

History of Soil Testing Activities in Kansas

Prepared by David A. Whitney

The intent of this history of soil testing in Kansas is to chronicle the major activities by Kansas State University in providing soil testing services to farmers. It is beyond the scope of this history to identify and detail the valuable contribution of all individuals. Significant contributions have been made by numerous county agents, extension specialists and researchers to the success of soil testing over the decades. Lime and fertilizer demonstrations and research studies conducted by county agents and University research and extension personnel have been the foundation of sound lime and fertilizer recommendations, but will not be covered in this history.

Soil testing has long been recognized as a valuable aid in assessing lime and nutrient needs for crop production. As early as 1925, county agricultural agents were using an in-field test for assessing soil acidity (note from E. A. Clearinger, county agent in Coffey County in 1926 and later extension agronomist retiring in 1968). Professor Emil Truog at the University of Wisconsin developed the soil acidity test used by county agents (Wisconsin Agricultural Experiment Station Bulletin 312). The Truog test was based on the chemical reaction between zinc sulfide and acid soil giving off sulfide gas when boiled. The more acid the soil, the more gas evolved. Lead acetate paper was placed over the mouth of a boiling flask to absorb the sulfide gas which darkens the paper in proportion to the amount of gas evolved. (See appendix for photo of test kit.)

The Truog test for acidity was replaced in 1928 by procedures developed at the University of Illinois by Roger Bray (Illinois Agricultural Experiment Station Bulletin 337) that tested for both soil acidity and phosphorus referred to as "Rich or Poor" for acidity and "Hi-Lo" for phosphorus (note from E.A. Clearinger). These qualitative in-field tests were used extensively by county agents in the eastern half of Kansas. At this time little soil testing was being done in western Kansas because of high pH soils. Teagarten, in the history of the Kansas Cooperative Extension, reported "The number

of soil samples tested for acidity reached 8,897 in 1929". No records of total soil samples tested in the 30's and early 40's was found, but references in the Teagarten history to increased use of lime and fertilizer during this period suggest continued strong growth of the soil testing program.

County Soil Test Lab System

The first county soil test laboratory was established in Cowley County in 1947 by the Cowley Agricultural Extension Council with County Agent George Gerber in charge. Prior to establishment of the lab, a group of research and extension personnel traveled to the University of Missouri and University of Illinois to observe and to learn about lab operation and equipment from scientists in both states. Dr. C.W. (Woody) Woodruff at the University of Missouri was very enthusiastic about the Missouri system which was structured on county soil test labs operated by county agents using a lime meter (pH) built by Dr. Woodruff for testing pH and lime needs and a colorimeter for testing for phosphorus (P), potassium (K) and organic matter.

Dr. R.V. Olson, Soil Chemist at K-State, worked with the Cowley County Agent and Extension Council to establish the first county lab providing written instructions for operation and training on analytical test procedures. By 1949 soil testing labs also had been established in Brown, Bourbon, Labette and Crawford counties. Each lab was equipped with a Woodruff limemeter and a Coleman Junior Spectrophotometer for a colorimeter. The county agent, in his respective county, supervised the operation of the county soil testing laboratory. All county agents were trained at Kansas State College in soil testing principles and techniques. In most instances the county agents did not actually test soil samples. Ordinarily, they trained a soil testing technician who prepared the soil samples for analysis, analyzed the soil samples, and took care of records pertaining to each soil sample. The soil testing technician forwarded soil test results to the county agent who wrote a lime and fertilizer recommendation (information supplied by Dr. Robert A. Bohannon).

Concurrent with the development of county soil test labs, a service for testing of public soil samples was established in the Department of Agronomy at Kansas State College to handle samples from counties without a lab. Dr. R.V. Olson of the department was responsible for setting up the county lab procedures and development of test interpretations and most likely handled the initial on-campus testing. Scientists involved in soil test calibration and correlation research in this time frame included Dr. Olson, Dr. Harold Jones, and Dr. Floyd Smith. Figure 1 shows the results of an early set of experiments conducted by Dr. R.V. Olson on calibration of the Bray P-1 test with wheat yield response to phosphorus illustrating some early correlation work. The results show an excellent relationship between Bray P-1 test and percent yield without added phosphorus for wheat. This 1950 relationship is still valid today.

Soil testing was promoted heavily by county agents, researchers and extension specialists with a peak of 60 labs in 1955 (Map 1) and greater than 31,500 soil samples tested in 1953-1954 (Table 1).

County agents in several counties had special programs to promote soil testing. One example is taken from the 1962 Annual Report by Art Johnson, Jefferson County Agricultural Agent for the agricultural program in Jefferson County.

“The Crops and Soils Committee suggested that more emphasis be put on soil testing. The intensified Soil Fertility Program stressed soil testing as a key management tool. All fertility plots were based on soil test amounts of fertilizer versus no fertilizer and twice soil test recommended amounts. The plot results were used to demonstrate the soundness of the soil test recommendations under field conditions.

The main publicity given to the Intensified Soil Fertility program was for the Soil Test Week held in November 1961. The week was set aside to focus attention on this important soil management tool.

All of our county newspapers and area television, radio, and newspaper sources gave us a great amount of publicity. The Jefferson County Mirror-Times came out with a 40 page special edition to help promote soil testing week. A press conference held a month in advance of soil test week, November 17-31, gave news media people the opportunity to plan publicity well in advance. No county activity has had as much well planned publicity as did our Soil Test Week.

A kick-off dinner of our various committees, fertilizer dealers, college personnel and other cooperators highlighted preparation for Soil Test Week. Our goal was to get at least 1,000 soil samples during the week. The result - rain. We had a pro-longed spell of very bad weather that made collection of samples impossible. The educational program did have lasting effects however. We exceeded all previous years soil sampling numbers as we tested over 800 samples. Most of these came in the spring after corn and milo were finally harvested. People were conscious of the need and desirability of soil testing. The agent has visited with many farmers about crop production and those not having recent soil test apologize for the lack of getting the job done. It also had an effect of starting at least 35 farmers sampling that had never had their soil tested before. We believe that is quite an accomplishment in one year.”

The number of county labs declined in the 1960's and 1970's because of several factors including soil sample volume, county agent/county extension council interest, cost of equipment maintenance and replacement, and farmer demand for tests beyond the county soil test lab capabilities. Soil test analysis through commercial soil test labs also became available in the early 1960's and many dealerships started utilizing their services. The last county labs were in Cherokee, Montgomery, Jefferson, and Sedgwick counties, all closing in the late 1990's.

State Lab Development

The physical location of the State Soil Testing Laboratory in Manhattan has evolved from being a part of a research lab utilizing instrumentation in the lab to a separate designed lab in Phase II of Throckmorton Plant Science Complex. No records were found of the location of the lab when a public soil testing services was initiated, but it undoubtedly was part of a research lab facility.

The Soil Testing Lab was located in the early 1950's in Waters Annex in a large open lab in space shared with several research projects. With the completion of the new Department of Chemistry building, King Hall in 1966, the lab was moved in the next year into space in Waters Annex (southwest corner) previously used as a teaching lab for introductory chemistry with minor modifications. In the planning phase for a new plant science building in the early 1970's, a soil testing facility was included in the building plan. However, because funding shortfalls required reducing the size of the designed complex, the soil testing lab was one of the items deleted. Space, however, was identified within Phase I by the department head because the lab support of research and teaching activities was considered essential. The lab moved into Throckmorton Phase I in 1981 into what originally had been designated research and greenhouse space. In the planning of Phases II of Throckmorton, a soil lab was designed into the building and with completion of Phase II in 1994 the lab moved into facilities specifically designed for the operation.

A lab at the Garden City Experiment Station was added to the system in about 1950 offering the same tests as available through the county labs plus irrigation suitability tests. This lab was set up in the basement of the Garden City Experiment Station office by Carl Carlson, soil scientist at the station and subsequently managed by L.V. Withee (1953) who followed Mr. Carlson at the station. Dr. George Herron succeeded L.V. Withee in 1956 (information from Dr. L.V. Withee and Dr. George Herron). The lab moved to the new research building on the station in 1968. Sample volume declined drastically in the early 1980's and the lab closed as a public service lab.

Soil Testing Specialists

In 1953 Robert A. Bohannon was hired as the first Extension Specialist in Soil Testing. His appointment was half-time for Extension and half-time for the Experiment Station. His responsibilities included training County Agents who had soil testing labs and visiting the county laboratories at least once a year. In addition he held regional and state training schools for County Agents to provide them with the latest information on soil testing, to train them in making fertilizer recommendations based on soil test results, and to keep them familiar with new information and technology in soil fertility. In 1955, he took leave to continue study for his doctorate at the University of Illinois. Glenn W. Hardy was hired in a temporary position during his study leave to continue support of the county lab program. In 1957, Dr. Bohannon returned to Manhattan and resumed his soil test responsibility. In June of 1962 Dr. George Wright was hired to replace Dr. Bohannon who was asked to develop a program on unlimited opportunities through higher education. With Dr. Wright's departure to private industry in 1965, Dr. Roscoe Ellis, Jr. was interim manager until Dr. David Whitney was hired in September of 1966 to replace Dr. Wright. Dr. Whitney retired in January of 2001 and Dr. Ray E. Lamond, Extension Specialist Soil Management and Soil Fertility was assigned the lab supervisory responsibilities.

Laboratory Analytical Tests

An early mimeo from the State Soil Testing Lab (Form STIA, 9-49) advised producers of tests offered and how to determine which tests were needed (see appendix). Tests available included a general soil fertility test (soil pH, lime requirement, available phosphorus, exchangeable potassium and organic matter), salt-alkali test, advisability to irrigate test and irrigation water quality test. Tests for other soil constituents also were available by special arrangement and a minimum of 6 samples was required. This list of available analysis was maintained into the late 50's to early 60's. The soil test for advisability to irrigate was discontinued in the late 50's as soil survey information became available and proved to be more accurate than the advisability to irrigate soil

test on disturbed soil samples.

In the late 1950's and early 1960's irrigation was expanding rapidly across the state. Most of this irrigation development was for flood/furrow irrigation systems which require significant land leveling for efficient water flow. Areas within these leveled fields where topsoil was removed frequently were found to be deficient in zinc. Through the correlation work of Dr. Roscoe Ellis, Jr. and others, a soil test for zinc (0.2 N HCl extraction) was added in the early 1960's to the tests available through the labs in Manhattan and Garden City. Further research with zinc and iron by Dr. Ellis, Dr. Larry Murphy, Dr. George Herron and Dr. David Whitney led to the adoption of the DTPA extraction method for zinc and iron in 1972 replacing the HCl procedure. (For procedure see 1998 NC Regional Res Pub 221 (revised) Recommended Chemical Soil Test Procedures for the North Central Region)

Nitrogen has long been recognized as the nutrient most likely to be deficient in Kansas for non-legume crops. Organic matter measurement gives some estimate of potential nitrogen release from the soil and was a part of the soil analysis package from the initiation of the testing program. However, the organic matter test has serious limitation as it does not measure legume effects on succeeding crops nitrogen needs and does not measure residual available soil nitrogen (nitrate) from past fertilization/manuring. In 1970 a profile nitrogen soil test was added for which samples to a depth of two feet were recommended. The test analyzed for ammonium plus nitrate concentration in a two-foot profile. Total pounds of available nitrogen was calculated and the amount found was used to reduce standard nitrogen recommendations. In the mid-1980's the profile nitrogen test analytical method was changed to determining only nitrate concentration. Researchers involved included Dr. George Herron, Carlyle Thompson, Dr. Herb Sunderman, Dr. Larry Murphy, Dr. David Whitney and Roy Gwinn.

In 1998 a test for chloride was added as a test available to the public drawing on the research of Dr. Ray Lamond and others. Sulfur research has been conducted for many years by several researchers and a test for sulfate-sulfur also was added officially in 1998.

In addition to a public service samples, the Soil Testing Lab in Manhattan in the early 1970's evolved into a service lab for research scientists in the Kansas Agricultural Experiment Station for analysis of soil, plant and water samples. Sample volume in the late 1990's was 25,000 soil samples, roughly half research and half public, and 15,000 plant samples from researchers.

Soil Test Recommendations

The Kansas Soil Testing service at its inception was structured to work closely with county agents in all aspects of the program (soil sampling, analysis, interpretation and recommendation). Until the mid-1980's all analytical results from the Manhattan lab were returned to farmers through county extension offices with the county agent making the recommendations as was the practice in the county labs. With the development of a computer recommendation program and with county agent requests for results returned with recommendations, results are now returned with recommendations. However, the majority of public soil samples still continue to come through county extension offices.

ACKNOWLEDGMENTS

This brief history of soil testing in Kansas would not be possible without the helpful input of many individuals and I must especially thank several. When I first thought about doing this project in the late 1990's, I had a secretary, Cindy Harris, who had just completed a degree in history at K-State and was eager to pull together archived information. I thank Cindy for gathering much of the information on the early history. Next, I must recognize Dr. Robert A. Bohannon for his input and enthusiastic support. His reflections on the program through the

late 1940's into the 1960's both from the county and state perspective were very helpful. Likewise, Dr. L. Van Withee was most helpful on dates and personnel for the establishment and operation of the lab at Garden City, as well as, his remembrances of soil testing events during his study at K-State in the late 1940's. I also would like to thank Dr. George Wright and Dr. George Herron for their reflections. Last I would like to thank Troy Lynn Eckart for her secretarial input getting the history into manuscript form.

First soil testing Lab in State
of Kansas - May be first
County soil testing Lab in U.S.

Toussig method

cup of soil - spoonful of reagent
plus 100cc of distilled water.
Bring to a boil & lead acetate paper
placed over mouth of evaporator flask.
Dark if turned dark underneath from
steam of the soil was acid. Degree
of darkness indicated degree of acidity.
Amt of lime required was judged from
degree of blackness.

First used by C. A. (Chuck) Jones
County Agent in Johnson County in 1925 & 1926.
E. A. Cleavinger in Johnson & Coffey
County (shifted from this to Rich in
Poor & high - low PO4 in 1928)

Statement by E. A. Cleavinger
December 1963



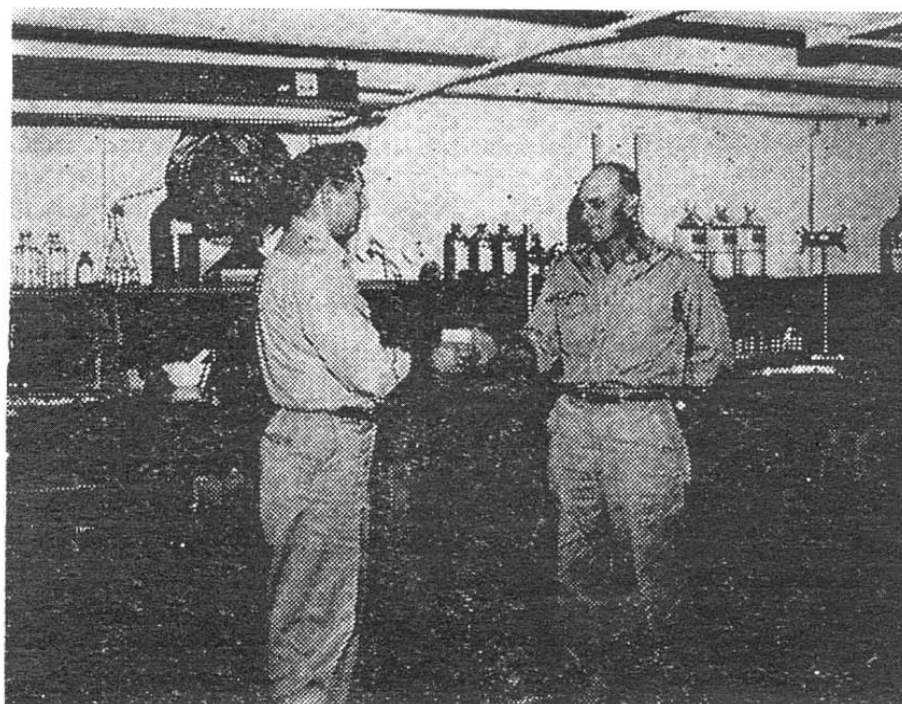
Lead Acetate Test Paper
4.56 (100 PIECES) 4.56
PUT UP EXPRESSLY FOR TRUOG SOIL
ACIDITY TEST
Central Scientific Co. Chicago

Kinsley, Kansas

August, 1953

EDWARDS COUNTY

SOIL TESTING LABORATORY



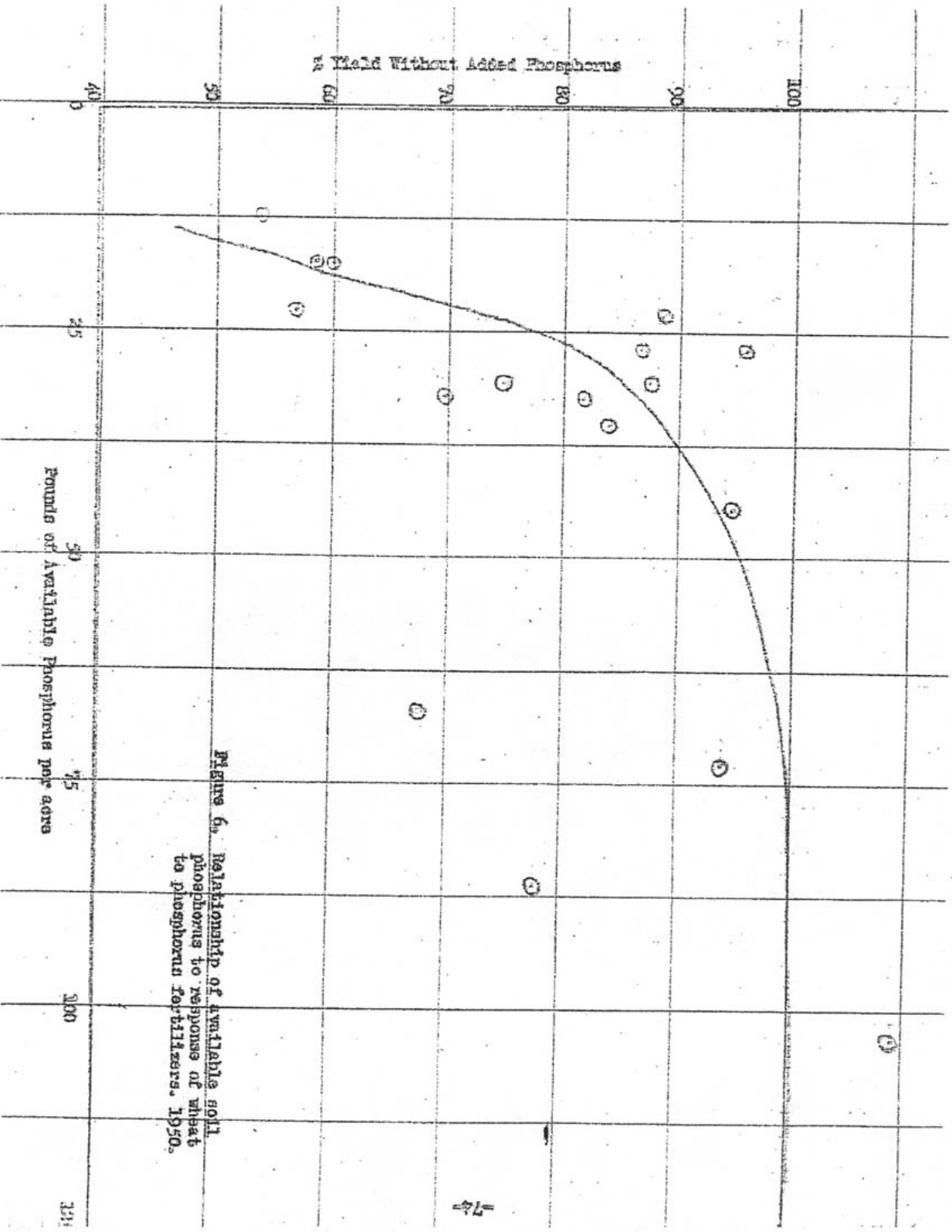


Figure 6. Relationship of available soil phosphorus to response of wheat to phosphorus fertilizers, 1950.

Table 1. Number of soil test labs and soil sample volume from 1948 to 1960.

Year	Number of County Labs	Number of Samples*
1948-49	6	
1949-50	19	4,400
1950-51	40	7,700
1951-52	45	23,000
1952-53	53	30,000
1953-54	58	31,612
1954-55	60	24,189
1955-56	60	25,946
1956-57	59	24,318
1957-58	59	18,102
1958-59	60	24,298
1959-60	59	23,591

* Total samples from county and state labs

Source: 1957-60 annual soil test summary compiled by Dr. R.A. Bohannon

THE KANSAS STATE SOIL TESTING SERVICE

The Department of Agronomy of Kansas State College maintains a soil testing laboratory to provide the farmers of Kansas with a soil testing service. Charges for the tests are such that they will defray the cost of the service.

Tests Offered and Purpose of Tests

The following soil or water tests are offered:

1. General soil fertility test - This test is designed to determine if economical crop yield increases can be obtained by using lime and fertilizers and if so to estimate the amount of lime and kind and amount of fertilizer to use. Analyses for available phosphorus, exchangeable potassium, soil pH, lime requirement, and organic matter are included. \$1.00 per sample.
2. Soil test for salts and alkali - This test is designed to determine if crop yields are being impaired by the presence of excessive soluble salts or alkali in the soil. The results of the test serve as a basis for suggesting methods of improving the alkali or salt condition if it is present. Analyses for exchangeable sodium, conductivity of the saturation extract, soil pH, calcium carbonate, and approximate exchange capacity are made. With high salt soils, soluble sodium is determined. \$4.50 for one site (1 sample from each foot to a depth of 3 feet).
3. Soil test to determine if it is advisable to irrigate - This soil test, which should be made in conjunction with the test for irrigation water quality, is designed to determine if salt, alkali, or soil permeability problems will be encountered if a soil is put under irrigation. Analyses for exchangeable sodium, conductivity of the saturation extract, soil permeability, calcium carbonate content, soil pH, and approximate exchange capacity are made. With high salt soils, soluble sodium is determined. \$7.50 for one site. (1 sample from each foot to a depth of 3 feet).
4. Irrigation water quality - This test is designed to determine if water from a given source can be safely used for irrigation without causing the accumulation of excessive salts or alkali in the soil that is to be irrigated. Analyses for the soluble sodium percentage and conductivity are included. \$1.00 per sample.
5. Special soil tests - Soil tests for other soil constituents are made under special arrangements with the laboratory. In general, special analyses will not be made on fewer than 6 samples.

How To Determine Which Soil Test Should Be Made On Your Soil

The following key will help you decide which soil test you should have made on your soil. If you are still in doubt about the test to have made after reading this key, seek the advice of your County Agent or Soil Conservation Technician.

1. If crops grow normally but you wish to know if yields can be increased by using a fertilizer or wish to know the kind and amount of fertilizer that should be used - have general soil fertility test made.

2. If crops grow very poorly:

(a) If soil is upland soil or well-drained bottom land, if water drains freely from soil after rains, if area is not lower than surrounding areas, if soil is relatively loose and can be plowed without forming many large clods (6 inches or more in diameter), and if there is no evidence of a white crust on the surface when the soil dries after a rain - have general soil fertility test made.

(b) If soil is poorly-drained bottom land, in a slight depression in level uplands, or in a depression in rolling areas, if soil is hard and cloddy and difficult to work, if water stands on soil a long time after a heavy rain, or if there is evidence of a white crust on the surface when it dries after a rain - have soil test for salts and alkali made.

In some cases it may not be possible to select the proper soil test to determine why crop growth is poor. It may be necessary to have one test made and if it fails to show the cause of poor growth a second sample may have to be submitted for the other soil test.

3. If none of the seed germinates or if young seedlings die or stop growing while very short - have soil test for salts and alkali made.

4. If you are considering the establishment of an irrigation system - have soil test made to determine if it is advisable to irrigate and have irrigation water quality test made.

Procedure In Getting Tests Made

1. Decide what tests should be made on your soil.

2. Obtain sampling instructions from your County Agent, Soil Conservation Technician, or from the Soil Testing Laboratory, Department of Agronomy, Kansas State College, Manhattan, Kansas. Under no circumstances should soil samples be sent unless they have been taken as instructed by the laboratory. This is important. Improper selection and handling of samples may cause the test results to be in great error, making the test worthless.

3. For salt and alkali or irrigation advisability tests obtain soil sample information sheet to be submitted with sample.

4. Collect and submit the samples to the laboratory at least 6 weeks before the land is to be planted. A delay of two weeks to one month can be expected between the time the soil is sent to the laboratory and the time the results are reported. There may be even longer delays encountered in obtaining the fertilizer or amendment you need. It will usually be advantageous to collect samples in the fall for land to be sown the next spring and to collect samples in the spring for fall-sown crops.

5. The laboratory will supply you with a copy of the test results for your soil and with literature telling you how to interpret and use the soil test results.

Department of Agronomy
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Soil Testing Reflections

Dr. Robert A. Bohannon

At one time all County Agents had operating laboratories in their office complex where soil samples were received, dried, crushed and screened preparatory to being analyzed by well-trained laboratory technicians.

The first soil testing laboratory was established by the Cowley County Agricultural Council and was operated by County Agent George Gerber. It was Gene Cleavinger, Extension Agronomist for Southeastern Kansas, who in consultation with Cowley County Agent George Gerber decided to make a "facts finding visit" to two states that already had soil testing programs in operation. They were the Agronomy Departments at the University of Missouri and the University of Illinois. The purpose was to visit with soil testing specialists in those states in order to gather information concerning the pro's and con's of each system. The KSU Visitation Team included Gene Cleavinger, George Gerber, The Cowley County Board Chairman and Dr. Ray V. Olson, Soil Chemist.

At the University of Missouri the team met with Dr. C. W. Woodruff. He developed the Limemeter for the quick determination of pH and lime requirement of the soil. Woodruff was enthusiastic about the Missouri Soil Testing Program and pointed out that it was paving the way for farmer acceptance of the need to use lime and fertilizer to insure achievement of higher yields of farm crops and forages. Dr. R. V. Olson quickly recognized the merit of the Woodruff Buffer Solution Technique for determining soil pH and lime requirement.

The group also reviewed the University of Illinois Soil Testing Program which was operational but emphasized a State Soil Testing Laboratory approach whereby all soil samples would be sent to the State Lab in Urbana for the analysis and fertilizer recommendations. The

Kansas Team returned favoring the University of Missouri system because of its simplicity and adaptability to a County Soil Testing Laboratory approach.

Cowley County became the first county in Kansas to establish a soil testing laboratory in the county seat town. Dr. Ray V. Olson supervised the purchase of equipment needed to analyze soil samples. He trained George Gerber to operate the lab and also write fertilizer recommendations that producers could use to apply lime and fertilizer according to recommendation rates.

Looking back over 50 years, it was a noteworthy event. It was a catalyst that capitalized on using nitrogen manufacturing capacity from WW II as a fertilizer material for agricultural purposes. Instead of legumes and barnyard manure, farmers were introduced to a new option for stimulating higher yields of crops – things like anhydrous ammonia, ammonium nitrate, ammoniated superphosphate, etc. KSU agronomists were in the forefront on new, more effective ways of stimulating crop production. Drs. Floyd W. Smith and Ray V. Olson were two highly effective prime movers in promulgating a new era in Kansas Agriculture.

Soil Testing Recollections

Dr. L. V. Withee

After service in the Army Air Corps, I enrolled at Kansas State in February of 1946. In September of that year I began working for the Department of Agronomy. Dr. Harold Jones was my supervisor and the work was in the field and in the laboratory. Dr. Floyd Smith had returned to Kansas State in the spring of 1946 after completing work for his PhD from Michigan State University. He had as a student assistant George Krause of Harper. George and I frequently worked in the same small laboratory and whatever routine soil testing was done was done by George. I recall that Floyd Smith had purchased a colorimeter which he highly prized and protected its use. Dr. Ray Olson came to the department from the University of Wisconsin in the spring of 1947 after completing his PhD in soil chemistry. I was vaguely aware that he was to be responsible for soil testing.

I graduated in the spring of 1947 and went to work for the Soil Conservation Service in Butler County. Gene Payer was the County Agent at the time and he made soil tests on a very modest scale. He had in his office two solutions in pint bottles – Rich or Poor and Hi-Lo Phos. The first was a test for soil reaction that could be interpreted as a lime requirement and the other was a test for available phosphorus. The solutions were prepared by a commercial firm, but as I recall the procedures were developed by the University of Illinois.

Interest in use of lime and fertilizer had increased rapidly as a result of research by universities at their experiment fields and the University of Missouri had developed county soil testing laboratories in response to this interest. The County Agent in Cowley County went to the University of Missouri and obtained information and directions which enabled him to establish a laboratory in Winfield. Eventually this led to the establishment of many county laboratories in Kansas with technical support from the Department of Agronomy.

In 1950 or thereabouts Carl W. Carlson who at the time was a MS graduate student in the Department of Agronomy took a newly created position at the Garden City Branch Experiment Station. He was to do soil fertility research on irrigated crops and to establish and operate a soil testing laboratory. In February of 1953 I took the position when Mr. Carlson left to work for the Bureau of Reclamation in Wyoming. Mr. Carlson had set up a soil testing laboratory using the procedures Dr. Olson had developed – the same procedures that were used in the county laboratories. The test for available potassium was not made because experience had shown that the soils of southwestern Kansas contained abundant potassium. In addition to the fertility tests others for salinity and alkalinity in soils were available and water was tested for suitability for irrigation using procedures developed by the USDA Soil Salinity Laboratory in Riverside, California and modified for use in Kansas by Prof. Olson. I recall the test for advisability to irrigate took the better part of a day for a technician to run a three sample profile for permeability and we only charged \$7.50 for each profile which really did not cover costs.

George Herron took the position at Garden City when I moved to Manhattan to study under Prof. Roscoe Ellis, Jr. I have forgotten the sequence of events, but Bob Bohannon and George Wright were responsible for the Soil Testing Laboratory in Manhattan and also responsible for quality control at the county laboratories during the 1950's and early 1960's.

Soil Testing Reflections at Garden City

Dr. George Herron

When I came aboard in February 1956 the laboratory was in the basement of the office building. We had the facility to run pH, organic matter, phosphorus and potassium. The county agents were helpful in promoting soil testing. Since irrigation was expanding there was considerable interest in irrigation water test. As the fertilizer industry increased soil testing increased, and private laboratory became very active. When the new laboratory was completed (1968) this was a much improved facility. By the end of the 70's, the private laboratories and fertilizer companies were very active and our service decreased.