ANNUAL REPORT FOR 1945

E.S. Turville

Acting Specialist in Soils

PRESCOTT, JANUARY 1, 1946

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Background and General Plan

Since this is the writer's first full year's annual report as "Acting Specialist in Soils" it is considered advisable to present some background.

The recordsof Arizona Extension show that soils have always been considered a feature of other projects, as horticulture, agronomy, irrigation or range management. The net result has been that "soils" as such, have never received much attention. Relatively few demonstrations or field tests have recorded the character of the soil used, at least, in such detail as to bring out the soil response feature.

Such a plan leaves out many important factors in Arizona crop production results. A few of these may here be mentioned.

Arizona soils range in pH from 6 to 9 - quite acid to strongly alkali. There are also all grades in between. To make general recommendations to cover these soils is of course out of the question. Texture varies as it does elsewhere. Another soil factor is temperature. The same tillage recommendations cannot be made for a heavy alkali soil in high altitude counties, where freezing and thawing occurs, as would be proper for the same soil where the air temperature seldom goes below freezing and regularly up from 100 to 120°. But just how should these recommendations differ?

The soil salt tolerance of crops is also a production factor where the salts vary from 150 to 15000 ppm.

Such variations in soil character make general recommendations for good farm practice quite difficult, and impossible for the laboratory man who does not know the State, unless he be supplied with much data.

The recommended policy is to consider "soils" as a project in itself, and to attempt to record results of tests and demonstrations as these may be influenced by the soil character. To illustrate; legumes (especially)winter growing) generally respond to phosphate fertilization, but sometimes they do not - and the demonstration fails. Is this variation in results, a soil response? If so, can such response be predicted from a more complete knowledge of the character of the soil used?

The above indicates the reasons for the first step in the writer's program.

Project 1 A selection of soil measurements for use by the County Agents.

This selection will be made by the research men and the county agents, after experience in the use of these in the field. The tentative list of analyses is:

1. pH.
2. Total Soluble Salts (T.S.S.)
3. Moisture equivalent (M.E.)
4. Some measure of soil structure - dispersion or aggregation,
5. Available nutrients,
6. Calcareous or non-calcareous character.

It is self evident that the final selection of these measurements for field use will depend upon, (1) their effectiveness, (2) their cost in laboratory time and (3) their ease of interpretation.

Project 2 The second project will be an attempt to secure as large a number as possible of field tests and demonstrations.

Using the standardized soil measurements as noted above, to classify the soils, the attempt will be made to secure as many as possible demonstrations and field tests indicating the results obtained when use is made of fertilizers, soil correctives or special tillage or irrigation practices.

Project 3 The third project is to encourage among the agents, the working out of a standard, Extension field technique, in the handling of field tests and demonstrations in soil projects.

The reason for such a project may be briefly stated as follows:

1. The natural inclination of field men is to follow the methods used by the Research departments, since these are standard and well known.

2. But the tests mentioned are not research projects - except where some research department actively cooperates - and the use of all the detail necessary in research would make each project expensive in both time and money. Thus the number of these that could be put on would be limited and programs consequently slow.

3. The opposite of this method - often used - is to secure an operator willing to treat a "20" or a

"40", and get the figures from him at harvest time. Still another plan is to use full borders, treating alternate ones, as suits the purpose.

4. The last two plans noted, prove quite satisfactory when the soil is uniform throughout, either the whole acreage or the border. Frequently, however, this is not the case, and the results are rather a measure of the "Heterogenity" of the soil than of a particular soil response. The soil samples taken may represent merely an average of the soils included and therefore may not provide yield data for any soil class or character.

5. As a compromise, and where the other plans do not work well, there is suggested for consideration, a system of "spot testing". This plan might be thus described.

   (a) The agent would request of a farmer cooperator merely the privilege of carrying out some test plots on the farmer's land, and the assistance of the cooperator to the extent that he would notify the agent when he expected to plant, plow, seed, irrigate or harvest. The agent would do the rest himself - treating, harvesting and recording.

   (b) The area used could vary, but a plot 10' x 10' is plenty large. It could be located anywhere in the border and marked by a stake 1 foot long and 2" x 2" driven to the level of the ground in, say, the S.W. corner of the plot or otherwise as convenient.

   (c) A soil sample from the center of this plot would likely be representative, and harvesting data could be obtained by the use of quadrat sampling, or by harvesting the block. Row crops could be adjusted to suit conditions.

The objective is to make sure that the yield data are from "a" soil, rather than from an average of soils.

SOILS PROGRAM -- December 11, 1945

Room 104 - Agriculture Building

A. M.

9:00 - 9:10	
9:10 - 9:35	Mark Bliss Soil Problems of Cochise County
9:35 - 9:50	David W. Rogers Soil Problems of Apache County
9:50 - 10:15	Glen E. Blackledge Soil Problems of Pima and Yuma
10:15 - 10:25	Intermission
10:25 - 10:50	Pat Powers Soil Problems of Maricopa County
10:50 - 11:05	Charles Lueker Dry Land Soil Problems
11:05 - 11:30	David Creighton Soil Problems of Navajo County

P. M.

2:00 - 2:15	W. T. McGeorge Salinity & Fertility Problems in Arizona Agriculture
2:15 - 2:30	Dr. F. T. Buehrer Available Moisture in Soils
2:30 - 2:45	H. V. Smith Aggregation of Arizona Soils
2:45 - 3:00	Dr. A. B. Caster The Values and Limitations of Analytical Service
3:00 - 3:10	Intermission
3:10 - 4:15	Karl Harris Farm Practice & Soil Structure
4:15 - 5:00	Discussion led by Mr. McGeorge

The Record of Activities for 1945

On page 4 is shown a copy of the Soils program at the Annual Conference, December 10th to 14th.

It will be noted that the morning session was devoted to reports of soils problems by the agents from a number of counties. Because of the background value of the reports, the summary of each is presented.

1. Apache County -- David W. Rogers, Agent. The agent's report of his soils problems appears on page 7. They speak for themselves. No soil projects were carried on in 1945, but an inspection was made by the Station staff.

This county is of interest because it carries some heavy alkali lands, but is at an altitude where severe freezing and thawing occurrs. A project taking these factors into consideration may be developed.

2. Cochise County -- Mark A. Bliss, Agent. This report appears on page 8 and 9. It explains itself. On page 10 is a copy of some plot work done with gypsum, sulphur, aluminum, deep tillage, etc.

Mr. Bliss reports some evidence of improvement in the crop where the five ton of gypsum was used, but believes that more time is necessary before final decisions can be reached.

It will be noted that the agricultural chemistry dept. at the University took an active part in the carrying out of this project.

Mr. Bliss also carried on an effective test with fertilizers on chili. Mr. Bliss describes the soil used as Elfrida sandy clay loam, with a surface soil analyses of pH, 7.10; total salts 505; nitrogen 17 and phosphates 11. The results are summarized as:

Treatment per acre	Total weight of	% increase
No fertilizer	236 lbs.	
150 lbs treble superphosphate	256 "	8.5
300 " calcium nitrate	306	29.66
300 " " " + 150 " treble superphosphate	328 "	39.00

3. Coconino County -- Chas. Lueker, Agent. Coconino has some very interesting soil conditions - from highly alkaline to distinctly acid. Also the county has a short cool growing season. These factors make of this county an important location for comparing soil and climate effects within the state. The agent's report begins on page 12.

4. Graham County -- S. L. Owens, Agent. On page 14 is a report from County Agent Owens of Graham County on the soil problems of this county. These problems, along with some others in that county will be inspected in January and a program arranged.

5. Maricopa County -- John O'Dell, Agent. On page 15 is given a report on soils problems from Maricopa County. The report was agreed to by the Maricopa County Extension staff and was presented by H.B. Powers. This county carried on test work in soils and the work is reported in the agent's reports.

6. Navaho County -- David Creighton, Agent. The writer arranged for two trips by the station soils men, into this county and a plan of testing correctives and fertilizers on some heavy silt soil was carried out. A plot of this appears on page 17. No written report is available, but the agent has stated that no results are apparent as yet.

The agent also conducted some fertilizer tests on alfalfa at Woodruff. This was later examined by the Station group with the agent, but no results were in evidence. No report of this work is as yet available.

7. Pima and Yuma Counties -- On page 18 is presented a summary of the report from Pima and Yuma Counties, by Glen E. Blackledge, and on page 21 is shown a chart of results in fertilizing alfalfa. On page 20 is a table giving all of the figures, from which the chart figures were selected. Such a curve is common in the hot valleys of Arizona. How general it may be in the cooler areas is not known.

8. Yavapai County -- Jno. McLernon, Agent. On pages 24 to 27 appears a report of the fertilizer and soil projects in this county. All of the work is in the test plot phase. The results will be of value, not alone in that county but elsewhere. All of the work has been done in cooperation with the Department of Agricultural Chemistry and Soils.

9. Yuma County -- Robert J. Moody, Agent. A partial report of Yuma appears under the Pima-Yuma report by Mr. Blackledge, formerly agent in Yuma. This is shown on page 18. Again on pages 28 and 29 are given samples of analyses showing the character of some of the soil problems in that county. The table, page 29, gives figures from an area used by the agent to try out a leaching program.

The Department of Agricultural Chemistry and Soils are cooperating in this work.

SUMMARY OF TALK ON SOILS PROGRAM (Apache Co.)

D.W. Rogers
December 11, 1945

Due to salty water, which we have in abundance for part of Apache County, and the bad lands from which a lot of our soils are made, we do have a real soil problem fundamentally. Also in St. Johns, we have a great deal of alkali. We also have in the Hunt Valley a very tight soil about which we know little or nothing as to methods of reclamation. We have slick spots, particularly in the St. Johns area. In the Round Valley, due to over irrigation, we possibly water logged our land.

On dry land farming area, our big problem is to get the seed into the soil before the moisture leaves in the spring. This can be overcome with a Lister Drill. We think that some work should be done on the range to check or to find out the amount of water penetration we have under special conditions.

SOIL PROBLEMS IN COCHISE COUNTY

Dec. 11, '45
Mark Bliss, Agt.

I. The Problem of Certain Tight Soils and Studies relating to their iimprovement.

1. Early Observations:- Spotted condition particularly noticeable in alfalfa and orchard plantings but also present in other crops.

Bad areas appear as lighted colored areas on freshly plowed fields.

Such areas more prevalent in the Stewart District and on certain soil types.

Soil temporarily classified as McAlister sandy clay laoms and silty clay loams are the farming soils most affected, although several other soil types in the area show similar character.

McAllister soils near Stewart School show spottiness not nearly so pronounced as same soils 3 to 5 miles closer to Willcox.

2. Early use of Soil Correctives:-

Under stimulus of AAA payments gypsum was widely used for 2 or 3 years by many farmers in county and some are still using gypsum.

Checkup made by McGeorge, Matlock and Agent in 1943 - Most pronounced results of soil improvement with Gypsum on non-calcareous, non-alkaline soils - Grizzle & Gardner farms. Carter farm - gypsum had improved surface but not subsoil - McAllister silty clay loam. Some imppovement in nearly all other cases but limited to surface.

Other observations: E.C. Russell farm - very heavy gypsum application caused water penetration on soil nearly impervious before treatment. However, beds immediately began showing heavy incrustation of white alkali. Several reported some improvement - others little or none - others only first year.

Test planted to corn but to be returned to alfalfa as being best indicator crop.

3. Attempts to solve penetration problem in McAllister s oils.

Sampling of comparative areas of light and heavy growth on Christian (formerly H.L. Wheat) farm in late summer of 1944. Gave indication of the trouble as follows:- High total salts (but not prohibitive to growth) in upper horizona of subsoil - consistently higher in all subsoil than in surface soil - soils highly dispersed and shown as too heavy to measure moisture equivalent.

Discussion at Soil Clinic:- Bliss Brought out question that we

have no guide to show much gypsum to apply or whether or not some methods of application are better than others. Also, that ordinary amounts may not be sufficient for some soils because of factors not yet known.

Decision reached to set up tests on Christian farm. Agent and Soils Department to cooperate.

Tests to include:

Gypsum at rates of 1000, 5000, and 10,000 lbs. per acre.

Application to topsoil and to subsoil.

Subsoiling part of each plot to find if this aid to penetration increased gypsum efficienty.

Added: Border to test application through irrigation water, and use of alum.

4. Observations on present years work:-

Lack of uniformity in soil destroys reliability of visual observation.

Subsoiling stood out in early development but was not uniform and not too noticeable in matured corn except possibly on untreated or lightly treated plots.

Soil sampling - Prior to test and in fall - Also samples for mechanical tests by Smith - U. of A. to reports on tests.

Noticeable accumulation of white alkali at surface on heavily treated plot.

Shallow rooted crop not a good indicator. Future years and future soil tests will be required to determine what is actually happening.

II. The Problem of How to Fertilize Certain Crops.

Fertilization of Chili to determine whether Nitrate or Phosphate is of most importance on typical partially depleted soils.

Results tabulated:- accompanying sheet.

North

H.L. Wheat
Cochise County

ROAD

Plot No.	Border 1 (Heavy Irrigation)	Sub-soiled	Border 2 (Normal Irrigation)	Plot Width
1	guard			100'
2				
3	check			50'
4	1000 lbs Gyp.	Sub-soil	Application	50'
5	1000 lbs Gyp.	Surface		50'
6	Check			
7	2½ ton Gyp.	Sub-soil	Application	
8	1½ ton Gyp.	Sub-soil:	1½ ton Surface	
9	2½ ton Gyp.	Surface	Application	
10	Check			
11	5 ton Gyp.	Sub-soil		
12	2½ ton Gyp.	Surface:	2½ ton Sub-soil	50'
13	5 ton Gyp.	Surface	Application	50'
14	Check			50'
15	Aluminum Sulphate			10'
16	Guard			190'

West

East

Border

30'
Border 1 - heavy irrigation

30'
Border 2 - Normal irrigation.

All amounts are at per acre rate

Tucson, December 11, 1945

SUMMARY

Coconino County - Charles Lueker

1. While Coconino has some tight soil, with high PH and high salts, these areas are relatively small and are not included in this report, which deals only with dry land farms. These tight areas must be irrigated.

2. Our problems in the dry land areas may be listed as:

   a. Selecting soils that are suitable for dry land farming under Coconino rainfall conditions.

   b. Selecting the type of tillage practice that will make the most efficient use of the rather limited average annual precipitation, rain and snow.

   c. Selecting crops that are specially suitable to our soil conditions.

   d. Maintaining the fertility of the soil under dry land conditions.

Coconino County -- Charles Lueker, Agent.

Coconino County is especially interesting because of its dry land farming industry. The agent's report of his problems appears on page 11 . These dry land soils vary of course, but appear to include two quite distinct types.

The following table presents important factors of one type of soil -- showing surface soil only. This is the acid soil type.

Name of operator	pH	T.S.S.	Nitrate	Phos.	Pot.	M.E.
Proctor, Ben D.	5.80	100	11	5	49	27
	5.95	105	7	6	31	29
	5.98	205	33	4	48	30
Jordon, Oakly	6.68	190	8	Tr	0	33
	6.00	210	20	4	28	26
	6.22	220	12	Tr	19	38
Marlar, Thos.	7.10	150	Tr	Tr	[illegible]	28
	6.90	160	Tr	Tr		30
Burris, Henry	5.98	150	Tr	Tr	53	32
Piper Ranch	6.90	365	123	8	?	?
Rowland, O.H.	6.82	100	7	4	100	21
	7.23	325	13	Tr	41	47
Pringle, Andrew	7.10	350	278	16	--	--
Anderson, W.E.	6.55	205	40	22	--	28
	6.55	180	16	24	--	26

The agent reports these soils as, having a low pH and a relatively high M.E., and that such soils are slow soils, crops require more time, adapted to small grains and potatoes.

The agent also reports another type of soil, which he describes as having a higher pH, above 7, and a lower M.E. "These soils," he says, " will succeed with less but with more frequent rains, and quick soils, promoting early maturity. They are adapted best for beans, corn and potatoes. When rain is abundant will succedd with small grain and potatoes.

The agent presents a comparative analysis of this type of soil.

Farm	Zone	pH	T.S.S.	Nit.	Phos	Pot.	M.E.
Lawson	0-18	7.20	110	6	8	--	21
Orr	0-15	8.15	230	8	9		17

A set of M.E. figures for a typical farm in this area is also available.

M.E. Figures

Hole No.	0-7"	7-12"	12-48"
1.	13	17	18
2.	11	13	16
3.	13	15	17
4.	11	13	16

The figures indicate the relatively coarse character of this soil material.

SOIL PROBLEMS OF GRAHAM COUNTY

Tucson, Dec. 11, '45
S.L. Owens, Agent

The most important soil problems in relation to the Safford area are:

(1) the control of alkali salts where one does not have sufficient water to do leaching.

(2) The getting of a stand of cotton on heavy soils which crack open after each irrigation.

(3) The control of alkali on soils where the water table is within 4 feet of the surface and where it is almost impossible to get drainage on account of this land being the same elevation as the river bed. In fact the farms I have in mind are right along the river bottom.

(4) How to get water penetration in steep clay land growing alfalfa which has previously been irrigated several times with muddy water.

(5) How to get water to penetrate in slick spots. Some of these spots being not over 20 feet square.

Soil Problems of Maricopa County
by
H. B. Powers

Tucson
Dec. 11, '45

A. Problems

1. Moisture penetration in 4/5 zone
2. Slick spots
   a. Dispersion
   b. Black Alkali
   c. Soil Structure
3. Compacted or tight zones
4. High pH
5. High Salinity
   a. permanent
   b. transient
6. Fertilizing - Gains - Amounts

B. Methods of Correction

1. Moisture penetration in 4/5 zone
   a. Cultural or mechanical
      1. Method of irrigation
         a. Routh or smooth
      2. Releveling -- proper slope
      3. Sub-soiling
      4. Organic matter
   b. Use of soil amendments, i.e., sulphur and gypsum
      1. Determination of need - chemical and mechanical analysis
      2. Rate of application
      3. Method of application - Maddox Coy
      4. Determination of results - Doulson
2. Slick spots
   a. Determination of cause

1. Cultural practices
    a. Dry ploughing vs. wet ploughing
    b. Floating
2. Dispersion
3. Black alkali
4. Soil structure
5. Soil analysis

b. Corrective measures
1. Addition of organic matter
2. Irrigating rough
3. Soil amendments
4. Drying out

3. Compacted or tight zones
a. Surface
b. Subsoil - Maddox

4. High pH
a. Relationship to alkalinity
b. Sulfur - roses
c. Gypsum
1. Classification of soils
d. Organic Materials

5. High Salts
a. Permanent
1. Tolerance of different plants to salt
2. How corfected - effects of leaching
3. Subsoil type and ground water level.

b. Transient Salts
1. Tolerance of seedling plants to salt
2. Correction.

SOILS PROJECT

Jas. A. Hansen RND Agricultural Agent)
College of Agriculture) Cooperating

Location: Section Tsp. 18N., R. 18 E.
Size: 150' x 175' = .06 ea. plot

Irrigate E to W
Grade Level
Water Silty

Rotation: Corn 1945
Corn 1946
Oats 1947
Alfalfa 1948 on

N.

11-48	Gyp.2000#		10
11-48	Gyp.2000#	Manure 10 T	9
11-48	S 400	Manure 10T	8
11-48	S 400	400#	7
A 1 So 1	Check		6 E
Gyp.	Am Sul	2000#	5
Gyp.	Treble	Super 300#	4
Gyp.	11-48	300#	3
11-48	Manure	10 T	2
	Check		1

Subsoil Ripped

150

S

1945 applications

Application Rate

1-Gypsum 2000# per A
2-S 400# " "
3-Manure 2000# " "
4-Al So4 2000# " "
5-11-48 300# " "
6-Am Sul. 300# " "

D.E. Creighton

SOIL PROBLEMS YUMA AND PIMA COUNTIES

Tucson, Dec. 11, '45
G.E. Blackledge, Agt.

SUMMARY

I. Penetration of air and water is foremost problem.

(a) First essential is proper land levelling.

1. Need more study on amount of fall in relation to soil type and profile.
2. Need study on efficient size of borders.
3. Need work on construction of borders.

(b) Means of improving crumb structure needs more study.

1. What methods or materials will work on what problem soils?
2. Costs in relation to benefits?
3. More field work supporting laboratory work.

II. Plant Food Deficiencies are general.

(a) Available phosphates.

1. Probably tied up with soil reactions and physical conditions in many soils. More attention should be given to correcting soil structure.
2. Use of supplemental plant food requires more study on rates and methods of application. Carefully conducted field tests on different soils are essential.

(b) Nitrogen deficiencies.

1. Also tied up with soil reactions and physical conditions in many soils.
2. Methods, rates and time of applications are important. Requirements probably vary with different soils, different crops and weather.

(c) Deficiencies in minor elements.

1. Field tests to supplement Lab. work.

III. Value of Soil Analyses

(a) Available phosphates very good. Need physical analyses with it.

(b) Nitrogen - very indefinite - maybe an indication.

(c) T.T.S. - very perplexing without a complete picture of the soil.

(d) M.E. and aggregates gives valuable information.

(e) Profile study very important for interpreting soil anaylses.

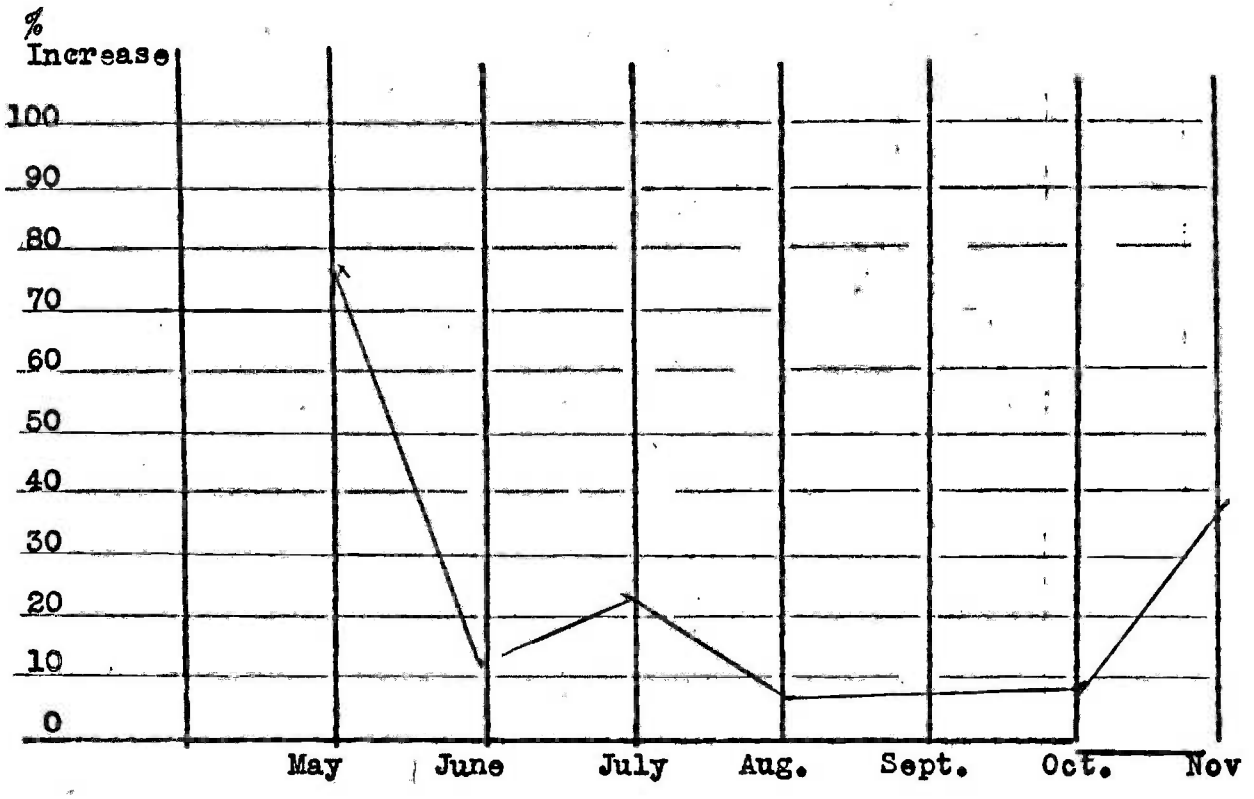
An Alfalfa Fertilizer Test -- Glen E. Blackledge

Pima County -- 1945

Border No.	Treatment per acre	By cuttings: % increase in yield					
		May 17	June 19	July 24	Aug 25	Oct. 8	Nov. 30
		1st	2	3	4	5	6
9	Check	x	x	x	x	x	x
10	200 lbs Tr Super P.	92.3	9	5.4	17.9	6.7	21.4
11	400 " Single Super P.	100	25	39.4	-2.3	14.3	36.4
12	5 ton manure	30	8.3	20	9.1	14.3	45.5
13m	Check	x	x	x	x	x	x
14	20 gal. L. Phos.				2.3	0	42.9
15	Check				x	x	x

The above figures illustrate a rather common experience in the warm valley areas - a definite lowering of the response to phosphates during the hot months of the year, and an increase as the weather cools. Over a period of years, this writer found no exceptions to this general fall and rise. (Work done at altitude of 3000 feet). Whether such results occurr in the cooler areas is not known to the writer. The results are important in that agents should know what to expect from demonstrations.

Chart showing climatic influence on alfalfa response to phosphate and manure. (For further comment see Pima and Yuma report page 18 and table of results, page 20).



Percentage increase percutting (6 cuttings) calculated from average results from 4 treatments - 200 lbs. Treble Superphosphate; 400 lgs. Single Superphosphate; 5 ton of manure; 20 gallon of liquid phosphate. (All figures on a per acre base). This type of curve is quite frequent in the hot valleys.

A Possible Long-Time Effect of Gypsum

An interesting piece of work was done in Pima County by the County Agent, Mr. Blackledge, and the University Soils division. While conditions do not permit the drawing of definite conclusions, the facts and figures are indicative of a definite result.

The analysis figures are shown on page 23, and the facts may be related as:

A car load of gypsum was applied to this land about 15 years ago, and the effect was pronounced of no value. In November, 1945 holes were dug on the treated and untreated areas and analyses made as shown on page 23.

The similarity of the M.E. figures in the first three plots indicate a similar soil, while the dispersion percentage figures show a very marked difference between the treated and the untreated borders, especially between borders 2 and 3.

Is it possible that it took a number of years to bring about the desired results.

See Pima C. report p 18. ✓

13

Analytical Data - E. L. Rogers - Soil Samples

Border No.	Sample Markings		pH of Paste	Total Soluble Salts P.P.M.	Moisture Equivalent %	Percentage Dispersion: Clay %	Fine Silt and Clay %	Silt, Fine Silt and Clay %
1. No Gyp.	West	0"-6"	7.90	1,010	37.2	16.7	20.0	65.0
	"	10"-20"	8.40	2,900	(P) 49.5	79.3	86.5	94.1
	"	20"-23"	8.60	2,960	(P) 46.6	71.4	85.0	96.4
	"	23"-38"	8.30	4,125	(P) 51.4	74.7	89.1	97.8
	"	38"-48"	8.27	7,250	36.1	60.0	84.5	96.1
2. No Gyp.	North	0"-6"	8.03	1,265	34.3	25.0	35.3	78.9
	"	6"-12"	7.98	1,435	32.2	28.6	39.1	81.9
	"	12"-32"	8.22	2,920	24.4	56.4	47.0	84.0
	"	32"-42"	8.27	5,605	37.1	69.2	77.0	87.0
	"	43"-48"	8.25	2,840	18.6	50.0	73.7	89.7
3. Gyp.	East	0"-4	7.93	1,015	33.3	10.5	14.7	63.7
	"	4"-11"	7.90	805	35.9	12.8	23.4	66.7
	"	11"-17	7.85	915	38.7	16.7	24.6	55.2
	"	17"-19"	7.90	895	34.1	14.1	22.6	60.9
	"	20"-25"	7.90	950	30.0	13.1	18.5	65.5
	"	27"-45"	8.22	600	19.7	16.7	20.2	79.0
4. Gyp.	East, middle	0"-4"	8.03	530	20.5	8.0	7.3	71.7
	"	4"-12"	8.00	615	23.9	15.4	22.4	63.3
	"	12"-15"	8.00	635	24.9	11.5	14.5	68.2
	"	15"-20"	8.06	480	17.3	5.6	11.4	72.1
	"	25"-38"	8.45	340	8.1	0.0	0.0	47.8

(P) Puddled

Yavapai County -- John McLernon, Agent.

On page 27 is shown the diagram of a plot for testing the influence of certain materials (shown on the diagram) on the structure and fertility of the soil. There follows a table showing the analysis of four soil samples taken from four borders included in the area being considered.

Soil Analysis from the K-4 Ranch

Sample No.	Zone	pH	TSS	N.	PO	M	Dispersion % of clay & fine Silt
1.	0-12	8.05	320	14	9	27	20.2
2.	0-8	8.30	405	19	14	27	16.4
3.	8-16	8.17	470	73	15	25	16.3
4.	0-12	8.15	390	33	10	30	45.0

When dry this soil is inclined to "fluff", and when wet to feel rather "soapy". The pH, though not high is in the danger zone, but the dispersion figures are quite moderate. Correctives and organic materials are being used - as noted on the chart, page 27 . The results will not be available until the fall of '46.

On pages 25 and 26 appear plots of two fertilizer tests on natural meadow grass. Each plot includes one-tenth acre and the figures shown are on a per acreage basis. Since the treatments were made in late July and early August, the best season's results were not expected. As there was no way of harvesting the increased yields of grass, observation was depended upon. On both plots, the operators report:

no results from the Treble Superphosphate
no " " " 300# application of 16-20
fair " " " 700# " of 16-20
good " " both applications of the amonium nitrate.

The soil is of a rather heavy clay character and sub-irrigation operates on both ranches.

Both plots have had one-half their area seeded to clover and a phosphate response should appear this fall or next spring. All plots will be observed in the 1946 season.

This work was planned and carried out by Jno.McLernon, County Agent, Yavapai County.

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Commercial Fertilizer Tests on

Meadow Lands

Long Meadow Ranch

1/10 acre plots

Check	
Am. Nitrate 700 lbs. per acre	
Check	
Am. Nitrate 300 lbs. per acre	
Check	
16-20 700 lbs. per acre	North →
Check	
16-20 300 lbs. per acre	
Check	
Treble Superphosphate 700 lbs. per acre	
Check	
Treble Superphosphate 300 lbs. per acre	
Check	

West ↑ ↓ East

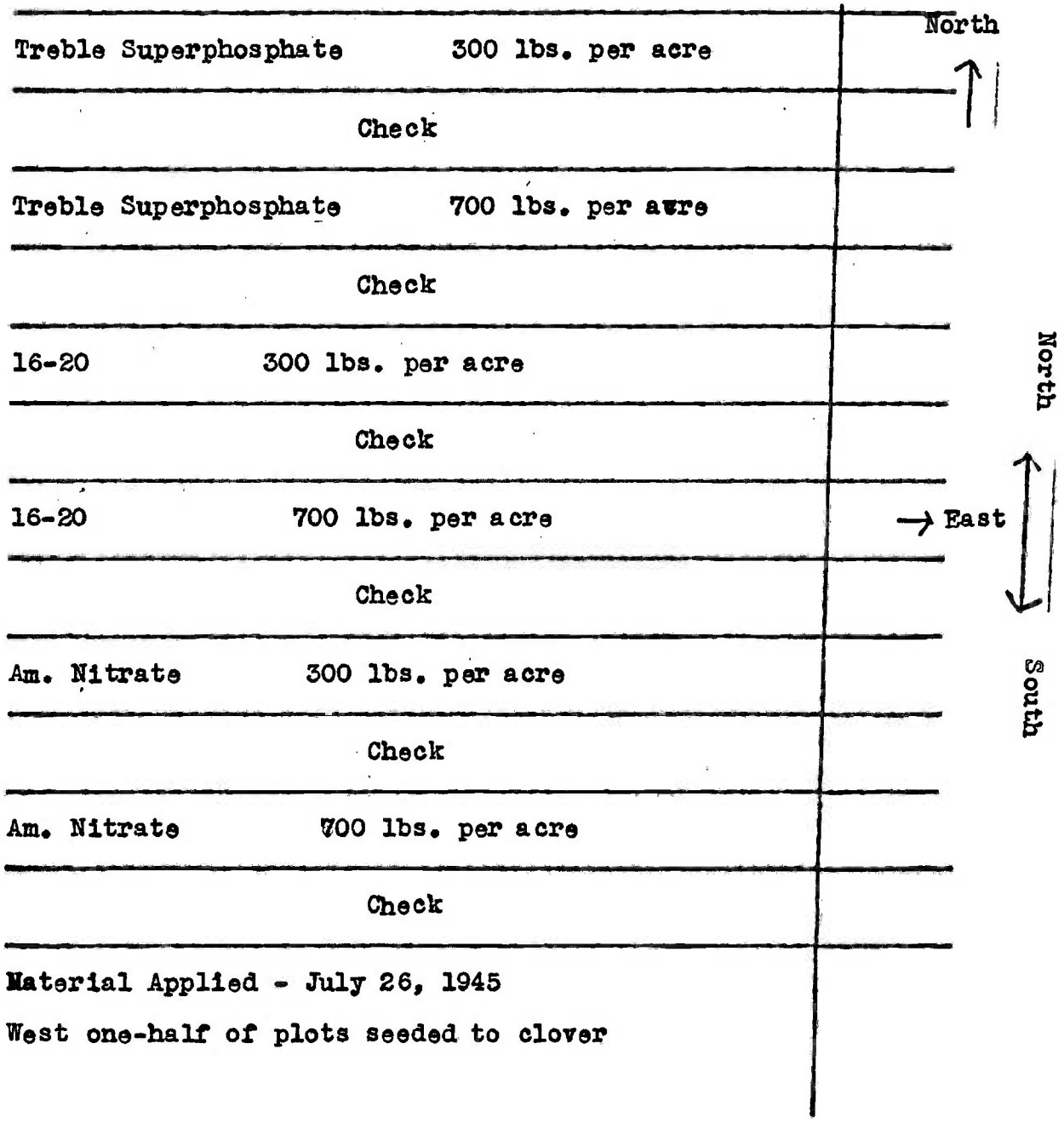
Material applied - August 2, 1945

North one-half seeded to clover

Commercial Fertilizer Tests on

Meadow Lands

John Thompson Ranch (Williamson Valley)



Material Applied - July 26, 1945

West one-half of plots seeded to clover

K-4 Ranch --- F.W. Donovan, Foreman. Big Chino, Paulden, Arizona

North

50 lbs. Tr. Super	400 lbs. Gyp	1 ton Manure	20 lbs. Am. Nitrate	200 lbs. Sulphur	9 lbs. rye Plowed under
W		CHECK			E
Rye 400 lbs. Gyp	400 lbs. Sulphur	20 lbs. Tr. Super Phos.	800 lbs. Gyp.	2 ton Manure	20 lbs. Am. Nitrate 20 lbs. Tr. Super Phos.

Nov. 9, '45 -- Plowed, Bordered, Treated, Irrigated -- except nitrates.

Plots to be planted to corn about May '46 -- and treated with Nitrates.

Plot size -- 33' by 135'

South

Yuma County -- Robert Moody, County Agent

This county is in the process of rapid expansion and carries many soil problems, from the coarse mesa sands - M.E., 4 to 10 - to the heaviest of clays and silts, often carrying high salt content.

Mr. Moody has sent many samples to the laboratory this past year and is carrying on a major project in leaching.

As illustrating the character of the soil, a table is presented on page 29 showing the pH, T.S.S., and M.E. of the soils on the leaching project. Water is not abundant at this place, and the agent reports no leaching results so far. It is feared by the agent that when leaching is accomplished the pH will rise, and correctives will have to be applied. The Soils Division at the College is cooperating fully in this project, and correctives have been applied on this test.

As illustrating a more complete analysis of the character of the soils, the following sample is submitted. Note the salt content variation.

A. J. Naquin, Roll

Hole	Zone	M.E.	Phos.	N.	pH	T.S.S.
1.	1st ft	31	4	15	7.65	13,500
2.	" "	28	11	14	8.15	610
3.	" "	34	8	252	8.05	1,115
4.	" "	33	4	11	7.80	5,465
5.	" "	32	4	Tr	7.85	2,735

C.E. Linfesty - Yuma Mesa

1.	0-2"	12	2	9	7.90	2,595
2.	2-8"	9	12	9	7.90	1,695

Besides this intimate study of the soil, Mr. Moody is considering the salt tolerance of the various plants, and the use of the grass family as a reclaiming agent.

ANALYTICAL RESULTS FROM J. REILY FARM
Yuma Soils Project
Submitted by R. J. Moody, April 2, 1945

Sample Markings			pH of Paste	Total Soluble Salts	Moisture Equivalent
Field No.	Check No.	Depth of Sample			
1	1	0"-6"	7.85	2,330	35
1	1	6"-24"	7.95	1,160	20
1	1	24"-48"	8.30	1,050	5
1	1	48"-84"	8.60	1,180	5
1	2	0"-6"	7.75	3,250	25
1	2	6"-24"	7.90	2,435	17
1	2	24"-48"	8.10	1,405	12
1	2	48"80"	8.45	890	4
1	3	0"-6"	7.75	1,990	28
1	3	6"-24"	7.80	1,665	26
1	3	24"-48"	8.65	610	3
1	3	48"-80	8.40	980	4
1	4	0"-6"	7.85	1,725	5
1	4	12"-18"	7.80	1,925	32
1	4	18"-30"	7.85	1,810	28
1	4	30"-48"	8.45	625	25
1	4	48"-80"	8.50	665	5
1	5	0"-6"	7.70	2,820	3
1	5	6"-24"	7.85	1,875	34
1	5	24"-48"	7.70	4,300	30
1	5	48"-80"	7.80	3,595	24
2	1	0"-6"	7.75	2,800	33
2	1	6"-24"	7.65	4,325	30
2	1	24"-48"	7.70	4,325	27
2	1	48"-80"	7.70	5,280	29
2	2	0"-6"	7.70	5,780	35
2	2	6"-24"	7.90	2,280	31
2	2	24"-48"	7.95	2,455	23
2	2	48"-80"	7.85	3,760	28
2	3	0"-6"	7.90	2,855	35
2	3	6"-24"	7.65	7,810	29
2	3	24"-48"	7.75	6,220	23
2	3	48"-72"	7.65	4,875	20
2	4	0"-6"	7.75	4,525	34
2	4	6"-24"	7.50	12,420	32
2	4	24"-48"	7.70	6,620	22
2	4	66"-72"	7.75	5,370	16
2	5	0"-6"	7.75	8,830	32
2	5	6"-24"	7.60	11,265	30
2	5	24"-48"	7.65	12,000	32
2	5	48"-80"	8.30	1,745	3

A List of 'Soil' Problems presented at Soils Day - Extension Conference, Tucson, Dec. 10 to 14, '45.

---------- By Counties

HIGH SALT .... WATER & SOIL

Apache ... Maricopa

TIGHT SOIL

Apache, Cochis, Graham, Maricopa

SLICK SPOTS ... SPOTTED

Apache, Graham, Cochise

ALKALI SOILS (high pH.)

Apache, Maricopa, Cochise.

WATER-LOGGED LAND.

Apache, Graham

AMENDMENTS ... HOW MUCH? ... HOW APPLY?

Cochise, Maricopa, Pima-Yuma.

FERTILIZERS .. KINDS? .. AMOUNTS? .. METHODS? .. TIME?

Cochise, Maricopa, Pima and Yuma.

HIGH WATER TABLE PROBLEMS ... HOW TO HANDLE.

Graham.

POOR WATER PENETRATION

Maricopa, Apache.

TIGHT SUB. SURFACE ZONES ... HOW TO HANDLE?

Maricopa

SUB. SOILING EFFECTS?

Maricopa

ORGANIC MATERIALS ... KINDS AND METHODS OF USING?

Maricopa

MORE MECHANICAL ANALYSES NEEDED ... Maricopa

PROPER TILLAGE PRACTICES? ... Maricopa

Soil Problems by Counties -- continued

EFFECTS OFLEACHING? ... Maricopa

RELATION OF SLOPE, WATER PENETRATION AND SOIL CLASS? Pima-Yuma

IMPROVEMENT OF SOIL STRUCTURE? .. Maricopa, Pima-Yuma

FIELD WORK NEEDED TO SUPPORT LAB. WORK .. Pima-Yuma

PROPER BORDER CONSTRUCTION? .. Pima-Yuma.

EFFECTS OF DRYING OUT SOILS ... ON STRUCTURE? .. Maricopa

EFFECTS OF HIGH SALT CONTENT ON SEEDLINGS? .. "

THE USE OF MINOR ELEMENTS IN FERTILIZING? .. Pima - Yuma

SELECTION OF LAB. ANALYSES FOR FIELD USE AND INTERPRETATION OF THESE? .. Pima - Yuma.

METHOD OF STUDYING SOIL PROFILE? .. " "

OVERCOMING EFFECTS OF MUDDY WATER IRRIGATION? .. Graham

DRY LAND

BEST SEEDING METHODS TO SECURE GERMINATION? .. Apache, Coconino

SELECTING EFFICIENT DRY LAND SOILS ... Coconino

SELECTING ADAPTABLE DRY LAND CROPS AND VARIETIES? .. Coconino

BEST MOISTURE CONSERVATION TILLAGE METHODS .. Coconino & Apache

WHAT PENETRATION IS BEING OBTAINED ON THE RANGE? .. Apache

SUMMARIZATION AND RECOMMENDATION OF THE SOILS COMMITTEE

I.A. Briggs and K.K. Henness
Tucson, December 11, 1945

The purpose of the Workshop on Soils was to assemble the problems of soil management so that research and extension workers would have as complete a picture of the problems as possible and to present briefly the methods of approach and recommendations on (1) salinity and fertility problems, (2) available moisture in soils, (3) aggregation of soils, farm practice and soil structure, and (4) soil and water analyses.

The discussion developed that the following soils problems are common in all irrigated areas:

1. Land levelling or preparation of land for irrigation.

   This may include terracing and the preparation for corrugating where used, as well as other specialized types of handling. More results benefiting more people can be had from work on this matter than on any other one thing. It is fundamental to reaching fertilizer trials and soil amendments tests. Recommendations will vary but can be made fairly definite. Better leveling is a project that best can be handled in the field by the County Agricultural Agent, cooperating where possible, with other agencies including such work in their field of operating.

2. Tight soil problems including slick spots, tight surface soils and impervious sub-soils. These usually are combined with

3. High pH problems and often salinity problems including saline water conditions.

4. Soil amendment problems, particularly gypsum, sulphur and organic matter.

5. Fertilizer problems.

Special soil problems of more or less localized nature are almost endless and include such things as, handling dry farm soils, high water tables, weed problems, use of silty water, depth of cultivation and many others.

The discussion further developed the fact of the great importance of soil physics, water analysis, character of salts, elevation considerations and response to treatment at different times of the year. Much consideration was given to

the use of gypsum and sulphur as soil correctives. Because of the cost of such treatments there is a possibility that gypsum or sulphur applications should be on an exploratory basis, often with combination with fertilizers and/or organic matter and continuing from year to year in amounts considered necessary. In the discussion there developed that there may be some soils which better might be abandoned than to undertake the expensive soil treatments necessary for reclamation.

The committee feels that insufficient emphasis was given to the use of sod crops as a means of correcting soil troubles and that in many cases such crops will reclaim land where the use of soil amendments would be prohibited.

The subject of fertilization was given considerable attention. There appears to be a considerable amount of laboratory information on the subject, but a marked lack of information on the behavior of fertilizer treatments under many soil conditions. There is a considerable observation material on the effect of different fertilizers under different soil conditions. However, results achieved on one farm often are not indicative. In general, there is a lack of information upon which to base definite recommendations.

The use of fertilizers has developed rapidly in Arizona, sales have increased to the point where they approximate $1,250,000 a year and it is felt that there will be a further increase.

See also 31-A.

The preceding report accurately records the sentiments expressed at the Soils meeting and the following set of resolutions, after some consideration and changes by the committee, are approved by the writer.

Recommendations of the Soils Appraisal Committee
of the
Extension Service Conference -- Dec. 10 to 14, 1945.

1. The Extension Service appreciates all types of field Service rendered by the Station Staff and would especially appreciate the services of a man from the Department of Agricultural Chemistry and Soils, who would spend much time in the field supervising research and field-test plots on various soil types and in different areas.

2. The Soils Specialist of the Agricultural Extension Service should, with the advice of the County agricultural extension agents and the Department of Agricultural Soils and Chemistry secure cooperators and assist in the management of the above research and test plots. He will also assist county agents in conducting demonstrational and exploratory work along with field-test work, with fertilizers and soil amendments.

3. It is recommended that the Extension Service through its soils specialist, and acting in cooperation with the Department of Agricultural Chemistry and Soils would do well to seek some type of active cooperation with the Salinity Laboratory in work on major soil salinity problems.

4. It is recommended that the Extension Service request from the Station as much service as may be possible in the field of microbiology. This recommendation was suggested by the fact that almost no discussion was devoted to the subject of soil microbiology, though green and barn-yard manures were mentioned, as was the use of Bermuda grass in one area. It is suggested that under some conditions microflora may be as important as soil structure and soil composition.

Climatic Data in Representative Areas of Arizona

Location	Annual precipitation inches	Ext. Max. temperature	Ext. Min temperature
Flagstaff	22.8	92	-25
Florence	9.99	115	11
Holbrook	9.43	106	-20
Mesa	8.91	116	17
Phoenix	7.9	118	16
Pinedale	20.68	111	-26
Prescott	18.52	105	-12
Snowflake	12.49	102	-24
St. John	11.42	105	-22
Thatcher	8.87	116	8
Tucson	10.96	110	12
Wellton		116	19
Wilcox	10.95	110	2
Yuma	3.10	119	22

If any significance be attached to the effect of "freezing and thawing" on the tilth of normally tight soils, or to the influence of temperature on the ease of water penetration into these soils or to the influence of temperature on phosphate response on alfalfa(see temperature curve page 21), then certainly such data as is given in the above table should receive careful attention. (Climatic data from The Climate of Arizona by H.V. Smith - U. of A. bulletin No. 130).

A Study of Published Literature Dealing with Growth Response on Soils Similar to those in Arizona.

In order to better understand Arizona's soils, the writer has undertaken a study of the published literature from State and Federal Agencies that include studies of soils similar to those of this state. Chiefly this study has been confined to those adjoining states, and the areas within those states, where the annual precipitation is normally below 15 inches and the soil is alkaline. Consideration is also given to the temperature factor in these areas. So far special attention has been given to reports from New Mexico, Colorado, Nevada, Utah, and Southern California, along with the reports emanating from the U.S. Salinity laboratory at Riverside.

This literature is being abstracted for Extension use and a sample of such abstraction appears on page 34. All statements are direct quotations.

Publications Relating to Mineral Fertilizers (see p 32A)

Name of publication	No.	Date	State
Cotton Fertilizer Experiments in the Salt River Valley	Bulletin 129	Sept.15, 1929	Arizona
Fertilization of Alfalfa on Alkaline Calcareous Soils	Bulletin 154	Oct. 15, 1936	Arizona
The Productive Capacity of Semiarid Soils and the Present Emergency	Bulletin 182	March 1942	Arizona
Grain Following Sorghums Nitrogen Improves	Reprint	April 1932	California
The Phosphate Nutrition of Fruit Trees III. Comparison of Fruit Tree and Field Crops Response on a Phosphate Deficient Soil	Reprint	1942	California
Nutrient Deficiencies of Citrus Symptons, Cause and Control	Reprint	1945	California
Sweet Corn Fertilizer Test	Mimeo	1942	California
Onion Fertilizer Test Plot	Mimeo	1944	California
Sweet Corn Fertilizer Test	Mimeo	1944	California
Fertilizer Tests on Early Sweet Corn	Mimeo	1941	California
Comparison of Methods for Estimating Available Phosphorus in Alkaline Calcareous Soils	Bulletin 2	March 1933	Colorado
Phosphate Fertilization Pays	Circular 44	April 1945	Idaho
Carbonic Acid Soluble Phosphorus and Lime Content of Idaho Soils in relation to Crop Response to Phosphate Fertilization	Reprint	October 1944	Idaho
Commercial Fertilizers for the Irrigated Sections of Western Nebraska	Bulletin 365	December 1944	Nebraska
Nebraska Outstate Crops and Soils Tests	Bulletin 373	January 1945	Nebraska
Fertilizers and Manure in the Improvement and Maintenance of Soil Productivity in Southern Nevada	Bulletin 171	September 1944	Nevada

Abstracts from "Some Soil Properties Related to
the Sodium Salt Problem in Irrigated Soils."
U.S. Technical Bulletin #902
By Robert Gardner, working at the Riverside Salinity Laboratory

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(All statements are quotations)

"The settling volume was related directly to the extent to which the soil had been dispersed." Page 2

"Mechanical puddling resulted in settling volumes approximately the same as the 100-percent sodium treatment and dispersion by dilution, regardless of whether the soils had been previously treated with sodium salts." 3.

"The rate of wetting by capillary movement of water and the rate of water conductance under a hydraulic head were both found to be closely related to the poor structure resulting from salinity." 3.

"The results indicate that either the rate of wetting or the permeability of samples treated with soil amendments can be used to indicate whether a soil will respond to amendments in the field and how much amendment material will be necessary." 3.

"It is concluded that the poor physical condition of many saline soils is modified by so many other factors that it is not always directly correlated with either the percentage of replaceable sodium or the concentration of salts found in the soil." 3.

"To make the experiences gained in improving a saline tract of land applicable to other tracts, it is evidently necessary to modify the methods to suit local environment conditions and inherent soil features." 4.

"The degree of clay dispersion, the settling volume of floccular or granular soil in water, the permeability of soil

to water, and the rate of wetting by capillary movement of soil moisture are closely related to the extent and type of aggregation of the clay crystals." 4.

"The soils deflocculated after treatment with high percentages of sodium salt, however, form massive aggregations of low density that settle slowly to form large settling volumes of gelatinous consistency." 8

"In the past there has not always been a clear differentiation between the granular particles of soil of good structure and the bulky floccules of a soil of poor structure." 8.

"Comparatively large changes in sodium percentage in the lower percentage range produce small effects, while comparatively small changes in the higher percentages range produce large effects." 10

"The results show that more than merely saturating the soils with calcium may be required to correct the undesirable physical properties that have been caused by sodium." 11

"Since the change from a sodium to a calcium system does not necessarily restore a desirable physical condition, the effect of other possible factors must be considered. Among these is the process of drying. It has been observed that drying often has a very beneficial effect upon the soil structure both in the field and in the laboratory." 12

"The settling volume of the soils dispersed by mechanical puddling was greatly increased in all cases, regardless of the extent of sodium saturation." 14

"The production of vegetation on the land where possible is thought to be the most generally economical method of improving permeability." 16.

"G "Gypsum has sometimes been effective and, for reasons not always clear, at other times has failed to give good results." 16.

"Gypsum applications to the field, however, have not always functioned effectively in increasing soil permeability. Since this is the case, some method of determining whether it will be effective is needed before it is applied." 16.

"The quantity of gypsum required to effect improvement was generally much greater than a normal field application." 17.

"Soils No. 373, No. 385 and No. 386 all contain an excess of gypsum, and therefore, showed little effect from gypsum treatments." 23

"Although No. 87 has the lightest texture of any of the soils studied, it ranks among the lowest in permeability." 23.

"The vast difference in the behavior of these soils toward treatment indicates that a wide variety of conditions must be considered in reclaiming saline soils in the field and that generalizations from one or a few experiments should be made with extreme caution." 24.

"It is well recognized that the clay minerals of the soil may exist as individual crystals dispersed through the solution, as loosely aggregated floccules, or as granular aggregates. Many physical properties of the soil depend upon the balance between these three states. The factors that control dispersion, flocculation, andgranulation are therefore of fundamental importance." 26.

"Variations in the concentration of the solution may change the state of aggregation greatly, while the ratio of the replaceable bases is held relatively constant." 26.

Tucson, Arizona, January 1st, '46. Extension Soils Division

On determining when to use field tests and when demonstrations when using commercial fertilizers and soil amendments on different soil types.

E. S. Turville

There are two distinct types of Extension activities possible, and officially recognized when conducting soil projects.

(1) The demonstration. When the user is reasonably sure he knows the results he will get, this plan is appropriate.

(2) The field test. When the user has confidence in a certain principle, but is not sure what results will be obtained by its application to any particular set of soil or climatic conditions, the field test is preferable.

The two systems differ mainly in the amount of publicity that is given, and will differ some in technique.

The "field test" differs from research in that, in the former, no new principle is being sought and no attempt made to explain the results, but only to record the effect of a single practice. Research seeks new principles and the explanation of old ones. Generally speaking, Extension is permitted to do research only when the responsibility for this rests with some cooperating Research Agency.

When the problem in hand can normally be stated in such a manner that the answer can be given as a simple "yes" or "no", the field test is in order. If, on the other hand, the answer is likely to be involved, conditional or to include new principles, the project is one of research.

Field tests may again be divided into two classes, (A) the preliminary or "observation" test and (B) the regular "measurement" field test.

(a) Preliminary tests, using only observation - not measurement - to determine results may be used. A few square feet may be treated by hand and the results observed. If these latter are not sufficient to be readily seen or easily determined in the laboratory, certainly the field test rather than the demonstration should be used, the measurements carefully taken and the soil character carefully determined - before announcing results.

(b) If however, as frequently happens, the results are quite apparent, the agent will decide whether to use a complete field test with measurements or to procede directly with the demonstration.

From experiments carried on by the Arizona Experiment Station and other stations similarly situated as concerns the alkalinity of the soil, the following suggestions are made.

(1) Legumes, especially alfalfa, respond to phosphorous but not to nitrogen fertilizers - at least, not profitably so.

(2) A wide variation exists in the results obtained from the application of phosphorous to alfalfa, and these appear to vary to some extent as the soil texture and structure changes - a larger increase in yield on the sandy, than on the heavier soils. Climate may also be a factor.

(3) The non-legumes appear much more responsive to nitrogen than to phosphorous applications.

(4) Also, in their response, the non-legumes frequently showa higher increase on the lighter than on the heavier soils. This statement may be less true for sods.

(5) In the case of phosphorous on alfalfa, frequently tests show a decrease in the yield, over the check, as the weather warms up in the summer.

(6) An ordinary application of phosphorous (200 to 300 lbs. per acre of treble superphosphate) appears to show profitable increase in production, at least into the third year - when a first year response is obtained.

(7) The evidence appears to be that trees generally do not respond to phosphorous, and do to nitrogen.

(8) Results obtained from commercial fertilizers during cool weather growing conditions may not be duplicated during hot or warm weather growing conditions.

Compounds and Mixtures

All of the above assumes the use of single elements, but also the compounds and mixtures must be considered. The compounds as the amophos 11-48-0 or 16-20-0, as well as the mixtures carrying all of the simple elements as a 10-4-2, as well as the trace elements, copper, sulphur, manganese, etc. have their place and should be recognized.

The suggestion is made, that if the effects of the "simples" are known, the facts will aid greatly in the selection of the compounds and mixtures.

Sampling Soils for Fertilizers and Amendments

For methods of sampling soils, see the mimeograph "Sampling Soils for Analysis" by Dr. Caster and ~~Fred~~ George Draper.

37-B

An Example of the Plan Proposed

As stated at the beginning of this report, the material presented is mainly intended to indicate the nature of Arizona soils, as background for project work. Also it has been stated, that because of the former policy of including soils as merely one factor in crop production projects, the soils themselves have not received the attention which are their due.

As a beginning in this line of project activity three projects were listed:

1. a selection of soil measurements for extension use,

2. the securing of a considerable number of field tests and demonstrations, and

3. the working out of a standard extension field technique.

While it is true that much research work has been done on soils in Arizona or on soils similar to these, the field testing of the principles developed - preparatory to demonstration work - has not been carried out on any large scale, by any agency.

Such field tests do not constitute research, since they are merely an attempt to apply a known principle and to record results, no attempt to explain the results or to discover new principles is included.

With these thoughts in mind, there is presented a sample list of questions concerning only the phosphorous - alfalfa relations, which it would seem could be answered for any particular soil or climatic condition, by the use of field tests. In cases where the results are not obvious or are not in accord with those expected, the matter should be referred back to the research division.

Questions relating to alfalfa-phosphorous response:

1. To what extent do the soil measurements in general use, pH, T.S.S., M.E., dispersion and nutrient deficiency, give information of value in the correct diagnosis of soil problems?

2. Have we a right to expect a growth response on alfalfa from a treatment of phosphorous on all soils regardless of their differences in texture and structure? If not what ones do or do not respond?

3. Are the response results the same in the warm valleys as in the cool areas of the State?

4. How general is the result - frequently obtained - of securing a large growth increase in the spring cuttings, much reduced increases in the summer and a somewhat greater increase in the fall?

5. Do crops following alfalfa that has received phosphorous show a phosphate effect when:

(a) the alfalfa showed a growth response,
(b) the alfalfa showed no growth response?

6. How many years will an alfalfa field show growth response after a treatment of say 200 lbs. of treble superphosphate per acre, providing it showed response the first year?

7. Is it true that alfalfa responds more generally to phosphorous application when the soil is sandy than when it is heavy?

8. Is there a difference between the response likely to occurr from the use of phosphorous on the heavy acid soils of Coconino County and a similarly heavy alkali soil of Maricopa County? (pH 7?8). Coconino County is pH 6-7.

9. Should one expect a difference in response from phosphate on alfalfa when the material is broadcast over an existing stand, when it is plowed under before seeding or when disked deeply into an existing stand, when

(a) the soil is sandy?

(b) the soil is a clay loam (pH 7-8)?

10. Do nitrogen compounds produce an increased growth of alfalfa, either (a) alone or (b) in combination with phosphorous?

11. Does alfalfa treated with phosphorous show commercially important increases in the phosphorous content of the hay

(a) when the yield shows increase and

(b) when the yield does not show increase?

12. Should the amount of alfalfa seed per acre be reduced when the soil is treated with phosphorous at seeding time?

It is assumed that a large number of "spot tests" -

areas of not more than 10' x 10' - would provide a fund of factual field information that would be of service to all parties concerned. Extending this practice to all crops - and considering only the response varying with soil variations - the results should soon take on real significance.

Such tests would not and should not, in any sense, replace research experiments, but might assist in the wider application of the findings.

Outlook and Recommendations

Besides the physical facts so far stated, together with a preliminary statement of the projects for the coming year, the writer s ubmits his own impressions of the situation.

He believes:

1. That most soil anaylses should include as a minimum a report on (1) pH; (2) T.S.S. (3) Texture, (4) structure and (5) nutrients - when indicated,

2. That tillage is primarily a matter of soil management and should be included as a part of soil science;

3. That gypsum, sulphur and the standard commercial fertilizers have a place in Arizona agriculture and should be studied for their proper and efficient use;

4. That the different root systems of common plants - especially those of the grass family - should be studied for their influence on soil structure (tilth);

5. That field tests of amendments, fertilizers, tillage practices, etc. should be freely used by the Extension Service for the purpose of determining the adaptability of these materials and practices to local soils and climatic conditions;

6. That as far as possible, the Service should cooperate with the Experiment Station men, to the end that they may more readily form field contacts and learn of field conditions, and;

7. That no efficient science of soil management in Arizona can be developed without the aid of the Soils laboratory and the men who operate there.

Soils, as an Arizona Extension project is new and will have to grow in popularity and technique.

The bright spot in the picture is the fact that the Maricopa County staff has added an "Assistant County Agent in Soils and Irrigation". In this particular field, a man holding this position can collect more good extension soils materials than could a flock of State specialists.

Statistical for the Year 1945

Days in field	161
Days in office	145
Meetings attended	11
Total attendance	438
Separate official trip	
Contacts with agents	52
Letters written	285
Circular letters sent out	1
News articles published	1
Counties officially visited	7