adequate nitrogen is important in the vegetative development of the cotton plant. When it is in adequate supply the framework of the plant is good and it bears sufficient branches for high production. The cotton bolls produced with adequate nitrogen are numerous and are borne predominately on the upper or middle fruiting branches. Deficient plants produce fewer bolls and bear them on the lower branches. Fertilization can thus be an important factor in affecting the type of plant best suited for mechanical harvesting. Excess nitrogen should be avoided since it tends to make the plant excessively rank and vegetative and prolongs the fruiting period.

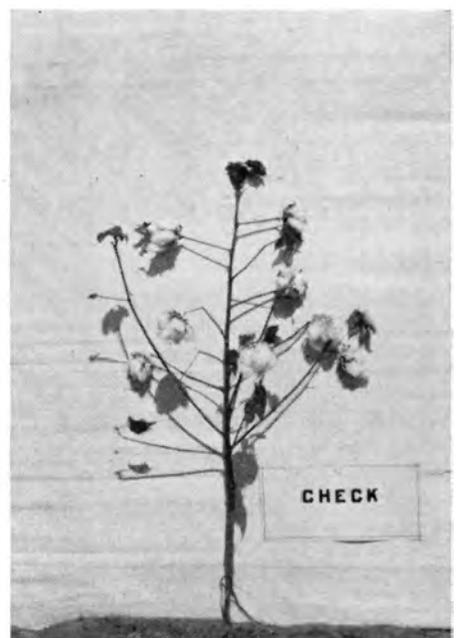
Cotton yields have been increased by nitrogen fertilization because of the greater number of bolls produced but it has not greatly affected lint per cent or other fiber qualities. In some instances,

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Effect of Nitrogen, Phosphate and Potash Fertilization on Average Acre Yields of Seed Cotton

Effect of treatment on acre yield's	None	50N*	Fertilizer treatments (pounds/acre)			
			100N	150N	100N 120P ₂ O ₅ †	100N 120P ₂ O ₅ ; 100K ₂ O‡
Hesperia fine sandy loam						
Seed cotton (pounds)	3063	3341	3247	3341	3375	3490
Increase over unfertilized		9.1%	6.0%	9.1%	10.2%	13.9%
Panoche fine sandy loam						
Seed cotton (pounds)	2143	2308	2493	2540	2423	2486
Increase over unfertilized		9.7%	16.3%	18.5%	13.1%	16.1%
San Emigdio fine sandy loam						
Seed cotton (pounds)	1510	2460	3108	3486	3628	3259
Increase over unfertilized		63.2%	105.8%	130.8%	140.3%	115.8%
Tulare clay loam						
Seed cotton (pounds)	2328	2583	2709	2752	2802	2727
Increase over unfertilized		11.0%	16.4%	18.2%	20.4%	17.1%
Tulare clay loam						
Seed cotton (pounds)	2195	2695	2820	2657	2724	2616
Increase over unfertilized		22.8%	28.5%	21.1%	24.1%	19.2%

* N—Nitrogen. † Phosphorus. ‡ Potassium.



Plant growth and cotton yield is increased by fertilization with ammonium sulfate. The plant on the left received 750 pounds per acre of ammonium sulfate; the plant in the center 250 pounds per acre; the plant on the right received no treatment.

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nitrogen has increased the weight of the cottonseed and its protein content as much as 9% and 19.5%, respectively. Oil yields an acre were increased but the percentage oil content of the cottonseed was slightly reduced. Other quality factors associated with the oil were not significantly altered by nitrogen fertilization.

Phosphorus

Where sufficient phosphates are not already in the soil, increased seedling vigor and earlier crop maturity can be obtained by phosphate fertilization. Phosphates applied with adequate nitrogen do not materially alter the morphology of the cotton plant, but through better nutrient balance increase seed cotton yields. Phosphorus deficiencies when corrected and when other growth factors are near optimum have increased the staple length of the cotton fiber, the weight of the seed and their percentage oil content.

Past experience has shown that phosphate fertilizers used alone do not increase cotton yields appreciably and when used without adequate nitrogen give no apparent growth response. Where phosphates are required it is important that they be supplemented with nitrogen for their best effects.

Potassium

Potash fertilization has not generally benefited cotton production in California. Most soils contain a sufficient natural supply of this plant nutrient and further additions through fertilization do not increase yields. In some tests reported here and tests conducted earlier, potash fertilization has directly or indirectly caused reduced yields regardless of accompanying fertilizer elements. It has not been demonstrated that potash fertilizers improve the growth of the plants, the yield of seed cotton or the quality of cotton grown under conditions prevailing in California.

Reduced cost of producing cotton can

be achieved when fertilizers are properly employed and supplemented with good soil management practices. Fertilizer tests indicate that:

1. Nitrogen will benefit crop production on most soils being cropped to cotton, except those where alfalfa or other legume-pasture rotations are used.
2. Phosphates increase productivity in certain areas when adequate nitrogen is supplied.
3. Additional fertilizer response has not been demonstrated where nitrogen and phosphates are adequate.

The studies reported here were initiated in 1951 and expanded greatly during 1952. They will be continued to explore thoroughly the problems involved in cotton fertilization.

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The above progress report is based on Research Project No. 1437.

Partial view of fertilizer plots receiving varied fertilizer treatments. Four-row treatments compare the short, low-yielding cotton, left, with taller and better producing cotton fertilized with 50 and 100 pounds nitrogen, left to right.

