May 22, 1946

To the Committee on Graduate Study:

I am submitting to you a thesis written by John Arthur Ewing entitled "Crop Response to Fertilization in Carter County, Tennessee". I recommend that it be accepted for eighteen quarter hours credit in partial fulfillment of the requirements for the degree of Master of Science in Agriculture, with a major in Agronomy.

Eric Winters

Major Professor

We have read this thesis and recommend its acceptance:

John B. Washko

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Accepted for the Committee

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Dean of the Graduate School

CROP RESPONSE TO FERTILIZATION IN

CARTER COUNTY, TENNESSEE

A THESIS

Submitted to
The Committee on Graduate Study
of
The University of Tennessee
in
Partial Fulfillment of the Requirements
for the degree of
Master of Science

by

John Arthur Ewing

June, 1946

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John Arthur Ewing

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Carter County, which is located in the upper east corner of Tennessee, has soils which today present a wide range of fertility levels. These differences in soil fertility may be attributed chiefly to variations in the mineral composition of the parent materials from which the soils were derived and to the variable intensities of cultivation over a long period of years. Agricultural workers, who must constantly answer farmers' questions in regard to the best fertilizer treatments to be used under these different soil conditions, feel the need for dependable methods to evaluate fertilizer requirements of soils. The following study was designed to determine the reliability of selected rapid chemical soil tests used at the present time to evaluate the fertilizer needs of soils.

CHAPTER II

PROCEDURE AND METHODS

The procedure and methods followed in this study were in general similar to those described by Davidson (6) and Evans (8); therefore, only a brief discussion of the major points will be given.

Three crops - alfalfa, corn, and potatoes - grown under normal farm conditions were used in this study. Field plots for these crops were selected on the more important soil series found in Carter County. In selecting these plot areas care was taken to locate them on as uniform soil areas as possible. The tests in this study were conducted in three different years, 1941, 1942, and 1944.

Each plot was 1/100 acre in size except with alfalfa in which case each plot was 1/40 acre. Each treatment was replicated three times. All row crop plots consisted of four rows varying in length from 31.5 feet to 35 feet depending upon the width of the rows. The plot arrangement of each experiment was in the form of a modified Latin square. (See Figures 1, 2, and 3)

The various crops on each experimental plot area were planted and cultivated by the farmer at the time and in the same manner as the remainder of the field in which the plots were located. In the case of potatoes, certified seed of an adapted variety was planted. Eleven of the fifteen corn plot areas were planted to approved Tennessee hybrids. In the case of alfalfa only established stands were used.

The methods of weighing, mixing, and applying the fertilizer to corn and alfalfa were identical with those methods used by Davidson (6). In

Crop ______________________

Soil Series ________________

Cooperator _________________

I	II	III
1	2	3
IV	V	VI
3	1	2
VII	VIII	IX
2	3	1

Plot Number - Roman Numerals

Fertilizer treatment - Arabic Numerals

Borax applied on one half the area of each plot

Figure 1. Diagram showing arrangement of alfalfa plots

Crop ____________________

Soil Series ______________

Cooperator _______________

I 1	II 2	III 3	IV 4	V 5	VI 6
VII 6	VIII 4	IX 5	X 2	XI 3	XII 1
XIII 3	XIV 1	XV 6	XVI 4	XVII 5	XVIII 2

Plot Number - Roman Numerals

Fertilizer treatment - Arabic Numerals

Figure 2. Diagram showing arrangement of Irish Potato plots and 1941 corn plots.

Crop ____________________

Soil Series ______________

Cooperator _______________

I 1	II 2	III 3	IV 4	V 5
VI 4	VII 5	VIII 1	IX 2	X 3
XI 2	XII 3	XIII 4	XIV 5	XV 1

Plot Number - Roman Numerals

Fertilizer treatment - Arabic Numerals

Figure 3. Diagram showing arrangement of 1942 corn plots.

the case of potatoes the weighing and mixing were the same as for corn. Sufficient ground limestone was added to each fertilizer mixture to make it physiologically neutral except the mixtures used for potatoes. Lime was omitted from the potato fertilizer mixtures because the presence of lime tends to encourage certain potato diseases. The rates of potassium and phosphorus fertilization and the methods of harvesting will be described for each crop separately.

Alfalfa

Muriate of potash (50 per cent K_2O) was applied at rates of 0, 100, and 300 pounds per acre in February and March of 1941. In addition, borax was applied at the rate of 30 pounds per acre to one half of each plot. Both of these materials were carefully weighed and applied broadcast as a top dressing.

Three areas of one ten-thousandth (1/10,000) of an acre each were harvested from each sub-plot every cutting. Composite hay samples were taken for each fertilizer treatment and were air-dried under a metal roof and the yields computed in tons of dry hay per acre. Three cuttings were harvested with the exceptions as noted in tables.

Corn

For the potash fertilization experiment in 1941, muriate of potast containing 50 per cent K_2O was applied at rates of 0, 50, and 150 pounds per acre. All the plots received 40 pounds of nitrogen and 50 pounds of P_2O_5 per acre in order to eliminate any serious deficiency of these two important elements. In 1942 and 1944 the nitrogen was increased to 50 pounds and the P_2O_5 to 60 pounds per acre.

For the phosphate fertilization experiments in 1941, superphosphate containing 20 per cent P_2O_5 was applied at rates of 0, 125, and 375 pounds per acre. All these plots received 40 pounds of nitrogen and 75 pounds of K_2O. In 1942 and 1944 superphosphate containing 20 per cent P_2O_5 was applied at rates of 0, 100, and 300 pounds per acre and all plots received 50 pounds of nitrogen and 75 pounds of K_2O.

Only the two center rows of the four-row plots were harvested in order to eliminate border effects. The corn was harvested in late October and early November. Samples of grain were taken and dried to determine moisture content. Grain yields were computed after field weights had been corrected for moisture.

Irish Potatoes

For the potash fertilization experiments, sulphate of potash (48 per cent K_2O) was applied at rates of 0, 100, and 300 pounds per acre. All these plots received 30 pounds of nitrogen and 50 pounds of P_2O_5.

For the phosphate fertilization experiments, superphosphate (20 per cent P_2O_5) was applied at rates of 0, 125, and 375 pounds per acre. All plots received 30 pounds of nitrogen and 75 pounds of K_2O.

The fertilizer applications were made in the row and thoroughly mixed with soil a few days before the potatoes were planted.

The two center rows of each plot were harvested after the vines had completely died. The potatoes from each plot were graded according to U. S. standard grades with two grades being made for each plot.

Collection and Preparation of Soil Samples

Individual soil samples of both surface soil (to a depth of 6 inches) and subsoil (depth 6 to 15 inches) were taken from each sub-plot before any fertilizer was applied. Approximately 6 to 8 borings with a soil auger were composited to form each of these samples. Each sample was dried, crushed, passed through a 20 mesh sieve and thoroughly mixed before analyses were made. Composite samples of top soil and subsoil were prepared for each experimental plot area by mixing equal aliquots from each subplot sample.

Analytic Methods

pH was determined by Truog indicator method (12) and later checked with a Beckman glass electrode. Exchangeable potassium was determined by extracting the soil with neutral sodium perchlorate and precipitating with sodium cobaltinitrite as outlined by Bray (2) with modifications by Davidson (6). Available phosphorus was determined by extracting the soil with sodium perchlorate which had been made tenth normal with perchloric acid. Ammonium molybdate was added to the filtrate, and the color developed with S_nCl_2 was compared to that of standard P solutions treated in the same way.

In 1941 determinations for exchangeable K and available P were made on both surface and subsoil samples from all the plots. In 1942 and 1944 determinations for exchangeable K and available P were made for both surface and subsoil samples from plots which received no K and no P as well as other plots selected at random. These determinations were also made on composite surface and subsoil samples. The pH was determined only on the composite surface and subsoil samples of each area.

Notes

The individual plot areas were visited at regular intervals for the purpose of checking results and making observations. Groups of interested farmers, as well as individual farmers, visited many of these areas during the growing season.

CHAPTER III

CROP RESPONSE TO POTASSIUM AND BORON

OBSERVATIONS AND DATA

Alfalfa

The alfalfa yields are shown in Table 1. Also shown in this table are the laboratory data for exchangeable potassium and pH determinations for composite soil sample from all the check plots. The results from each field experiment will be discussed separately.

Field Number 1 - Located on Lodi Soil. The alfalfa in this particular field was comparatively yellow in 1941. It was difficult to determine whether it was boron or potassium deficiency, as described by DeTurk (7), that was causing the yellowing of the plants; therefore, a plot area was established in this field. Figure 4 shows the effect of potash and borax fertilization compared to no treatment. From three cuttings the total increase in hay, as a result of 30 pounds of borax per acre was 0.18 tons; for 50 pounds of potash it was 0.57 ton and for 50 pounds of potash plus 30 pounds of borax it was the same, 0.57 tons. The 150 pound application of potash increased the yield 0.79 ton, whereas 150 pounds of potash with 30 pounds of borax gave an increase of 1.17 tons per acre over the untreated plot. Plots without potash treatment, although receiving borax, showed no potassium deficiency symptoms, yet the growth of the alfalfa on these plots was not quite as tall and there were fewer shoots from individual crowns. The plots receiving neither borax nor potash showed marked yellowing at each cutting and in these plots there was some thinning of the stand with some

TABLE I

YIELDS OF ALFALFA AS AFFECTED BY POTASSIUM

FERTILIZER WITH AND WITHOUT BORAX 1941

Cooperator	Soil Series	Number Cuttings	Yield of Dry Hay Tons Per Acre No. K Added U (a)	T (b)	50# K_2O U	T	150# K_2O U	T	Exch. K lbs. Per A.	pH
Hyder	Lodi	3	2.11	2.39	2.68	2.68	2.90	3.28	130	7.0
Hendrix	Dunmore	1	.85	1.03	.95	1.08	.89	1.09	160	6.4
Price	Frederick	3	1.35	1.96	2.24	2.61	2.84	3.25	110	6.5
Persinger	Holston	2	.73	.97	1.24	1.31	1.48	1.63	100	6.0
Reynolds	Westmoreland	3	1.92	2.82	1.99	2.77	1.99	2.98	175	7.0
Williams	Jefferson	3	1.67	2.55	2.61	3.25	3.15	3.86	140	6.8

(a) U refers to plots without borax

(b) T refers to plots treated with 30 pounds of borax per acre grass coming in. Both the medium (50 pounds) and heavy (150 pounds) applications of potash practically corrected the yellowing of the leaves even though this yellowing was not typical for potassium deficiency. Furthermore, the application of borax also corrected this yellow leaf condition. The borax did not increase the yield to the extent that the potash did. In this soil there was 135 pounds of exchangeable potassium per acre in the surface soil and 100 pounds per acre in the subsoil. The field had been very heavily treated with burnt lime (3 tons of C_aO per acre) which treatment possibly increased the plant needs for both potassium and borax.

Field Number 2 - Located on Dunmore Soil. This was an unusually good field of alfalfa seeded two years previously. The potash level in this soil was fairly high, slightly above 150 pounds of exchangeable potassium per acre in the top soil and 110 pounds per acre in the subsoil. The observed differences between the treated and untreated plots were negligible at the time the first and second cuttings were made; therefore, no yield records were taken. At the time the third cutting was made, following a short drought, there was a very slight yellowing of the upper leaves in all the lots receiving no borax. The individual plots were harvested and there was a slight average yield increase of 0.13 ton for the application of borax. There was no observed yield increase from the application of potash.

Field Number 3 - Located on Frederick Soil. The exchangeable potassium in this soil was slightly above 100 pounds per acre in the surface soil and less than 100 pounds per acre in the subsoil. Very pronounced potassium deficiency symptoms as described by DeTurk (7) were observed on the untreated plots especially in the first cutting. (See Figure 5) Considerable yellowing

Figure 4. The plot on the left received 150 pounds of potash and 30 pounds of borax per acre

Figure 5. Close up of potassium deficiency symptoms in Alfalfa on Frederick. Note the very small white or yellowish dots around the margin of some of the leaflets. On other leaflets the entire margin is yellow.

of alfalfa on the plot receiving no borax was observed at the time of the third cutting following a short drought. The average yield increase for an application of 50 pounds of potash per acre was 0.89 ton for the three cuttings; whereas, the heavier potash applications of 150 pounds per acre gave an increase of 1.49 tons over the untreated and 0.60 ton increase over the 50 pound application. The growth of the alfalfa on the more heavily treated plots was considerably taller and thicker than on the other plots. The difference was especially pronounced at the time of the second cutting when these heavily treated plots showed the only lodging of alfalfa in the field. The plants in the areas treated with both the 50 pound and 150 pound potash applications were quite vigorous; whereas, there was a thinning of stand in the untreated area. In this untreated area there was considerable crab grass by the time of the third cutting. Before the first cutting the yellowing of the alfalfa plants was corrected by the addition of borax except on the no-potassium plots where marked potassium deficiency symptoms were observed in borax treated sub-plots. The application of 30 pounds of borax per acre alone gave an increase of 0.16 ton of hay per acre, with 50 pounds of potash it gave an increase of 0.37 ton of hay per acre, and with 150 pounds of potash it gave an increase of 0.41 ton of hay per acre over the plots receiving potash alone.

Field Number 4 - Located on Holston Soil. In the early spring it was evident that some nutrient deficiency existed in this alfalfa which had been seeded the preceeding fall. There was a good stand of alfalfa but it was stunted, yellow, and unthrifty. Potash and borax were applied on April 24 and there was an almost immediate change in color. In plots where both borax and potassium had been applied alfalfa plants turned from yellowish green to a dark green color. At the time of the first cutting the plots were not harvested separately because the potash and borax had been applied only a few days before. The exchangeable potassium in this soil was less than 100 pounds per acre in both the surface and subsoil. The data reported in Table 1 for two cuttings show an average yield increase for an application of 50 pounds of potash per acre of 0.51 ton and for 150 pounds of potash per acre an increase of 0.75 ton. Thirty pounds of borax per acre increased the yield 0.24 ton per acre. The 30 pounds of borax with 50 pounds of potash per acre increased the yield over 50 pounds of potash per acre by 0.07 ton per acre. Thirty pounds of borax with 150 pounds of potash per acre increased yields of alfalfa over the 150 pound application of potash by 0.15 ton per acre. The stand of alfalfa gradually died out in the no-potash plots and by the following spring the stand was so thin that the field was plowed for corn. At this time there was still a good stand of alfalfa in the plots receiving the 150 pound application of potash and a fair stand in the plots receiving 50 pounds of potash.

Number 5 - Located on Westmoreland Soil. The exchangeable potassium in this soil was 175 pounds per acre in the surface soil and 150 pounds per acre in the subsoil. Three cuttings were harvested but there were no significant differences due to potassium applications. However, striking differences in color and vigor of plants were observed between plots treated with borax and those not so treated. The 30 pound application of borax per acre increased the hay yield in three cuttings from 1.97 tons to 2.86 tons, or an increase of .89 ton per acre.

Number 6 - Located on Jefferson Soil. On this soil there was a good alfalfa response to both potassium and borax. The exchangeable potassium of the surface soil was 140 pounds per acre; whereas, the subsoil was very low. The application of 150 pounds of potash per acre increased the yield of alfalfa by 1.48 tons; whereas the application of 150 pounds of potash and 30 pounds of borax increased the yield by 2.09 tons. The application of borax alone corrected the yellowing of the alfalfa plants. The heavy application of potassium without borax also corrected the yellowing of the alfalfa plants. There was a definite borax-potassium relationship on this light textured soil which had been heavily limed previous to seeding the alfalfa.

<u>Corn</u>

The yield data for all the corn plots are summarized in Table 2. Detailed data for individual plots are presented in the appendix. The three growing seasons (1941, 1942, and 1944) were favorable for corn production in Carter County; however, there were a few short droughts in some areas of the county that affected corn yields adversely. Since several of the plot areas exhibited very similar conditions, the observations will be presented by groups rather than individual plot areas. Groups I - VI inclusive represent experiments conducted in 1941 and 1942. Group VII represents experiments conducted in 1944.

Group I - Located on Holston, Congaree, (loam and fine sandy loam), Nolichucky, and Sequatchie Soils. On these soils in the no-potash plots the majority of the corn plants had a dwarfed appearance, due chiefly to short internodes; furthermore, the margins of the older leaves appeared to be scorched. These are potassium deficiency symptoms which correspond to the ones described by Hoffer (9). In the no-potash plots on the Holston soil over eighty per cent of the corn stalks had fallen down or lodged by harvest time. (See Figure 6). The ears on these stalks were very poorly developed and the grain was chaffy and loose on the cob. (See Figure 7 and 8). On the Holston Soil the exchangeable potassium was 75 pounds per acre in the surface. There was considerable lodging in the no-potash plots on Sequatchie, Congaree, (both loam and fine sandy loam fields) and Nolichucky soils, but the lodging was not so severe as that found on the Holston soil. Most of the corn ears from these plots were of poor quality. It was interesting to note that some corn plants on these potash-deficient soils in the no-potash plots stood up and produced good, vigorous ears showing quite a

TABLE II

YIELDS OF CORN AS AFFECTED BY POTASSIUM FERTILIZER

Year	Cooperator	Soil Series	pH	Exch. K	Bushels Per Acre No K	25# K_2O	75# K_2O
1941	Smalling	Holston	6.5	75	30.7	50.3	52.6
1941	Sharp	Congaree (loam)	6.5	100	62.6	75.7	75.7
1941	Range	Sequatchie	6.0	110	65.1	66.9	75.5
1942	Smalling	Nolichucky	6.5	120	62.7	68.1	77.5
1942	Hyder	Congaree (Fine Sandy loam)	5.7	100	60.6	72.7	84.3
1942	Hughes	Allen	6.0	120	69.4	80.7	83.8
1942	Williams	Jefferson	7.0	130	74.1	86.7	88.2
1941	Reynolds	Greendale	7.0	130	91.9	95.4	95.5
1942	Williams	Decatur	5.5	155	54.3	57.5	67.8
1941	Price	Frederick	5.2	140	27.3	26.2	30.6
1941	Greenlee	Lodi	5.5	110	56.8	69.9	59.1
1941	Hazlewood	State	6.0	210	62.9	63.8	65.1
1941	Anderson	Philo	6.2	110	47.5	51.5	55.8
1944	Sharp	Congaree	5.8	110	53.5	54.4	72.6
1944	Taylor	State	6.9	125	26.3	30.5	33.7

Figure 6. Plants in the four lodged rows in the center did not receive any potash but received the same application of Nitrogen and Phosphorus as the rows on either side. (Holston soil)

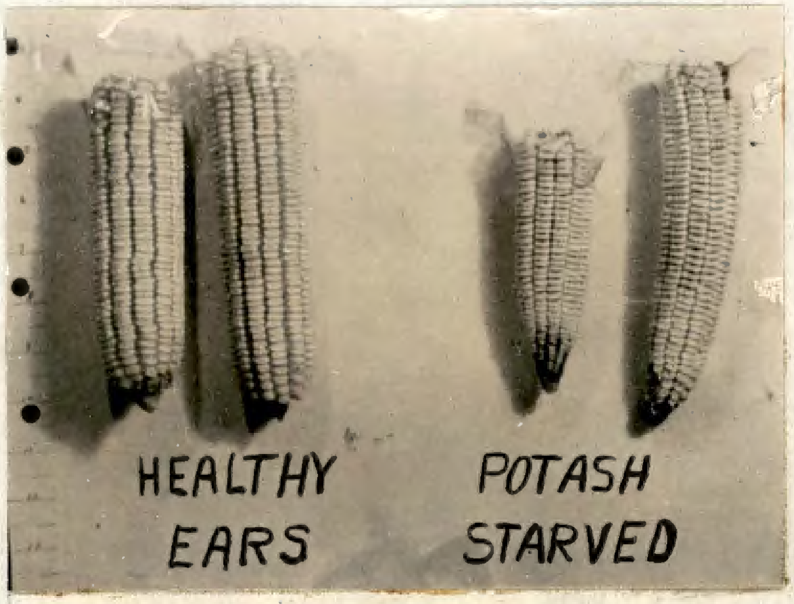


Figure 7. On left, ears from plants receiving complete fertilizer. On right, potassium starved ears from plants receiving nitrogen and phosphorus only.

Figure 8. Corn on left, from a two-hundredth acre plot receiving nitrogen and phosphorus but no potassium. Corn on right, from same size plot receiving a complete fertilizer (Nolichucky soil).

variation in individual plants in their ability to utilize the available potash supply in the soil.

Group II - Located on Jefferson and Allen Soils. Both increments of potash gave response on these soils that contained approximately the same amount of exchangeable potassium (130 pounds per acre). The second increment of potash on these soils gave an increase of thirteen to fifteen bushels per acre over the first increment. Deficiency symptoms as described by Hoffer (9) were not very pronounced on these soils; however, on the no-potash plots there were a few plants that showed scorched margins of the lower leaves and at harvest time there were a few lodged plants in these plots. The leaves of the plants in the no-potash plots showed a speckled or mottled appearance when viewed from the under side (See Figure 9).

Group III - Located on Greendale Soil. The corn yields on Greendale were the highest of any obtained in this study. The exchangeable potassium was only 130 pounds per acre and there was a very small increase in yield for the two increments of potash used. At this level of exchangeable potassium, increases in yield from the addition of potash would normally be expected. There was no observable potassium deficiency symptoms in the no-potash plots. A very heavy crop of dead sweet clover was turned during the winter in preparation for the corn crop. The decaying of this sweet clover during the spring and summer may have helped release sufficient potash to produce over ninety bushels of corn per acre.

Group IV - Located on Lodi and Philo Soils. The plot area on Lodi

Figure 9. Effects of potassium deficiency on corn plants. Note characteristic brown scorched leaf margins, and also light speckling of leaves. These plants received applications of nitrogen and phosphorus but no potassium.

soil showed a very good response to the first increment of potash, giving an increase of 13.1 bushels per acre. The second increment of potash only increased the yield 2.3 bushels over the untreated plots, which yield was several bushels less than the yield of the first increment. In all three sub-plots the yield of corn with the smaller (twenty-five pounds) increment of potash was higher than where the corn received seventy-five pounds of potash. There was very little variation in exchangeable potassium between sub-plots. The average exchangeable potassium was 110 pounds per acre which is considered a fairly low level. The low yield of corn on the heavily treated plots can be partly attributed to a thin stand in two of the sub-plots.

Corn on the Philo soil with the same level of exchangeable potassium (110 pounds per acre) gave very little yield increase for potash. The rainfall on both of these areas was ample to excessive during the growing season.

Group V - Located on Decatur and Frederick Soils. Both fields in which these plot areas were located had very low fertility levels and the plot areas stood out in sharp contrast as a result of the complete fertilization. The exchangeable potassium of these two soils was 140 pounds for the Frederick soil and 155 pounds for the Decatur soil. No potassium deficiency symptoms were evident on either area. The first increment of potash on the Decatur soil gave an increase of 3.2 bushels per acre and the second increment gave an increase of 13.5 bushels per acre. There was very little response to the potash treatments on the Frederick soil. The second increment of potash gave an increase of 3.3 bushels per acre.

Group VI - Located on State Soil. There was no apparent increase in corn yield to either increment of potash on State silt loam. There were 210 pounds of exchangeable potassium per acre in this soil.

Group VII - Field Plots in 1944 on State and Congaree Soils. The fertilizer was not applied on the State soil until the corn was about waist high and showing very pronounced potash deficiency symptoms. Dry weather had prevailed for several weeks previous to fertilization and continued several weeks thereafter. Neither the total yields nor the increases due to potash were large on this area. The field in which these plots were located had been heavily limed several years previously with burnt lime (6 tons Ca O per acre). Some response to side dressing with potash was observed; however, under the conditions described little response was to be expected. If adequate amounts of rain had fallen sooner, more response to potash would have been expected on this soil with an exchangeable potassium content of 125 pounds per acre.

The plot area on Congaree soil was fertilized at planting time. On two of the check plot replicates marked potassium deficiency symptoms were observed. Several stalks were lodged and the corn was of poor quality. One replicate of the no-potash treatment gave a very high yield which materially affected the average. Soil samples from two of the no-potash plots (those two plots having marked potash deficiency symptoms) had 110 pounds of exchangeable potassium per acre; whereas, the plot that showed no deficiency symptoms had 200 pounds of available potassium per acre. The yield for this high potash plot was very nearly equal to the average yield of the high potash treatments. (Table 3)

TABLE III

CORN YIELDS AND EXCHANGEABLE SOIL POTASSIUM FOR INDIVIDUAL REPLICATES OF THE NO-POTASSIUM TREATMENTS ON CONGAREE SOIL 1944

Replicate	Yield (Bu. Per Acre)	Exchangeable K (Pounds Per Acre)
1	75.5	200
2	43.5	110
3	41.5	110
Average	53.5	140

Irish Potatoes

The yield data for the potato plots are summarized in Table 4. Detailed data for individual plots are presented in the appendix. The soil series were divided into two groups for presentation of observations and data. The division of the soils was based on the amount of exchangeable potassium they contained.

Group I - Soils With More Than 200 Pounds of Exchangeable Potassium Per Acre. The soils in this group, Halewood, Porters, and Tusquittee, gave no apparent response to potash fertilization nor did they exhibit any of the potassium deficiency symptoms as described by Jones and Brown (10). These soils were all derived from parent materials high in potassium minerals such as feldspar and mica. Since this group of soils contained large amounts of these minerals it could be expected that sufficient potassium would be available to take care of the needs of the potato plant.

Group II - Soils With Less Than 200 Pounds of Available Potassium Per Acre. The soils in this group, Ashe, Congaree, Jefferson, and Lindside all showed an excellent response to both increments of potash. Potato plants on the no-potash plots showed definite potassium deficiency symptoms as described by Jones and Brown (10). The internodes of potato plants were shorter giving the plant a more compact appearance. The leaves were flatter with a marked dark green foliage. As the leaves aged they became yellowish, and starting from the edges, a bronze color developed. (See Figure 10).

The increase of U. S. No. 1 potatoes due to the first increment of potash on the Jefferson soil was 35.9 bushels and the second increment gave an added increase of 27.5 bushels. The yield of U. S. No. 2 potatoes did

TABLE IV

YIELDS OF IRISH POTATOES AS AFFECTED BY POTASSIUM FERTILIZER

			Bushels of Potatoes Per Acre						Exchangeable
		Soil	No. K Added		50 lbs. K_2O		150 lbs. K_2O		K In Soil
Year	Cooperator	Series	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2	(lbs. per A.)
1941	Heaton	Tusquitee	155	18.1	154	14.9	148	18.2	450
1941	Street	Porters	142	10.0	168	6.6	154	7.0	230
1941	Blackwell	Halewood	97	10.8	89	7.4	85	6.7	420
1941	Hampton	Ashe	149.2	25.6	153.4	19.1	179.2	14.3	190
1942	Shell	Lindside	124.3	17.6	182.2	15.2	188.4	14.7	150
1942	Hazlewood	Jefferson	64.0	36.5	99.9	41.0	127.3	42.7	130
1942	Sharp	Congaree	53.3	54.9	97.2	47.8	102.1	48.7	100

Figure 10. Irish potato plants showing Potassium deficiency symptoms. Note the darker green foliage than normal and the bronzing of the older leaves. The leaves also have a somewhat flat appearance.

not increase with the potash treatment as did the yield of U. S. No. 1 potatoes. The first increment of potash on the Lindside soil gave an increase of 57.9 bushels of No. 1 potatoes and the second increment gave only 6.2 bushels more than the first increment. The yield of No. 2 potatoes decreased with the addition of potash. On the Congaree soil the first increment gave an increase of 43.9 bushels of U. S. No. 1 potatoes and the second increment further increased the yield 4.9 bushels. As on the Lindside soil the yields of No. 2 potatoes decreased with the addition of potash. The Ashe soil had the highest exchangeable potassium content (180 pounds) and gave only 4.1 bushels increase for the first increment of potash; whereas, the second increment gave 25.8 bushels more of U. S. No. 1 potatoes than did the first increment. The yield of U. S. No. 2 again decreased with the addition of potash.

Yield Response Curves For Each Crop

In order to bring out other significant relationships Bray (3) has suggested that data of this type be presented graphically. The yield on the plots receiving the high K_2O increment is taken as 100 per cent and the yield on the check plots is computed as a percentage of this yield. Then the response of a given crop to potassium fertilization from a number of experiments may be plotted on the same graph. The percentage yield of the check plots is represented on the ordinate and the exchangeable soil potassium is represented on the abscissa.

The data for alfalfa (from Table 1); Irish Potatoes (from Table 4); and Corn (from Table 2) are plotted in Figures 11, 12, and 13 respectively in this fashion. A smooth curve has been fitted approximately to the points for each crop to show the trends.

Figure 11

Relationship between exchangeable soil potassium and alfalfa yields on plots receiving no potassium

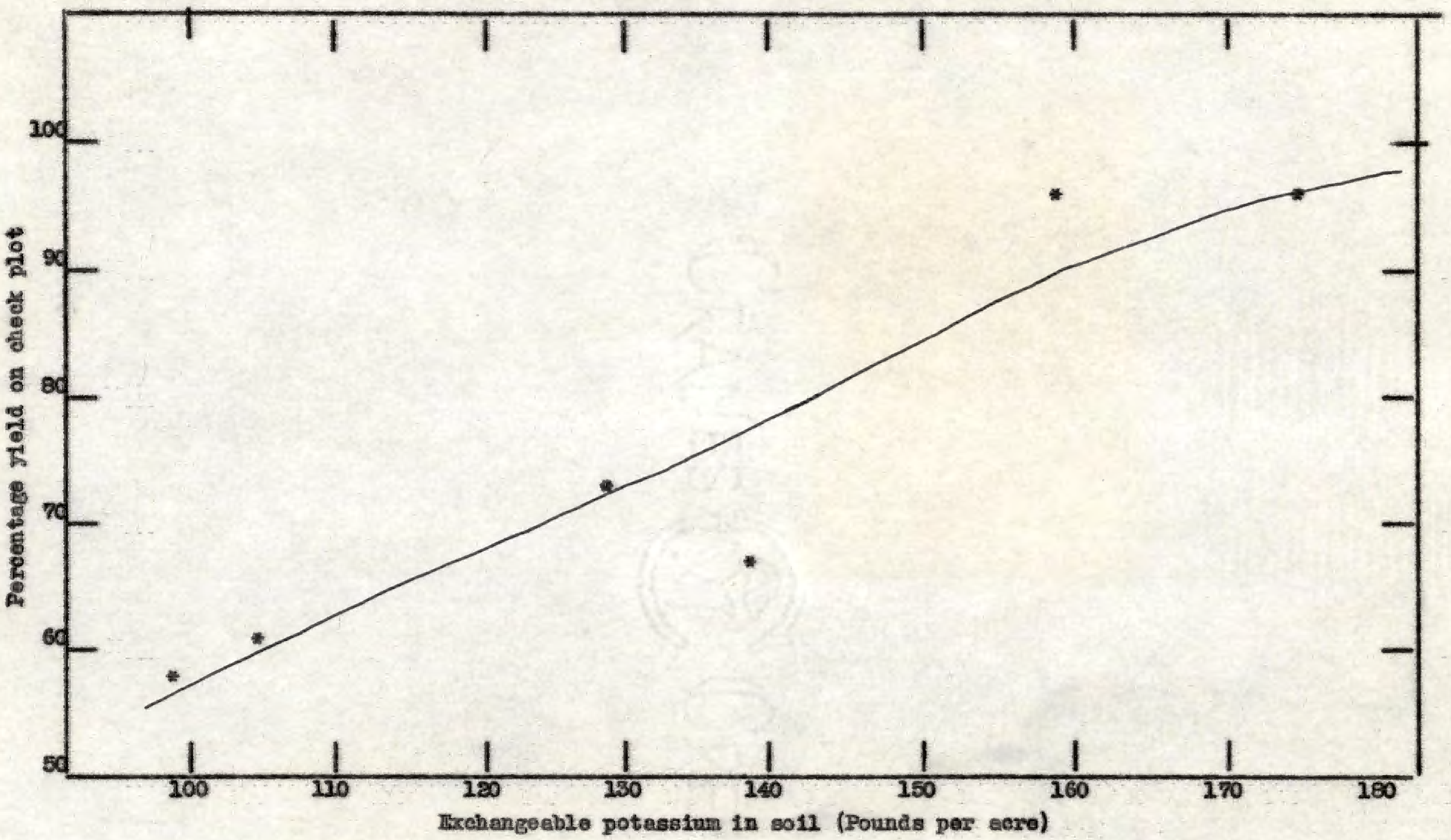


Figure 12

Relationship between exchangeable soil potassium and corn yields on plots receiving no potassium

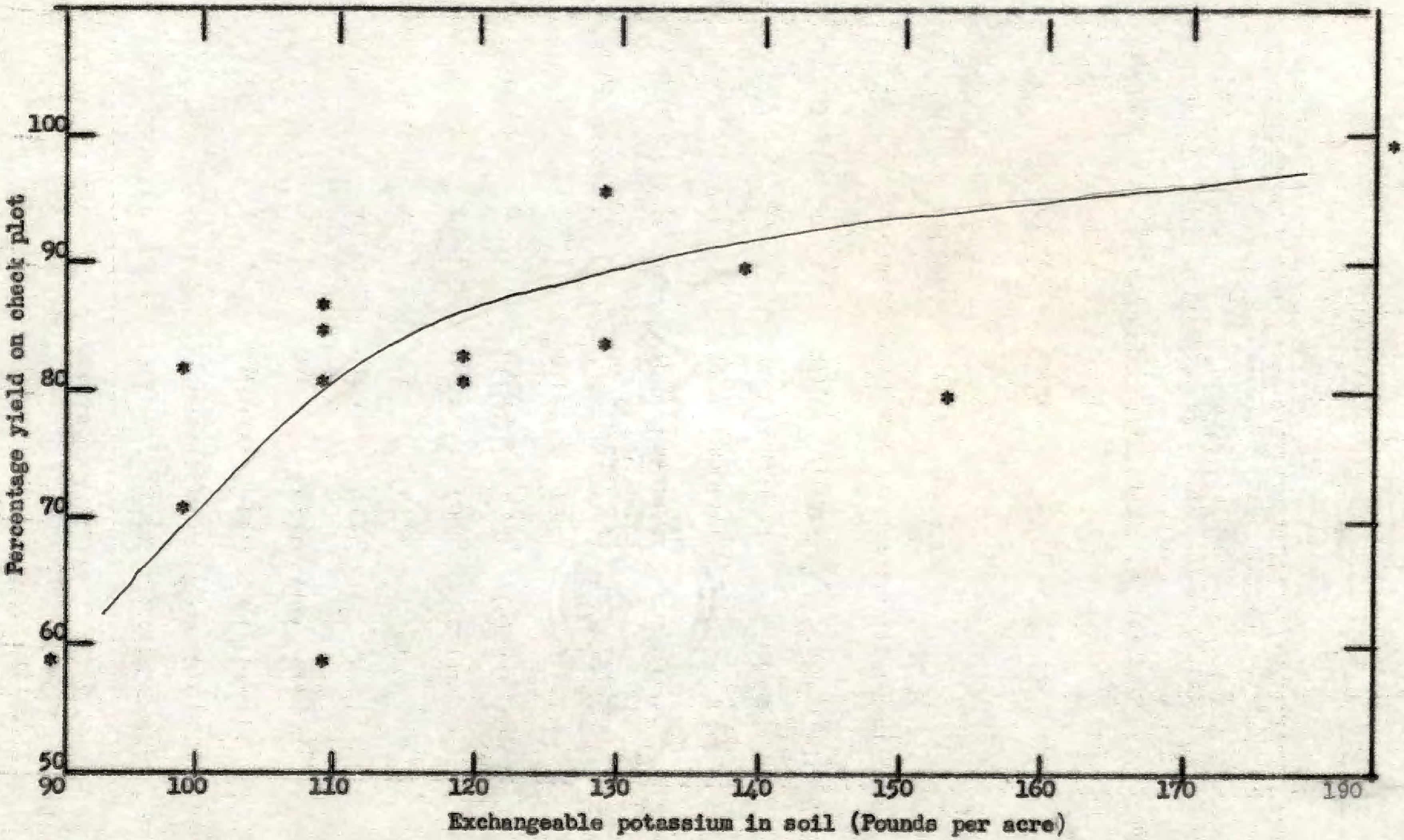
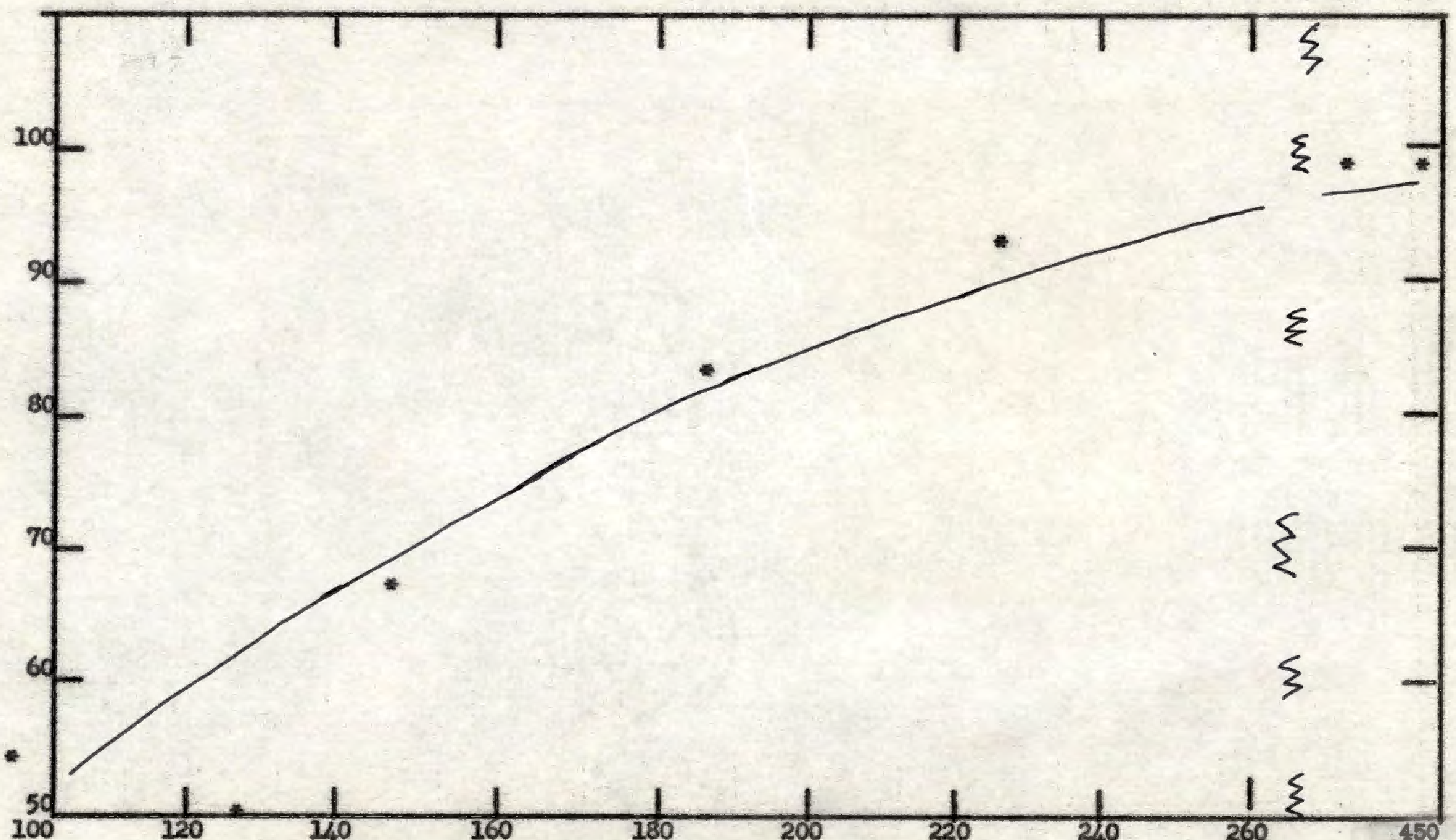


Figure 13

Relationship between exchangeable soil potassium and Irish potatoe yields on plots receiving no potassium



DISCUSSION OF RESULTS

A soil test for exchangeable potassium may serve effectively as a basis for making potassium recommendations for those soils and crops in a county or similar area on which there are sufficient data available to indicate the correlation between the exchangeable soil potassium and crop response to potassium fertilization. The discussion and development of correlations of data as evidence of the above statement are presented separately for each crop.

Alfalfa Response to Potash. The exchangeable potassium levels in soils where alfalfa plot areas were located varied from 100 pounds to 180 pounds per acre in the surface soil and from less than 100 pounds to 150 pounds in the subsoil. The data clearly show that alfalfa responds to the addition of potassium on soils with a low exchangeable potassium content. The amount of exchangeable potassium that must be present in the soil before potash applications cease to be effective in raising the yield of alfalfa can be approximated by observing the potassium levels at the 90 per cent yield level in Figure 11. This exchangeable potassium level for alfalfa is 160 pounds per acre. Applications of potash on alfalfa can be recommended for Carter County soils that have less than 160 pounds of exchangeable potassium per acre and can be omitted for soils above this level. From examination of Table 1 it will be noted that the average percentage yield increases from potash are greater on the soils with the lower exchangeable potassium. The amount of potash to apply to alfalfa on Carter County soils where the exchangeable potassium is below 160 pounds per acre seems to be from 50 to 100 pounds of K_2O depending upon the amount of exchangeable potassium, the higher rates being suggested for the soil with the lower exchangeable potassium.

Alfalfa Response To Borax. Only data from the plots where boron was applied were considered in interpreting potassium fertilizer results. The data in Table 1 show some responses to the application of 30 pounds of borax per acre on alfalfa. Boron deficiency symptoms as described by Cook (5) and illustrated in Figure 4 were observed to some extent in all plot areas. The symptoms were more pronounced on the lighter textured soils (Jefferson, Lodi, and Holston). The application of 30 pounds of borax per acre corrected this deficiency, improved the quality of the hay and gave a slight increase in yield. There was evidence of interaction between boron, potassium and calcium in alfalfa nutrition because the application of potassium would correct the boron deficiency symptoms. Bear and Prince (1) analyzed alfalfa grown in variously treated plots and found that the content of total bases (Ca + Mg + K) was about constant regardless of the treatment. Where potassium is deficient in relation to the supply of calcium, intake of the latter is greater and the need for boron becomes greater as Jones and Scarseth (11) have found. (The more calcium taken in by the plant, the more boron it must obtain to maintain normal growth.) In other words when potassium is applied the calcium intake is reduced and the boron needs are lowered. Based on the results of these experiments 30 pounds of borax per acre can be recommended as adequate for alfalfa in Carter County.

Corn. The exchangeable potassium levels in soils where corn plots were located varied from less than 100 pounds to 210 pounds per acre in the surface soil. The yield data for corn are quite variable as shown by the wide scatter of points on the graph. (Figure 12.) The amount of exchangeable potassium that must be present in the soil before potash applications cease to be effective in raising corn yields can be approximated by observing the potassium level at the 90 per cent yield level in Figure 12. This exchangeable potassium level is 140 pounds per acre. Evans (8) and Davidson (6) found this level to be somewhat higher; however, their results were for parts of the state where the rainfall is not as favorable as in Carter County. The favorable distribution of rainfall in Carter County may account for the lower potassium requirement for corn there. It has been observed that the appearance of potassium deficiency symptoms in most crops is more general in dry weather than when rainfall is plentiful. Therefore, the amount of potassium that should be present in the soil to produce normal yields may not be constant but may depend in part on the soil moisture supply.

The data in Table 2 show that the first increment of potash (25 pounds of K_2O) gave a larger increase in yield over the check plot than did the second increment (75 pounds of K_2O) over the first increment. Also, these data clearly show that the addition of potash to corn on soils where the amount of exchangeable potassium was below 140 pounds gave appreciable yield increases. The greater increases were on soils where the exchangeable potassium was below 110 pounds per acre. Addition of potassium fertilizer at rates of 25 pounds to 50 pounds of K_2O per acre can be recommended for corn on Carter County soils where the exchangeable potassium is below 140 pounds per acre. The higher rates are suggested on the soils with lower exchangeable potassium.

Potatoes. The exchangeable potassium levels in soils where potato plot areas were located varied from 100 pounds to over 400 pounds per acre. The correllation of yield data for Irish potatoes with the exchangeable potassium in the soil is very consistent. The amount of exchangeable potassium that must be present in the soil before potash applications cease to be effective in raising the yield of Irish potatoes can be approximated by observing the potassium level at the 90 per cent yield level in Figure 13. This exchangeable potassium level for potatoes is 220 pounds per acre. As indicated by these data, (Table 4 and Figure 13) potash fertilization of potatoes may be guided by the quantity of available potassium in the soil as shown by the rapid chemical test.

The first K_2O increment on soils low in exchangeable potassium gave a larger increase in yield over the check plot than did the second increment of K_2O over the first. This suggests that the larger amount of potassium added is approaching the maximum that could be used by potatoes under conditions of these experiments. In Carter County potatoes should respond to applications of potash fertilizer at rates of 50 to 100 pounds of K_2O per acre on soils where the exchangeable potassium is below 220. Potatoes gave no significant response to potash fertilization where the exchangeable soil potassium exceeded 220 pounds. The average yields of the check plots of the soils where the exchangeable potassium was below 200 pounds per acre, plus the average increase in yield with the higher increment of K_2O approximately equals the average yield on the check plot of the soils higher in exchangeable potassium. Since very little yield increase resulted from potassium fertilization on these high potassium soils, it can be safely assumed that sufficient potassium was supplied by the higher rates of application. Another point to note is the effect of potassium additions on the grade of potatoes. On the low potassium soils there was very little change in yield of U. S. No. 2 potatoes (Table 4) when potash was applied but there was a big increase in the yield of U. S. No. 1 potatoes and a consequent lowering of the percentage of U. S. No. 2 potatoes.

CHAPTER IV

CROP RESPONSE TO PHOSPHATE FERTILIZATION

Data And Observations

Field observations and data summaries will be presented for each crop separately.

Corn

The summarized corn yield data and the available P content of the composite samples from each experimental plot area are given in Tables 5 and 6. Detailed data for each plot area are presented in the appendix. For convenience of inspection and discussion the yield data for corn have been grouped according to the available P content of the surface soils. After careful examination of the results two groupings were made rather arbitrarily - group (1) soils with phosphorus tests varying from one to six, and group (2) soils with phosphorus tests above six. The group of soils with the higher phosphorus content gave the higher yields and also gave less response to additions of phosphate fertilizer. It will be noted that the average yield on the check plots of the soils low in phosphorus, plus the average increase in yield with the larger increment of P_2O_5 approximately equals the average yield on the check plot of the soils high in phosphorus. Since very little yield increase resulted from phosphorus fertilization on these high phosphorus soils, it can be safely assumed that sufficient phosphorus was supplied by the higher rates of application so that it was not an important factor limiting yields under the conditions of these experiments.

TABLE V

YIELDS OF CORN AS AFFECTED BY PHOSPHORUS FERTILIZER

Year	Cooperator	Soil Series	pH	P Test	Bushels Per Acre No. P_2O_5	20# P_2O_5 (a)	60# P_2O_5 (b)
1941	Price	Frederick	5.2	1	23.8	30.1	32.9
1941	Greenlee	Lodi	5.5	3	51.4	55.7	63.8
1941	Range	Sequatchie	6.0	7	70.6	74.0	72.5
1941	Reynolds	Greendale	7.0	2	87.2	96.1	101.2
1941	Hazlewood	State	6.0	2	54.1	68.1	68.0
1941	Sharp	Congaree	6.5	18	75.8	70.6	78.8
1941	Smalling	Holston	6.5	8	43.4	44.5	47.1
1941	Anderson	Philo	6.2	2	45.4	56.9	55.0
1942	Hughes	Allen	6.0	4	72.3	77.6	83.8
1942	Hyder	Congaree	5.7	4	69.9	84.3	84.3
1942	Williams	Jefferson	7.0	7	75.0	87.8	88.2
1942	Smalling	Nolichucky	6.5	9	70.6	67.7	77.5
1942	Williams	Decatur	5.5	1	46.5	47.2	67.8

(a) 1941 25# P_2O_5
(b) 1941 75# P_2O_5

TABLE VI

AVERAGES OF CHECK PLOT YIELDS AT DIFFERENT LEVELS OF AVAILABLE PHOSPHORUS AND AVERAGE YIELD INCREASES FROM PHOSPHORUS FERTILIZATION

Crop	P Test	No. of Field Trials	Average Yield of No P Plots	Increment of P_2O_5 Pounds Per Acre	Average Yield Increase Per Acre
Corn	Under 6	8	56.3	20	8.2
				60	13.3
	Over 6	5	67.1	20	1.8
				60	5.1
Potatoes	Under 6	4	71.3	25	40.2
				75	58.1
	Over 6	4	142.5	25	25.2
				75	18.4

The yield data for corn have been graphed in Figure 14 as suggested by Bray (3). The yield of the plot receiving the high P_2O_5 increment was taken as 100 per cent and the yield on the check plot was computed as a percentage of this yield. Then the corn yield response to phosphorus fertilization from all the experiments were plotted on the same graph where the percentage yield on the check plot is represented on the ordinate and the available phosphorus content of the soil is represented on the abscissa.

On the high phosphorus soils (testing above 6) there was no apparent difference observed in the growth of corn plants on the check plots and those on the plots receiving the high P_2O_5 increment. Yield differences between treated and check plots were small, being only 1.8 bushels per acre increase for the 20 pound P_2O_5 increment and 5.1 bushels for the 60 pound P_2O_5 increment.

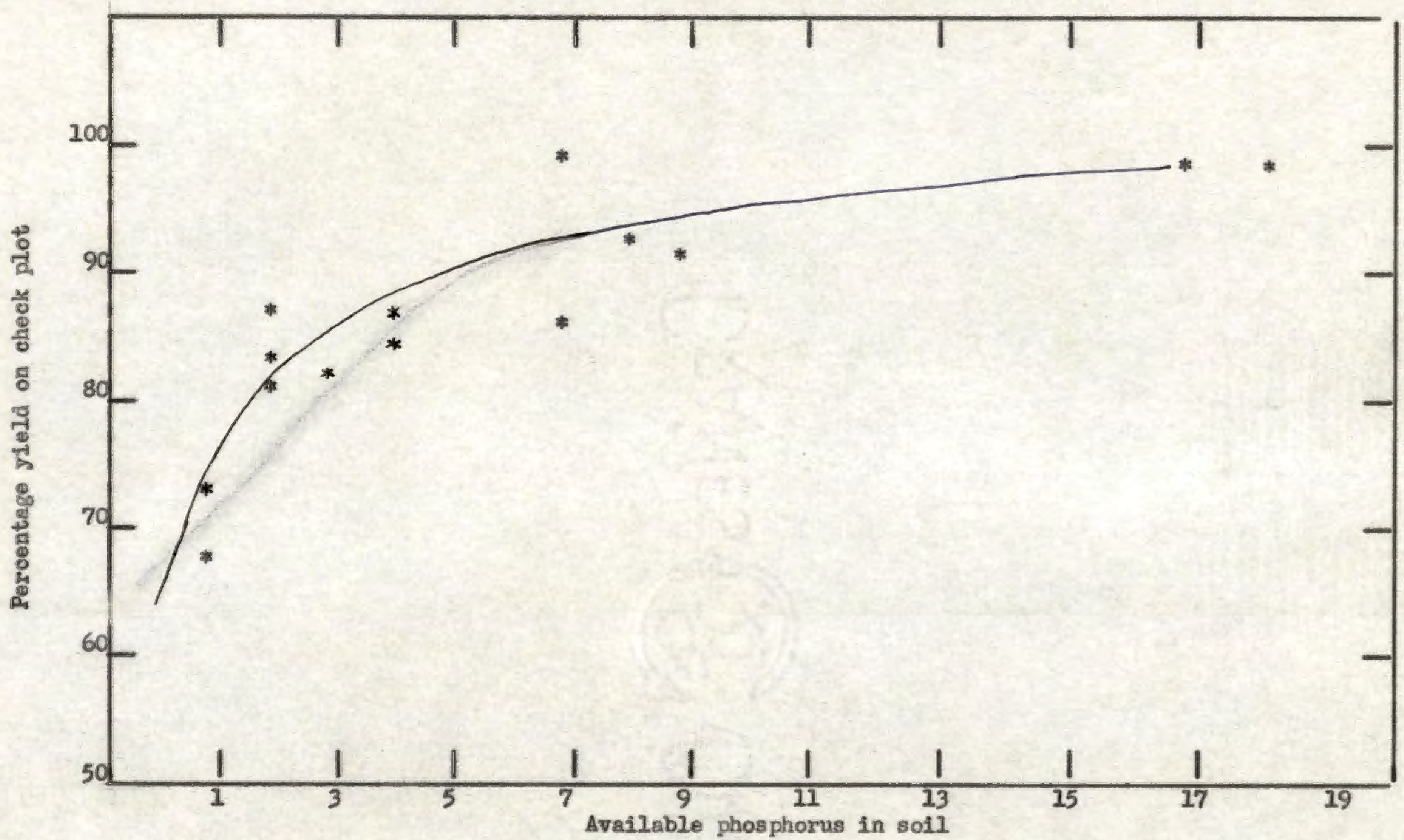
In the case of the low phosphorus soils a very noticeable difference between treated and untreated plots occurred during the pollination stage. Tassels and silks were a few days later emerging on the check plots than on the plots receiving phosphate fertilizer. On the Decatur soil the plants on the untreated plots were spindling and smaller than the corn plants where phosphate fertilizer was applied.

The reaction of the soil in which the tests were conducted made considerable difference in corn yields. For instance the plots receiving the high increment of phosphorus (60 pounds P_2O_5) on soils with a pH above 6.0 averaged 74.9 bushels as compared to only 62.2 bushels for the same treatment on soils with a pH below 6.0, a difference of 12.7 bushels.

Potatoes

The summarized potato yield data and the available P content of the

Figure 14
Relationship between available phosphorus in the soil and corn yields on plots receiving no phosphorus



composite samples from each experimental plot area are given in Tables 6 and 7. Detailed data for each plot area are presented in the appendix. Two groupings were made of the potato yield data. These groupings were based on the available P content of the soil. Group I, includes soils with phosphorus tests ranging from 1 to 6 and Group II includes soils with phosphorus tests above 6. The average yield increase from phosphate fertilization was greater on the soils with the lower phosphorus test, however, the soils in Group II with the higher available phosphorus gave some response to phosphorus fertilization. Figure 15 shows the yield data for potatoes graphed in the same fashion as the corn data was graphed.

There were no phosphorus deficiency symptoms observed in the foliage of the potato plants grown on soils testing above 6; however, there was some yield response to phosphorus fertilization. The plants in no-phosphorus plots on soils testing below 6 were spindling, unthrifty, and quite rigid. (Figure 16.)

These plots were easily identified in the field and were the latest to mature. The yield of potatoes on the Halewood soil was the lowest of any obtained in this study. This soil had a silty clay loam texture and was high in colloidal material with an abundant content of aluminum and iron. The pH was 5.0; therefore, this soil should have a high fixing power for phosphorus. For these reasons, Halewood silty clay loam is not a suitable soil for potato production.

TABLE VII

YIELDS OF IRISH POTATOES AS AFFECTED BY PHOSPHORUS FERTILIZATION

					Bushels of Potato Per Acre					
					No P Added		25# P_2O_5		75# P_2O_5	
Year	Cooperator	Soil Series	pH	P Test	U.S.No.1	U.S.No.2	U.S.No.1	U.S.No.2	U.S.No.1	U.S.No.2
1941	Blackwell	Halewood	5.0	1	39.3	6.4	85.0	5.6	115.5	4.8
1941	Hampton	Ashe	6.5	14	136.1	24.8	173.7	18.4	162.4	20.0
1941	Heaton	Tusquitee	5.2	14	135.6	17.5	157.8	17.7	168.5	19.9
1941	Street	Porters	5.2	3	90.0	9.5	150.9	5.9	160.7	6.0
1942	Hampton	Tate	7.0	4	69.9	14.7	97.5	16.7	122.4	13.2
1942	Hazlewood	Jefferson	5.0	5	85.9	45.2	112.5	44.3	118.9	35.2
1942	Heaton	Ashe	5.5	20	149.7	16.9	162.1	11.0	123.2	15.5
1942	Shell	Lindside	7.0	8	148.5	12.4	177.1	13.3	189.4	13.8

Figure 15

Relationship between available phosphorus in the soil and Irish potato yields on plots receiving no phosphorus

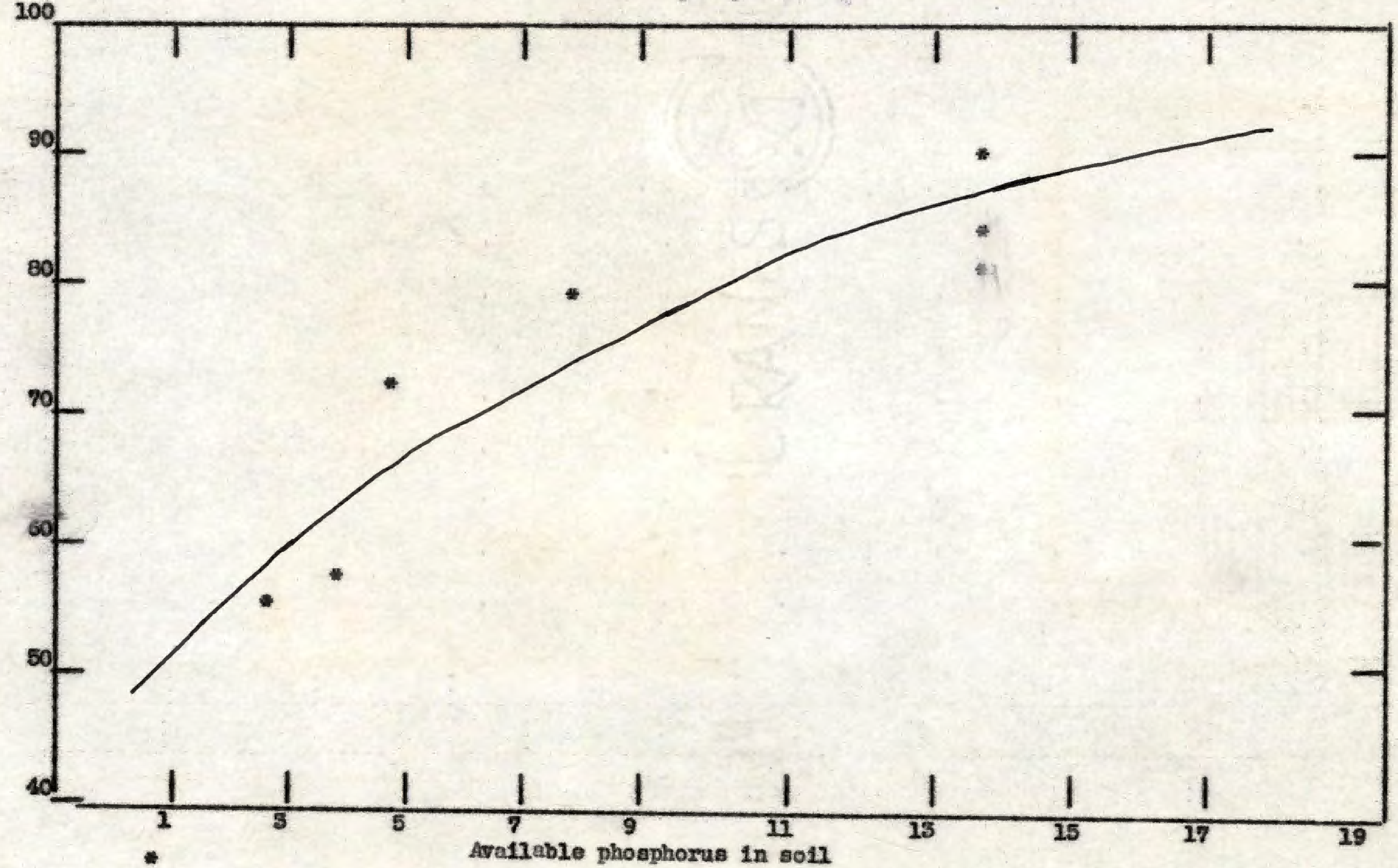


Figure 16. The Irish potato plants in the foreground did not receive phosphorus. Note that the plants are stunted in growth. The normal plants in the background received a complete fertilizer.

Figure 17. Irish potatoes on left from a two-hundredth acre plot receiving nitrogen and potassium but no phosphorus. Potatoes in center from plot treated same except received 25 pounds $P_2 O_5$ per acre, and the potatoes on right from plot treated same except received 75 pounds P_2O_5 per acre.

DISCUSSION

Phosphorus is frequently one of the limiting nutrients in plant growth. It has been called the "master key to agriculture" Collings (4). It has been found that superphosphate has its greatest availability in soils of a slightly acid reaction, pH of 6.5. In order to get most efficient utilization of superphosphate fertilizers it is important that the soil acidity be corrected by application of lime. Soluble iron and aluminum occur in acid soils and react with superphosphate to form unavailable compounds. The soils in this study with a pH below 6.0 averaged 62.2 bushels of corn per acre for the high increment of phosphorus as compared to 74.9 bushels per acre for the same treatment on soils with a pH above 6.0. The soils with heavy texture - Decatur and Frederick - were the lowest in available phosphorus and also gave low corn yields. The texture of both of these soils was a silty clay loam. The high clay content of these soils affords a very large surface for phosphate fixation. A similar textural condition in Halewood largely accounts for the relative low potato yields on that soil.

The relative phosphorus requirements of corn and potatoes may be inferred by comparing in Fugure 14 and Figure 15 the soil contents of available P at some suitable yield level, say 90 per cent. The approximate P requirement for a 90 per cent yield of corn is 5.5 and for potatoes, 15.0. Relatively good yields of corn and potatoes remove about equal amounts of P_2O_5 (35 pounds) from the soil, therefore, the corn plant must have a greater ability to utilize available phosphorus in the soil than does the potato plant. One reason that potatoes require a higher level of available P_2O_5 than does corn may be the difference in length of growing seasons of these two crops. Potatoes, which have a relatively short growing season during the cool part of the year, demand a large supply of available phosphorus for rapid intake; whereas, the demand of corn for phosphorus is distributed over a longer period.

The results of the chemical soil test for phosphorus have been in agreement with crop behavior, therefore, on those Carter County soils that test low in available phosphate, a response to phosphorus fertilization can be expected. Phosphate fertilization of corn can be recommended where the soil tests below 5.5, and for potatoes where the soil tests below 15.

SUMMARY

Potassium And Boron

To correlate the levels of exchangeable soil potassium and yield responses to potash fertilization, field experiments were conducted with three crops: alfalfa, corn, and Irish potatoes in Carter County, Tennessee during three different years. Potassium was used at two rates; nitrogen and phosphorus were applied uniformly to all plots, including the no-potassium check. Borax was used in connection with the alfalfa experiments. All treatments were in triplicate. Soil samples, both surface and subsoil, were collected from all plots for determination of available potassium before fertilizer was applied.

Yield data are presented from a total of 28 experiments. Soils that were well supplied with potassium showed little response from additional potassium in the fertilizer; therefore, potassium fertilization may be guided by the amount of exchangeable potassium present in the soil as shown by chemical tests. Photographs in color are included to illustrate potassium deficiency symptoms on the three crops studied.

Data for each crop were plotted on a graph, and smooth curves fitted to the points. These curves indicate the following approximate levels of exchangeable soil potassium above which potassium fertilization ceased to give significant increments in yield: Alfalfa, 160 pounds per acre; corn, 140 pounds per acre; and Irish potatoes, 220 pounds per acre. Based on the results of this study some practical potassium fertilization recommendations can be made.

Phosphorus

In 1941 and 1942 field experiments were conducted with corn and Irish potatoes to ascertain the relation between the readily available phosphorus in the soil and crop response to applied phosphorus fertilizer. Phosphorus was used at two rates; nitrogen and potassium were applied uniformly to all plots including the no-phosphorus check. All treatments were in triplicate. Soil samples, both surface and subsoil, were collected from all plots for determination of available phosphorus before the fertilizer was applied.

Yield data are presented from a total of 21 experiments. It was found that the test for available soil phosphorus could serve as a basis for recommending phosphorus fertilizer for the crops studied provided other factors, such as the soil reaction, soil texture, and crop characteristics are properly evaluated.

Data for each crop were plotted on a graph and a smooth curve fitted to the points. These curves indicate the following approximate levels of available phosphorus above which phosphorus fertilization ceased to give significant increase in yield: corn 5.5 and Irish potatoes 15.

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APPENDIX

TABLE I

ALFALFA YIELD, SOIL DATA, AND FERTILIZER TREATMENT FOR INDIVIDUAL PLOTS

Lodi Soil Series

Plot No.	Pounds Per Acre Exchangeable K Surface	Subsoil	pH Sur.	Sub.	Potash Applied Lbs. 1 A.	Yield of Dry Hay In Lbs. Per Acre First U (a)	Cutting T (b)	Second U	Cutting T	Third U	Cutting T
1	145	100	7.0	6.5	0	1926	2354	1458	1458	1083	1493
5	135	100	7.0	6.5	0	1284	1498	1404	1458	1605	1792
9	115	100	7.0	6.5	0	1070	1498	1431	1323	1418	1493
2	-	-	-	-	50	2140	2069	1728	1620	1867	2053
6	-	-	-	-	50	1748	2318	1728	1674	2352	1829
7	-	-	-	-	50	1498	1569	1296	1215	1717	1717
3	-	-	-	-	150	1712	2390	1782	1998	2315	2763
4	-	-	-	-	150	2354	2568	1917	1674	1867	1904
8	-	-	-	-	150	1569	1783	1620	1944	2240	2651

TABLE I (CONTINUED)

Dunmore Soil Series

Plot No.	Pounds Per Acre Exchangeable K Surface	Subsoil	pH Sur.	Sub.	Potash Applied Lbs.1 A.	Yield of Dry Hay In Lbs. Per Acre First Cutting U (a)	T (b)	Second Cutting U	T	Third Cutting U	T
1	165	115	6.5	6.0	0	-	-	-	-	1674	2233
6	150	105	6.2	6.0	0	-	-	-	-	1707	1904
2	-	-	-	-	50	-	-	-	-	2036	2233
4	160	110	6.2	6.0	50	-	-	-	-	1773	2101
3	-	-	-	-	150	-	-	-	-	1608	2002
5	-	-	-	-	150	-	-	-	-	1970	2364

TABLE I (CONTINUED)

Frederick Soil Series

Plot No.	Pounds Per Acre Exchangeable K Surface	Subsoil	pH Sur.	Sub.	Potash Applied Lbs. 1A.	Yield of Dry Hay In Lbs. Per Acre First U (a)	Cutting T (b)	Second U	Cutting T	Third U	Cutting T
1	105	100	6.5	5.7	0	820	1355	1349	1962	464	1160
5	115	100	6.5	5.7	0	856	1177	1656	1901	309	696
9	100	100	6.5	5.5	0	713	856	1594	1932	309	657
2	-	-	-	-	50	1498	1997	2177	2453	1198	1392
6	-	-	-	-	50	1355	1426	1738	2269	773	1044
7	-	-	-	-	50	1284	1533	2331	2392	1082	1160
3	-	-	-	-	150	1569	1747	2821	2821	1546	1856
4	-	-	-	-	150	1890	1997	2453	2944	928	1585
8	-	-	-	-	150	1676	2104	2637	3036	1237	1392

TABLE I (CONTINUED)

Holston Soil Series

Plot No.	Pounds Per Acre Exchangeable K Surface	Subsoil	pH Sur.	Sub.	Potash Applied Lbs./A.	Yield of Dry Hay In Lbs. Per Acre First U (a)	Cutting T (b)	Second U	Cutting T	Third U	Cutting T
1	100	100	5.7	5.5	0	-	-	624	936	796	1302
5	100	100	6.0	5.5	0	-	-	832	884	651	796
9	100	100	6.0	5.5	0	-	-	832	988	687	868
2	-	-	-	-	50	-	-	1248	1040	868	1013
6	-	-	-	-	50	-	-	1170	1248	1085	1338
7	105	100	5.5	5.5	50	-	-	1560	1612	1519	1591
3	-	-	-	-	150	-	-	1404	1404	1482	1736
4	-	-	-	-	150	-	-	1560	1872	1881	1989
8	-	-	-	-	150	-	-	1612	1612	940	1157

TABLE I (CONTINUED)

Westmoreland Soil Series

Plot No.	Pounds Per Acre Exchangeable K Surface	Subsoil	pH Sur.	Sub.	Potash Applied Lbs. 1A.	Yield of Dry Hay In Lbs. Per Acre First U (a)	Cutting T (b)	Second U	Cutting T	Third U	Cutting T
1	175	155	7.0	6.5	0	582	1229	-	-	-	-
5	190	145	7.0	6.5	0	776	1423	1867	2500	-	-
9	160	145	7.0	6.5	0	647	1293	-	-	1300	1820
2	-	-	-	-	50	549	1164	-	-	-	-
6	-	-	-	-	50	873	1164	1933	2633	-	-
7	-	-	-	-	50	711	1358	-	-	1330	1680
3	-	-	-	-	150	647	1261	-	-	-	-
4	-	-	-	-	150	776	1358	2000	2600	-	-
8	-	-	-	-	150	743	1164	-	-	1260	2100

TABLE I (CONTINUED)

Jefferson Soil Series

Plot No.	Pounds Per Acre Exchangeable K Surface	Subsoil	Ph Sur.	Sub.	Potash Applied Lbs./A.	Yield of Dry Hay In Lbs. Per Acre First U (a)	Cutting T (b)	Second U	Cutting T	Third U	Cutting T
1	135	100	6.7	5.5	0	675	1050	1913	2911	609	1556
5	150	100	7.0	5.5	0	637	825	2130	2343	1015	1421
9	135	100	6.7	5.5	0	562	1200	1846	2485	609	1489
2	-	-	-	-	50	825	1275	3195	3159	1150	1692
6	-	-	-	-	50	1087	1275	3266	3195	1083	2098
7	-	-	-	-	50	1050	1237	2982	3408	1015	1895
3	-	-	-	-	150	1237	1500	3550	3834	2165	2030
4	-	-	-	-	150	1125	1500	3053	4189	1489	2165
8	-	-	-	-	150	1050	1312	3670	3621	1556	2030

(a) a refers to plots that received no borax.

(b) b refers to plots treated with 30 pounds of borax per acre.

TABLE 2

CORN YIELD, SOIL DATA, AND FERTILIZER TREATMENT FOR INDIVIDUAL PLOTS

Congaree Soil Series - 1941 Season

Plot	Treatment	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per A.	Subsoil Exch. K Lbs. Per A.
1	0 P_2O_5	79.7	100	100
2	25# P_2O_5	84.0	100	100
3	75# P_2O_5	86.7	100	100
4	0 K_2O	60.9	100	100
5	25# K_2O	78.0	100	100
6	75# K_2O	78.3	100	100
7	75# K_2O	82.9	100	100
8	0 K_2O	62.9	100	100
9	25# K_2O	71.4	100	100
10	25# P_2O_5	63.4	115	100
11	75# P_2O_5	72.9	100	100
12	0 P_2O_5	69.7	100	100
13	75# P_2O_5	76.9	112	100
14	0 P_2O_5	78.3	100	100
15	75# K_2O	66.0	100	100
16	0 K_2O	64.0	100	100
17	25# K_2O	77.7	120	100
18	25# P_2O_5	63.4	100	100

TABLE 2 (CONTINUED)

Frederick Soil Series - 1941 Season

Plot	Treatment	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per A.	Subsoil Exch. K Lbs. Per A.
1	0 P_2O_5	20.6	105	100
2	25# P_2O_5	26.3	100 -	100
3	75# P_2O_5	28.3	100 -	100
4	0 K_2O	28.9	110	100
5	25# K_2O	30.0	133	100
6	75# K_2O	30.0	210	100
7	75# K_2O	28.0	100	100
8	0 K_2O	30.3	155	100
9	25# K_2O	29.1	100	100
10	25# P_2O_5	28.9	380	100
11	75# P_2O_5	35.7	175	100
12	0 P_2O_5	28.6	102	100
13	75# P_2O_5	34.6	100	100
14	0 P_2O_5	22.6	145	117
15	75# K_2O	25.1	125	100
16	0 K_2O	22.6	150	100
17	25# K_2O	20.6	400	130
18	25# P_2O_5	35.1	210	100

TABLE 2 (CONTINUED)

Holston Soil Series - 1941 Season

Plot	Treatment	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per A.	Subsoil Exch. K Lbs. Per A.
1	0 P_2O_5	43.7	100 -	100 -
2	25# P_2O_5	44.9	100 -	100 -
3	75# P_2O_5	45.1	100 -	100 -
4	0 K_2O	31.4	100 -	100 -
5	25# K_2O	55.1	100 -	100 -
6	75# K_2O	60.3	100 -	100 -
7	75# K_2O	46.9	100 -	100 -
8	0 K_2O	30.0	100 -	100 -
9	25# K_2O	45.6	100 -	100 -
10	25# P_2O_5	43.7	100 -	100 -
11	75# P_2O_5	48.9	100 -	100 -
12	0 P_2O_5	43.4	100 -	100 -

TABLE 2 (CONTINUED)

Lodi Soil Series - 1941 Season

Plot	Treatment	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per A.	Subsoil Exch. K Lbs. Per A.
1	0 P_2O_5	54.0	112	100 -
2	25# P_2O_5	54.0	122	100 -
3	75# P_2O_5	71.4	110	100 -
4	0 K_2O	57.1	107	100 -
5	25# K_2O	68.0	110	100 -
6	75# K_2O	55.1	115	100 -
7	75# K_2O	47.1	110	100 -
8	0 K_2O	43.4	102	100 -
9	25# K_2O	67.4	100	100 -
10	25# P_2O_5	59.4	107	100 -
11	75# P_2O_5	61.4	110	100 -
12	0 P_2O_5	54.9	110	100 -
13	75# P_2O_5	63.1	110	100 -
14	0 P_2O_5	47.7	110	100 -
15	75# K_2O	62.9	120	100 -
16	0 K_2O	70.0	115	100 -
17	25# K_2O	74.3	112	100 -
18	25# P_2O_5	53.7	110	100 -

TABLE 2 (CONTINUED)

CORN

Philo Soil Series - 1941 Season

Plot	Treatment Lbs. Per A.	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per A.	Subsoil Exch. K. Lbs. Per A.
1	0 P_2O_5	44.0	115	100 -
2	25# P_2O_5	61.7	112	100 -
3	75# P_2O_5	57.4	110	100 -
4	0 K_2O	46.2	110	100 -
5	25# K_2O	54.7	107	100 -
6	75# K_2O	53.1	107	100 -
7	75# K_2O	68.0	120	100 -
8	0 K_2O	56.9	120	100 -
9	25# K_2O	54.0	110	100 -
10	25# P_2O_5	57.7	107	100 -
11	75# P_2O_5	54.9	110	100 -
12	0 P_2O_5	40.3	105	100 -
13	75# P_2O_5	53.4	110	100 -
14	0 P_2O_5	52.6	112	100 -
15	75# K_2O	62.9	115	100 -
16	0 K_2O	39.4	110	100 -
17	25# K_2O	46.9	110	100 -
18	25# P_2O_5	51.4	100	100 -

TABLE 2 (CONTINUED)

Sequatchie Soil Series - 1941 Season

Plot	Treatment	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per A.	Subsoil Exch. K Lbs. Per A.
1	0 P_2O_5	70.4	120	100
2	25# P_2O_5	71.1	100	100
3	75# P_2O_5	76.3	100	100
4	0 K_2O	63.7	100	100
5	25# K_2O	71.1	117	100
6	75# K_2O	76.9	110	100
7	75# K_2O	82.6	100	100
8	0 K_2O	70.0	127	100
9	25# K_2O	63.1	100	100
10	25# P_2O_5	78.9	107	100
11	75# P_2O_5	76.3	130	100
12	0 P_2O_5	66.3	100	100
13	75# P_2O_5	66.6	100	100
14	0 P_2O_5	75.4	105	100
15	75# K_2O	76.0	100	100
16	0 K_2O	61.7	100	100
17	25# K_2O	66.0	100	100
18	25# P_2O_5	72.9	100	100

TABLE 2 (CONTINUED)

State Soil Series - 1941 Season

Plot	Treatment	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per A.	Subsoil Exch. K Lbs. Per A.
1	0 P_2O_5	48.8	210	210
2	25# P_2O_5	63.7	160	220
3	75# P_2O_5	69.7	175	210
4	0 K_2O	56.0	220	190
5	25# K_2O	65.1	285	215
6	75# K_2O	57.7	220	175
7	75# K_2O	60.0	165	130
8	0 K_2O	67.1	175	150
9	25# K_2O	55.1	175	130
10	25# P_2O_5	68.0	215	220
11	75# P_2O_5	78.3	240	220
12	0 P_2O_5	52.0	230	220
13	75# P_2O_5	56.0	215	210
14	0 P_2O_5	61.7	210	200
15	75# K_2O	69.1	215	185
16	0 K_2O	65.7	220	265
17	25# K_2O	71.4	275	175
18	25# P_2O_5	72.9	220	240

TABLE 2 (CONTINUED)

Allen Soil Series 1942 (2)

Plot	Treatment	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per. A.	Subsoil Exch. K Lbs. Per A.
1	0 P_2O_5	75.7	115	100 -
2	20# P_2O_5	73.1	-	-
3	60# P_2O_5	90.0	-	-
4	25# K_2O	81.1	-	-
5	0 K_2O	70.6	130	115
6	25# K_2O	87.1	120	100 -
7	0 K_2O	70.3	115	100
8	0 P_2O_5	66.3	120	100 -
9	20# P_2O_5	79.4	-	-
10	60# P_2O_5	86.9	-	-
11	20# P_2O_5	80.2	-	-
12	60# P_2O_5	76.3	-	-
13	25# K_2O	74.3	-	-
14	0 K_2O	67.7	115	100 -
15	0 P_2O_5	74.9	110	100 -

TABLE 2 (CONTINUED)

Congaree Soil Series 1942

Plot	Treatment	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per A.	Subsoil Exch. K Lbs. Per A.
1	0 P_2O_5	73.1	100	100 -
2	20# P_2O_5	87.4	-	-
3	60# P_2O_5	82.0	-	-
4	25# K_2O	76.3	-	-
5	0 K_2O	53.1	100 -	100 -
6	25# K_2O	73.4	-	-
7	0 K_2O	65.4	100 -	100 -
8	0 P_2O_5	71.7	120	100 -
9	20# P_2O_5	83.1	-	-
10	60# P_2O_5	94.6	-	-
11	20 P_2O_5	82.3	-	-
12	60# P_2O_5	76.3	-	-
13	25# K_2O	68.6	-	-
14	0 K_2O	63.1	100 -	100 -
15	0 P_2O_5	64.9	100 -	100 -

TABLE 2 (CONTINUED)

Decatur Soil Series 1942

Plot	Treatment	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per A.	Subsoil Exch. K Lbs. Per A.
1	0 P_2O_5	47.1	-	-
2	20# P_2O_5	46.9	-	-
3	60# P_2O_5	52.9	-	-
4	25# K_2O	54.9	-	-
5	0 K_2O	53.7	165	135
6	25# K_2O	60.0	-	-
7	0 K_2O	56.0	155	140
8	0 P_2O_5	46.0	-	-
9	20# P_2O_5	43.4	-	-
10	60# P_2O_5	68.0	-	-
11	20# P_2O_5	51.4	-	-
12	60# P_2O_5	82.6	-	-
13	25# K_2O	57.7	145	127
14	0 K_2O	53.1	145	130
15	0 P_2O_5	46.3	-	-

TABLE 2 (CONTINUED)

Jefferson Soil Series 1942

Plot	Treatment	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per A.	Subsoil Exch. K Lbs. Per A.
1	0 P_2O_5	86.5	150	230
2	20# P_2O_5	94.9	-	-
3	60# P_2O_5	89.7	-	-
4	25# K_2O	92.6	-	-
5	0 K_2O	67.1	130	175
6	25# K_2O	86.9	-	-
7	0 K_2O	86.0	135	175
8	0 P_2O_5	71.1	120	120
9	20# P_2O_5	78.6	-	-
10	60# P_2O_5	87.1	-	-
11	20# P_2O_5	90.0	-	-
12	60# P_2O_5	87.7	-	-
13	25# K_2O	80.6	-	-
14	0 K_2O	68.8	130	125
15	0 P_2O_5	67.4	122	155

TABLE 2 (CONTINUED)

Nolichucky Soil Series 1942

Plot	Treatment	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per A.	Subsoil Exch. K Lbs. Per A.
1	0 P_2O_5	79.4	-	-
2	20# P_2O_5	75.4	-	-
3	60# P_2O_5	83.7	-	-
4	25# K_2O	68.6	-	-
5	0 K_2O	63.4	152	125
6	25# K_2O	68.6	-	-
7	0 K_2O	68.0	-	-
8	0 P_2O_5	60.0	110	100 -
9	20# P_2O_5	68.6	-	-
10	60# P_2O_5	80.6	-	-
11	20# P_2O_5	59.1	-	-
12	60# P_2O_5	68.3	-	-
13	25# K_2O	67.1	-	-
14	0 K_2O	56.6	100 -	100 -
15	0 P_2O_5	72.9	-	-

TABLE 2 (CONTINUED)

Congaree Soil Series 1944

		Yield	Surface Soil		
Plot	Treatment	Bu. Per A.	Exch. K Lbs. Per A.	Av. P	pH
1	0 K_2O	76.4	200#	8	5.5
2	25# K_2O	60.5	-	-	-
3	75# K_2O	49.7	-	-	-
4	75# K_2O	98.0	185#	8	5.4
5	0 K_2O	44.0	110#	4	5.4
6	25# K_2O	47.0	-	-	-
7	25# K_2O	60.8	-	-	-
8	75# K_2O	72.9	-	-	-
9	0 K_2O	42.1	110#	8	5.8

TABLE 2 (CONTINUED)

State Soil Series 1944

Plot	Treatment	Yield Bu. Per A.	Surface Soil Exch. K Lbs. Per A.	Av. P	pH
1	0 K_2O	32.2	135	3	6.4
2	25# K_2O	35.9	-	-	-
3	75# K_2O	43.4	-	-	-
4	75# K_2O	28.5	-	-	-
5	0 K_2O	23.9	110	1	6.9
6	25# K_2O	29.5	-	-	-
7	25# K_2O	25.8	-	-	-
8	75# K_2O	29.8	-	-	-
9	0 K_2O	22.9	130	2	6.6

TABLE 3

IRISH POTATO YIELDS, SOIL DATA AND FERTILIZER TREATMENT FOR INDIVIDUAL PLOTS

Ashe Soil Series 1941 Season

Plot	Treatment Lbs. Per A.	Yield - Bu. Per Acre U. S. No. 1	Yield - Bu. Per Acre U.S. No. 2	Surface Soil Exch. K Lbs. Per Acre	Subsoil Exch. K Lbs. Per Acre
1	0 P_2O_5	127.7	28.0	275	275
2	25# P_2O_5	136.3	18.3	185	235
3	75# P_2O_5	143.7	14.3	127	175
4	0 K_2O	163.7	30.6	155	165
5	50# K_2O	141.3	20.0	100	155
6	150# K_2O	220.3	16.0	121	225
7	150# K_2O	158.3	15.6	190	235
8	0 K_2O	109.0	19.0	187	240
9	50# K_2O	138.3	12.3	160	152
10	25# P_2O_5	198.7	23.0	185	152
11	75# P_2O_5	166.0	19.3	165	128
12	0 P_2O_5	131.7	19.3	100	165
13	75# P_2O_5	177.7	26.3	175	185
14	0 P_2O_5	149.0	27.0	137	190
15	150# K_2O	159.0	11.3	128	175
16	0 K_2O	175.3	27.3	165	130
17	50# K_2O	180.7	25.0	160	152
18	25# P_2O_5	186.0	14.0	100	165

TABLE 3 (CONTINUED)

Halewood Soil Series - 1941 Season

Plot	Treatment Lbs. Per Acre	Yield - Bu. Per Acre U.S.No.1	U.S.No.2	Surface Soil Exch. K Lbs. Per Acre	Subsoil Exch. K Lbs. Per Acre
1	0 P_2O_5	44.7	7.0	400	170
2	25# P_2O_5	110.7	5.3	400	180
3	75# P_2O_5	123.7	5.0	380	155
4	0 K_2O	103.3	10.0	430	155
5	50# K_2O	97.6	7.3	430	215
6	150# K_2O	71.3	6.3	430	220
7	150# K_2O	91.0	3.0	430	190
8	0 K_2O	91.0	9.7	430	155
9	50# K_2O	111.0	9.7	430	155
10	25# P_2O_5	80.7	4.3	400	190
11	75# P_2O_5	93.0	5.0	400	190
12	0 P_2O_5	30.0	5.3	430	285
13	75# P_2O_5	129.7	4.3	430	210
14	0 P_2O_5	43.3	7.0	430	155
15	150# K_2O	93.7	10.7	430	185
16	0 K_2O	97.6	12.7	430	235
17	50# K_2O	57.0	6.7	400	175
18	25# P_2O_5	63.6	7.3	400	195

TABLE 3 (CONTINUED)

Porter Soil Series - 1941 Season

Plot	Treatment Lbs. Per Acre	Yield - Bu. Per Acre U.S. No.1	U.S. No.2	Surface Soil Exch. K Lbs. Per Acre	Subsoil Exch. K Lbs. Per Acre
1	0 P_2O_5	90.0	12.7	150	100 -
2	25# P_2O_5	159.0	8.0	165	100 -
3	75# P_2O_5	168.3	7.0	240	100 -
4	0 K_2O	119.3	10.0	175	100 -
5	50# K_2O	160.7	11.3	185	100 -
6	150# K_2O	151.0	8.7	175	100 -
7	150# K_2O	158.3	5.0	240	100 -
8	0 K_2O	146.7	9.0	240	100 -
9	50# K_2O	155.3	1.7	300	100 -
10	25# P_2O_5	147.0	5.0	230	100 -
11	75# P_2O_5	161.7	5.0	330	210
12	0 P_2O_5	97.7	5.0	230	100 -
13	75# P_2O_5	152.0	6.0	230	100 -
14	0 P_2O_5	82.3	10.7	300	127
15	150# K_2O	129.7	7.3	230	100 -
16	0 K_2O	160.3	11.0	265	100 -
17	50# K_2O	188.3	6.7	330	210
18	25# P_2O_5	156.7	4.7	220	190

TABLE 3 (CONTINUED)

Tusquitee Soil Series - 1941 Season

Plot	Treatment Lbs. Per Acre	Yield - Bu. Per Acre U.S. No.1	U.S. No.2	Surface Soil Exch. K Lbs. Per Acre	Subsoil Exch. K Lbs. Per Acre
1	0 P_2O_5	-	14.3	730	640
2	25# P_2O_5	-	27.6	800	800
3	75# P_2O_5	213.6	24.6	700	400
4	0 K_2O	154.6	22.3	430	285
5	50# K_2O	136.0	10.6	285	152
6	150# K_2O	131.4	10.0	355	120
7	150# K_2O	141.3	20.6	380	120
8	0 K_2O	160.0	15.0	380	105
9	50# K_2O	154.6	21.6	430	230
10	25# P_2O_5	134.4	15.3	530	135
11	75# P_2O_5	143.6	10.6	355	145
12	0 P_2O_5	126.6	15.0	300	100
13	75# P_2O_5	148.3	24.6	530	165
14	0 P_2O_5	142.3	23.3	530	115
15	150# K_2O	171.6	24.0	530	115
16	0 K_2O	149.6	17.0	530	112
17	50# K_2O	170.3	12.6	280	210
18	25# P_2O_5	135.0	10.3	430	165

TABLE 3 (CONTINUED)

Ashe Soil Series - 1942 Season

Plot	Treatment	Yield - Bu. Per Acre U.S. No.1	U.S. No.2	Surface Soil Exch. K Lbs. Per Acre	Subsoil Exch. K Lbs. Per Acre
1	0 P_2O_5	153.3	16.0	355	730
2	25# P_2O_5	169.3	17.0	355	640
3	75# P_2O_5	116.7	17.3	330	530
4	25# P_2O_5	146.0	11.3	500	640
5	75# P_2O_5	118.7	11.7	380	640
6	0 P_2O_5	126.0	11.3	380	640
7	75# P_2O_5	134.3	17.7	355	730
8	0 P_2O_5	170.0	23.3	355	530
9	25# P_2O_5	171.0	4.7	355	-

TABLE 3 (CONTINUED)

Congaree Soil Series - 1942 Season

Plot	Treatment Lbs. Per Acre	Yield - Bu. Per Acre U.S. No.1	Yield - Bu. Per Acre U.S. No.2	Surface Soil Exch. K Lbs. Per Acre	Subsoil Exch. K Lbs. Per Acre
1	150# K_2O	110.3	60.3	115	100 -
2	50# K_2O	116.0	48.0	100 -	100 -
3	0 K_2O	52.7	55.3	100 -	100 -
4	50# K_2O	92.7	48.0	100 -	100 -
5	150# K_2O	98.7	49.3	112	100 -
6	50# K_2O	83.0	47.3	100 -	100 -
7	0 K_2O	56.7	62.0	100 -	100 -
8	150# K_2O	97.3	40.0	100 -	100 -
9	0 K_2O	50.7	50.7	100 -	100 -

TABLE 3 (CONTINUED)

Jefferson Soil Series - 1942 Season

Plot	Treatment	Yield - Bu. Per Acre U.S. No.1	Yield - Bu. Per Acre U.S. No.2	Surface Soil Exch. K Lbs. Per Acre	Subsoil Exch. K Lbs. Per Acre
1	0 P_2O_5	77.3	46.0	130	100 -
2	25# P_2O_5	92.3	48.7	127	100 -
3	75# P_2O_5	118.3	26.3	125	100 -
4	0 P_2O_5	63.0	29.3	120	100 -
5	50# K_2O	97.0	51.3	120	100 -
6	150# K_2O	104.7	43.3	127	100 -
7	150# K_2O	145.3	42.0	110	100 -
8	0 K_2O	64.0	36.7	130	100 -
9	50# K_2O	99.7	24.0	130	100 -
10	25# P_2O_5	126.7	30.3	-	100 -
11	75# P_2O_5	110.3	44.3	-	105
12	0 P_2O_5	86.0	48.0	-	100 -
13	75# P_2O_5	128.0	35.0	-	100 -
14	0 P_2O_5	94.3	41.7	-	100 -
15	150# K_2O	132.0	42.7	-	100 -
16	0 K_2O	65.0	43.7	-	100 -
17	50# K_2O	103.0	47.7	-	100 -
18	25# P_2O_5	118.7	56.7	-	100 -

TABLE 3 (CONTINUED)

Lindside Soil Series - 1942 Season

Plot	Treatment	Yield - Bu. Per Acre U.S. No.1	U.S. No.2	Surface Soil Exch. K Lbs. Per A.	Subsoil Exch. K Lbs. Per Acre
1	0 P_2O_5	151.7	17.0	-	100 -
2	25# P_2O_5	182.0	13.3	-	100 -
3	75# P_2O_5	198.7	17.7	-	100 -
4	0 K_2O	118.3	16.7	150	100 -
5	50# K_2O	174.7	11.7	-	100 -
6	150# K_2O	171.0	12.7	-	100 -
7	150# K_2O	202.0	15.0	-	100 -
8	0 K_2O	133.7	19.3	155	100 -
9	50# K_2O	197.7	16.7	155	100 -
10	25# P_2O_5	186.7	14.0	152	100
11	75# P_2O_5	181.7	12.0	152	100
12	0 P_2O_5	143.7	10.0	220	112
13	75# P_2O_5	188.0	11.7	140	100 -
14	0 P_2O_5	153.3	10.3	150	100 -
15	150# K_2O	192.3	16.3	155	100
16	0 K_2O	122.0	16.7	155	100 -
17	50# K_2O	141.0	17.3	152	100
18	25# P_2O_5	162.7	13.3	152	100

TABLE 3 (CONTINUED)

Tate Soil Series - 1942 Season

Plot	Treatment	Yield - Bu. Per Acre U.S. NO.1	Yield - Bu. Per Acre U.S. No.2	Surface Soil Exch. K Lbs. Per Acre	Subsoil Exch. K Lbs. Per Acre
1	0 P_2O_5	90.3	19.3	285	230
2	25# P_2O_5	96.0	19.7	285	265
3	75# P_2O_5	135.0	13.7	285	220
4	25# P_2O_5	105.7	16.7	265	190
5	75# P_2O_5	112.3	7.3	285	230
6	0 P_2O_5	57.3	10.7	280	200
7	75# P_2O_5	120.0	17.7	265	165
8	0 P_2O_5	63.0	12.0	275	145
9	50# P_2O_5	90.7	13.7	-	-

TABLE 4

SOIL DATA FOR COMPOSITE SAMPLES

		Surface Soil			Subsoil
Soil Series	Crop	Exch. K Lbs. Per A.	P Test	pH	pH
Congaree (a)	Corn	100	18	6.5	5.7
Frederick	Corn	140	1	5.2	5.0
Greendale	Corn	130	2	7.0	-
Holston	Corn	75	8	6.5	6.0
Lodi	Corn	110	3	5.5	5.2
Philo	Corn	110	2	6.2	5.5
Sequatchie	Corn	110	7	6.0	5.0
State	Corn	210	2	6.0	5.5
Allen	Corn	120	4	6.0	5.8
Congaree (b)	Corn	100	4	5.7	5.4
Decatur	Corn	155	1	5.5	5.2
Jefferson	Corn	130	7	7.0	5.2
Nolichucky	Corn	120	9	6.5	5.2
Congaree (c)	Corn	110	-	5.8	-
State	Corn	125	-	6.9	-
Ashe (a)	Potatoes	190	14	6.5	4.5
Halewood	Potatoes	420	1	5.0	4.5
Porters	Potatoes	230	3	5.2	5.0
Tusquitee	Potatoes	450	14	5.2	5.0
Ashe (b)	Potatoes	360	14	5.5	5.0

TABLE 4 (CONTINUED)

SOIL DATA FOR COMPOSITE SAMPLES

		Surface Soil			Subsoil
Soil Series	Crop	Exch. K Lbs. Per A.	P Test	pH	pH
Congaree	Potatoes	100 -	15	6.2	5.7
Jefferson	Potatoes	130	5	5.0	5.0
Lindside	Potatoes	150	8	7.0	6.5
Tate	Potatoes	280	4	7.0	6.0

(a) 1941 Growing Season

(b) 1942 Growing Season

(c) 1944 Growing Season