INFLUENCE OF DEEP TILLAGE AND GIN TRASH ON PLANT HEIGHT AND YIELD OF COTTON

TREATMENT	PLANT HEIGHT ON VARIOUS DATES			LINT YIELD
	JUNE 21	JULY 20	AUGUST 23	
	INCHES	INCHES	INCHES	BALES/ACRE
1. Check	11	20	28	1.67
2. Vertical mulch	13	28	40	2.30
3. Subsoil	13	29	36	2.25
4. Broadcast	12	21	32	1.65
LSD, 5%	1	3	2	0.07

drill row with or without the addition of gin trash. Visible response in plant growth was observed in mid-June indicating a rapid early tap root development in the subsoiled treatments. Excavations of cotton tap roots at other locations (under favorable plant growth conditions) generally showed an extension to a depth of 2.5 feet by mid-June and to a depth of 5 to 6 feet by the end of the season. Root development observations in this test were made at harvest by digging trenches across rows in both normal tillage and subsoiled plots. These observations showed extension of large roots to the bottoms of the subsoiled slots and many small roots. On the normal tillage plots there were no large roots below 18 inches.

To evaluate possible nutritional contributions of the gin trash, petiole nitrate and phosphate levels were determined at regular intervals. Although the gin trash increased the content of these nutrients in the plant, particularly nitrates, the levels in the check treatment would not be expected to limit yield according to past experiments at this location. The effect of the treatments at a critical date is shown below:

INFLUENCE OF DEEP TILLAGE AND GIN TRASH ON NITRATE AND PHOSPHATE CONTENT OF COTTON PETIOLES ON JULY 31, 1961

TREATMENT	NO_3-N	PO_4-P
	PPM	PPM
1. Check	2200	1610
2. Vertical mulch	4300	2000
3. Subsoil	1800	1750
4. Broadcast	5600	1710
LSD, 5%	1400	N. S.

POTATO RESPONSE TO PHOSPHORUS

in organic soils at Tulelake

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Soil reaction and weather conditions can influence responses to phosphorus fertilization, according to field trials with potatoes in the Tulelake area of northern California. Further research is needed to clarify the phosphorus availability of soils and potato plant utilization. Studies are also in progress toward obtaining a better understanding of the use of soil analysis to predict phosphorus requirements of these organic soils.

Growers in the Tulelake Basin are using several commercial fertilizer formulations for the production of a potato crop. The reasons for selection of any one formulation are not clear. Data from previous field trials indicate that maintaining high potato yields with uncertain weather and growing conditions involves a relationship between phosphorus present in a formulation and plant uptake.

The organic soils of this region are a mixture of decomposed tule reed, volcanic ash and pumice, and lacustrian deposits. The soil content of potassium, calcium, and magnesium is high. From past field fertilizer trials, rates as low as 60 pounds of P_2O_5 per acre have usually produced potato yields comparable to higher rates of phosphorus. However, growers are apparently realizing increased potato yields in certain years by changing their fertilizer formulations or rates of application. Studies were initiated to re-examine the phosphate availability of soils in the Tulelake area. Results of only two of several field trials are discussed here.

Russet Burbank seed potatoes (cut) were planted and banded with fertilizer through use of a potato planter. The fertilizer formulations were added so that a relatively constant level of nitrogen was applied with varying levels of phosphorus for the Buckingham ranch trial in 1958. At the Dean ranch trial in 1959, the nitrogen and phosphorus levels were varied (see table). Plantings were made in late May and the crop was harvested in early October. Soil samples were taken prior to planting and plant petiole tissue was sampled during the growing season for chemical analysis. At harvest, yield and grade distribution data were recorded and the specific gravity of U. S. No. 1 potatoes was determined by use of a potato hydrometer.

No response, 1958

Data obtained from the 1958 trial indicated that no marked differences in yield or specific gravity of potatoes were found as a result of additions of phosphorus. Nor were there yield differences attributable to either commercial or experimental fertilizer mixtures.

The available water-soluble phosphate in this organic soil, prior to planting, was 1.12 ppm with a soil-solution conductivity of 0.82 mmhos/cm. Plant tissue analysis showed that the total phosphorus concentration in the petioles was high. By including phosphorus in the fertilizer, the concentration of phosphorus in the plant tissue was not materially increased. Therefore, as a result of the relatively high residual available soil phosphates and neutral reaction of the soil (pH 7.0) additions of phosphorus would not be expected to bring about higher tuber yields.

In the Copic Bay area of Tulelake the soil reaction tends to be more alkaline (above pH 7.5). Some beneficial responses to phosphorus applications to the

soil had been found by growers but the effects have not always been consistent. This area was selected for a trial and plantings were made in 1959 at the Dean ranch.

Good response, 1959

The available water soluble phosphate of the soil at the Dean trial site was 1.22 ppm with an alkaline reaction (pH 7.8) and a conductivity of 1.24 mmhos/cm. Total yield and yield of U. S. No. 1 potatoes was materially increased when phosphorus was added as contrasted with the fertilizer treatment containing no phosphorus. This increase resulted despite an early frost that occurred some 54 days after planting, which resulted in a low over-all potato yield. Damage to plant tissue was severe enough to erase differences in foliage growth first noted prior to the frost. Plant growth as a result of phosphorus treatment up to the time of taking the first tissue sample was markedly greater. Plant foliage was decidedly greener as phosphorus levels were increased up to 240 pounds P_2O_5 per acre. Growth was poorest where no phosphorus was added and a yellowing of plant foliage was seen.

Since frost may occur at any time during the growing season the occasional yellowing of foliage found in immature plant tissue has often heretofore been associated with extremes in the weather. Whether the abnormal foliage color is a direct result of a lack of adequate supply of soil phosphorus or due to a limited availability of some other essential nutrient is not presently known.

Petiole analysis

Petiole tissue taken from plants treated with the higher level of phosphorus showed markedly higher concentrations of total phosphorus up to 50 days of growth. Analysis of plant tissue sampled 23 days later, following regrowth from frost damage, revealed that the level of phosphorus in the tissue was low and no difference due to fertilizer treatment was evident.

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YIELD, GRADE DISTRIBUTION AND SPECIFIC GRAVITY OF RUSSET BURBANK POTATOES

FERTILIZER	NITROGEN AND PHOSPHORUS APPLIED TO GIVE LBS./ACRE		YIELD—CWT. SACKS/ACRE					SPECIFIC GRAVITY
	N	P_2O_5	SMALL	U. S. NO. 1	LARGE	DEFORM	TOTAL	
Commercial formulation	1958 Trial (Buckingham)							
21-0-0	126	0	21.7	205.9	38.2	44.1	309.9	1.082
16-20-0	126	157	27.1	215.5	35.9	50.3	328.8	1.084
10-10-10	126	126	25.1	225.6	39.9	49.0	339.6	1.084
19-9-0	126	63	26.8	234.5	32.3	48.8	342.4	1.084
17-7-0	126	52	24.0	218.6	47.2	54.2	344.0	1.084
Exp. Station formulation*								
17-7-0	126	52	21.6	198.8	36.0	46.2	302.6	1.082
16-20-0	126	157	25.2	220.0	37.3	56.0	338.5	1.082
16-40-0	126	314	21.6	226.3	50.2	44.6	342.7	1.082
L.S.D. 5%			N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
Commercial formulation**	1959 Trial (Dean)							
19-9-0	95	45	29.0	94.6		31.9	155.5	1.081
16-20-0	93	116	34.8	87.2		28.6	150.6	1.081
16-20-0 + P_2O_5	93	242	43.8	112.2		41.9	197.9	1.081
16-20-0 + N	193	116	26.5	88.8		39.0	154.3	1.080
20-0-0	114	0	26.9	61.7		29.4	117.0	1.079
L.S.D. 5%			9.3	29.4		N.S.	26.2	N.S.
1%			12.8	40.7		N.S.	36.2	N.S.

* N as $(NH_4)_2SO_4$ and P_2O_5 as treble super phosphate.

** Commercial formulations with amendments of N as $(NH_4)_2SO_4$ or P_2O_5 as treble super phosphate.

PER CENT TOTAL PHOSPHORUS FOUND IN POTATO PETIOLE TISSUE, BASED ON OVEN DRY TISSUE

Fertilizer	1958 Trial (Buckingham) 68 days after planting
Commercial formulation	(%)
21-0-0	0.31
16-20-0	0.41
10-10-10	0.37
19-9-0	0.36
17-7-0	0.34
Exp. Station formulation*	
17-7-0	0.34
16-20-0	0.38
16-40-0	0.43
L.S.D. 5%	N.S.

* N as $(NH_4)_2SO_4$ and P_2O_5 as treble super phosphate.

Analysis performed by Agricultural Extension Soil Laboratory.

Top growth comparison of potatoes 50 days after planting, treated with high and no P_2O_5. Left row, 16-20-0 plus super phosphate, right row $(NH_4)_2SO_4$ only. Grid in background scaled at 6-inch intervals. Plants from field trial conducted at Copic Bay, Dean Ranch.

Fertilizer*	1959 Trial (Dean) 50 days after planting	73 days after planting
	(%)	(%)
19-9-0	0.23	0.11
16-20-0	0.26	0.11
16-20-0 + P_2O_5	0.31	0.11
16-20-0 + N	0.25	0.13
20-0-0	0.23	0.11
L.S.D. 5%	0.03	N.S.
1%	0.05	N.S.