

A STUDY OF MATERIAL AND METHODS USED FOR TEACHING
SOILS IN VOCATIONAL AGRICULTURE CLASSES

by

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REASONS FOR UNDERTAKING THE PROBLEM

Every high school course in vocational agriculture includes some training in facts about the soil and in problems pertaining to its management. In states where vocational agriculture departments have a 130 minute period and offer, as they do in Kansas, a course in crops production one year and a course in livestock production another year, it is customary and logical to include the teaching of soils with the crops production work. In many states where vocational agriculture is taught four years, ninety-minute

periods being used, soils management is taken up as a separate course.

The outstanding feature of the vocational agriculture program is that instruction is based upon and motivated by a program of supervised home practice work which each boy carries on. The unit of instruction in vocational agriculture is the "Job". The information about and the experience in various phases of agriculture are as far as possible organized about the jobs which the boys will plan for and will carry through in their programs of supervised practice work.

It has been the writer's experience and observation that soils material is difficult to incorporate in a course of this kind. There seems to be great variation in the amount of soils material taught and in the time and methods of teaching it. Reasons for this difficulty and these variations seem to be as follows:

1. Facts about soils and soil management are technical and difficult for high school boys.

2. So much time is needed to teach some of the fundamental soil facts that there is a tendency for interest in the job being taught to lag if these facts are worked in as related science.

3. Vocational agriculture instructors, well trained in

soils work probably tend to overemphasize this work.

4. Many vocational agriculture teachers feel their own knowledge of soils is not sufficient to enable them to do a good job of teaching it.

5. Very few soils references have been prepared with the needs of the vocational agriculture student in mind.

STATEMENT OF THE PROBLEM

Very little research has been carried on relative to material and method used for teaching soils in vocational agriculture. It was necessary to restrict the problem somewhat. The following phases were studied because they were basic:

1. What facts about the soil and its management should be taught in vocational agriculture?

2. Should soil facts be worked into the course as related science in connection with jobs of crops production enterprises?

3. Should soil facts be taught in a separate short course on soils?

4. What methods are most effective for teaching the various facts about the soil and its management?

PROCEDURE

Because of the lack of reference material and research work in this field, it was necessary to depend almost entirely upon information obtained from men in the field who had experience in presenting soils work to high school vocational agriculture students.

A list of fifty Kansas teachers, who were well trained to do a good job of soils teaching, was obtained by consultation with Dr. F. L. Duley and with Mr. L. B. Pollow, State Supervisor of Vocational Agriculture. A list of supervisors of vocational agriculture in Nebraska, Iowa, Missouri, Oklahoma, Colorado, and Ohio was obtained from Mr. Pollow. Letters were addressed to each of these state supervisors asking for the names of ten teachers in the state whom they considered did a good job of teaching soils. A copy of the survey was enclosed with each letter, and the purpose of the survey was explained. Prompt answers were received from the supervisors of each state with the exception of Oklahoma.

The survey shown below was then sent to each teacher whose name had been obtained. This was done in August, 1931. Postal card reminders were sent to those teachers who failed to return the survey after a reasonable length of time.

Survey Used

A sample of the survey form used is given below. It is self explanatory. In the interest of brevity, the headings for columns to be checked are given only on the first page, the following pages simply listing the soil facts included in the survey.

Dear Fellow Teacher:

This survey, on the way you teach soils work in vocational agriculture, is arranged for your convenience. It can be filled in by checking. No writing required. Will you fill it out now and use the enclosed envelope to return it to me?

Instructions

In the columns opposite each soil fact that you teach put 1, 2, and 3, under the methods that your judgement and experience have shown you to be first, second, and third most effective in teaching these soil facts. Under "When Taught" check one or the other of the columns to indicate whether this fact is taught as part of a soils unit course or whether it is taught in connection with a job of some enterprise. If none of the columns opposite a soil fact are checked, it will indicate that you do not teach this fact.

For example:

Material Taught	When	How Taught								
	Taught									
	As part of a soils unit course									
	In connection with a job of some enterprise									
	Lecture									
	Illustration									
	Laboratory exercise									
	Demonstration									
	Farm Practice									
	Assigned reading and recitation									
	Field study									
	Supervised study and recitation									
	Other methods									
Effect of phosphorus on plant growth							3	2	1	
The nitrogen cycle										

The first line checked would mean that "The effect of phosphorus on plant growth" is taught in connection with a job of some enterprise, and that the supervised study and recitation, field study, and farm practice methods are considered most effective for teaching it. The second line left unchecked would indicate that "The nitrogen cycle" is not taught.

In the interest of uniformity, will you accept the following definitions of teaching methods? If your method differs only slightly from one of these described, list it under that one. If it is unlike any described, list it under "Other Methods" and explain it at the bottom of this page.

LECTURE: The teacher instructs the class orally. He may use charts or illustrative material, but the main source of information is what he tells.

ILLUSTRATION: Teaching by the aid of charts, maps, films, pictures, or specimens with very little telling. May have been preceded by study or other instruction.

LABORATORY EXERCISE: Setting up and following of a specific laboratory exercise by the students.

DEMONSTRATION: Work done by teacher, boy, or group of boys before the class. Principles involved and facts revealed explained by persons conducting the demonstration.

FARM PRACTICE: Teacher takes class to farm and performs practice that will teach a soils fact. For example, the teacher might take boys to farm and apply ground limestone, thus, teaching the material, "When and how to apply ground limestone".

ASSIGNED READING AND RECITATION: Student reads references selected by teacher and assigned to class. Class held for subject matter in the recitation.

FIELD STUDY: This method takes class to the field to study facts in their natural setting. This method will usually have been preceded by supervised study and recitation.

SUPERVISED STUDY AND RECITATION: Assignments are made, and the study supervised. Recitation and discussion bring out important points and clear up doubtful facts.

I will appreciate your explaining below any methods you use that do not lend themselves to the classification I have used.

Surveys Sent Out and Returned

<u>State</u>	<u>Surveys Sent Out</u>	<u>Surveys Returned</u>
Kansas	50	46
Missouri	10	3
Nebraska	10	7
Iowa	10	1
Colorado	10	5
Ohio	<u>10</u>	<u>8</u>
Total	100	70

FINDINGS

Organization of Facts Into Three Groups

Tabulation of the seventy surveys returned is shown below for each of the eighty-eight soil facts included. The facts are not given in the order of the survey but are divided into three groups as follows:

1. Those facts which over sixty per cent of teachers who taught them handled as part of a soils unit course.
2. Those facts which between forty and sixty per cent of teachers taught as part of a soils unit course.
3. Those facts which over sixty per cent of teachers

taught in connection with a job of some enterprise.

The reason for this grouping was the observation that a different type of soil facts seemed to be taught in unit courses than were taught in connection with jobs of crops enterprises. It seemed desirable to compare these facts and the methodology favored for the different types.

Returns on Each Soil Fact

The per cent of the seventy teachers who taught each soil fact is shown. The per cent of those teaching a fact, who taught it as part of a soils unit course, is shown in Tables I and II. The per cent teaching in connection with the job can be figured by subtracting this figure from 100 per cent. The per cent teaching a fact in connection with a job of some enterprise is shown for the last group in Table III.

Preference for the various methods is expressed as per cent, and was obtained as follows:

The number of first choices for the lecture method, for instance, on a certain fact were multiplied by three, the number of second choices by two, and the number of first choices by one. These three figures were added together and expressed as a percentage of the preference for all methods used having been obtained in the same way. Only the four most preferred methods are shown in each bar

diagram except where there was almost equal preference for several.

Table I

1. Definition of the soil

Per cent who teach this fact.....	95.7	%
Per cent teaching in unit course.....	80.8	%
Preference for various methods*		
A. _____	18.0	%
B. _____	17.0	%
F. _____	43.0	%
H. _____	8.1	%
C. _____	7.6	%

2. Soil forming materials

Per cent who teach this fact.....	90.0	%
Per cent teaching in unit course.....	80.9	%
Preference for various methods		
A. _____	8.0	%
B. _____	15.8	%
C. _____	15.8	%
D. _____	8.6	%
E. _____	9.8	%
F. _____	31.3	%
H. _____	15.9	%

3. Rocks containing soil forming materials

Per cent who teach this fact.....	75.7	%
Per cent teaching in unit course.....	82.7	%
Preference for various methods		
A. _____	8.3	%
B. _____	8.3	%
C. _____	16.6	%

*A-Lecture, B-Assigned reading and recitation, C-Illustration, D-Demonstration, E-Laboratory, F-Supervised study and recitation, G-Farm practice, and H-Field study.

D. _____	8.3	%
E. _____	20.4	%
F. _____	19.9	%
H. _____	16.4	%

4. The effect of plants on soil formation

Per cent who teach this fact.....	92.8	%
Per cent teaching in unit course.....	68.2	%
Preference for various methods		

A. _____	8.6	%
B. _____	13.9	%
C. _____	9.1	%
F. _____	34.6	%

5. How freezing and thawing help to form soils

Per cent who teach this fact.....	99.1	%
Per cent teaching in unit course.....	75.7	%
Preference for various methods		

A. _____	11.9	%
B. _____	11.5	%
C. _____	9.7	%
F. _____	35.2	%
H. _____	23.3	%

6. How action of water forms soil

Per cent who teach this fact.....	92.8	%
Per cent teaching in unit course.....	74.0	%
Preference for various methods		

A. _____	8.2	%
B. _____	12.5	%
C. _____	9.9	%
F. _____	34.9	%
H. _____	26.0	%

7. How action of wind forms soil

Per cent who teach this fact.....	90.0	%
Per cent teaching in unit course.....	72.5	%
Preference for various methods		

A. _____	11.3	XXXX
B. _____	15.2	XXXX
C. _____	11.3	XXXX
F. _____	35.4	XXXX
H. _____	21.2	XXXX

8. How ice has formed soil

Per cent who teach this fact.....	84.5	XX
Per cent teaching in unit course.....	80.7	XX
Preference for various methods		

A. _____	12.3	XXXX
B. _____	20.4	XXXX
C. _____	10.5	XXXX
F. _____	39.0	XXXX
H. _____	13.9	XXXX

9. Changes that occur after a soil is laid down

Per cent who teach this fact.....	73.0	XX
Per cent teaching in unit course.....	76.4	XX
Preference for various methods		

A. _____	10.4	XXXX
B. _____	13.8	XXXX
C. _____	9.3	XXXX
F. _____	38.3	XXXX
H. _____	23.5	XXXX

10. Meaning of soil texture

Per cent who teach this fact.....	97.1	XX
Per cent teaching in unit course.....	70.5	XX
Preference for various methods		

A. _____	9.1	XXXX
C. _____	11.5	XXXX
D. _____	11.5	XXXX
E. _____	19.9	XXXX
F. _____	25.6	XXXX
H. _____	13.5	XXXX

11. The soil separates what they are

Per cent who teach this fact.....	83.0	XX
Per cent teaching in unit course.....	72.4	XX
Preference for various methods		

A. _____	9.1	%%
B. _____	7.0	%%
C. _____	11.1	%%
D. _____	16.5	%%
E. _____	29.0	%%
F. _____	22.3	%%

12. Making a settling test of soil texture

Per cent who teach this fact.....	75.7	%%
Per cent teaching in unit course.....	75.4	%%
Preference for various methods		
C. _____	10.8	%%
D. _____	28.2	%%
E. _____	42.8	%%
F. _____	9.6	%%

13. Classes of soil based on texture

Per cent who teach this fact.....	84.3	%%
Per cent teaching in unit course.....	79.6	%%
Preference for various methods		
A. _____	10.5	%%
C. _____	9.1	%%
D. _____	11.1	%%
E. _____	21.0	%%
F. _____	27.0	%%
H. _____	12.5	%%

14. Field identification of soil classes

Per cent who teach this fact.....	73.0	%%
Per cent teaching in unit course.....	66.6	%%
Preference for various methods		
C. _____	6.0	%%
E. _____	10.9	%%
F. _____	15.2	%%
H. _____	50.2	%%

15. Meaning of soil structure

Per cent who teach this fact.....	94.3	%%
Per cent teaching in unit course.....	76.9	%%
Preference for various methods		

A. _____	10.6	
B. _____	11.2	
E. _____	13.0	
F. _____	31.7	
H. _____	15.2	

16. What colloidal material is

Per cent who teach this fact.....	63.0	
Per cent teaching in unit course.....	60.1	
Preference for various methods		

A. _____	12.6	
B. _____	8.4	
C. _____	9.6	
D. _____	19.0	
E. _____	9.9	
F. _____	25.2	

17. Effect of colloidal material on soil structure

Per cent who teach this fact.....	51.1	
Per cent teaching in unit course.....	63.9	
Preference for various methods		

A. _____	12.5	
C. _____	12.0	
D. _____	14.5	
E. _____	14.0	
F. _____	24.0	
H. _____	11.7	

18. What an element is

Per cent who teach this fact.....	90.0	
Per cent teaching in unit course.....	63.4	
Preference for various methods		

A. _____	22.6	
B. _____	13.6	
C. _____	11.2	
D. _____	13.5	
F. _____	29.0	

19. How to study a soil survey

Per cent who teach this fact.....	57.1	
Per cent teaching in unit course.....	72.5	

Preference for various methods

A. _____	24.3	%%
B. _____	10.1	%%
C. _____	11.6	%%
F. _____	30.5	%%

20. Use of potassium in commercial fertilizers

Per cent who teach this fact.....	54.2	%%
Per cent teaching in unit course.....	65.7	%%
Preference for various methods		

A. _____	19.8	%%
B. _____	18.3	%%
C. _____	8.9	%%
F. _____	38.6	%%

21. Reading fertilizer formulae

Per cent who teach this fact.....	90.0	%%
Per cent teaching in unit course.....	60.3	%%
Preference for various methods		

A. _____	19.5	%%
B. _____	14.0	%%
E. _____	14.0	%%
F. _____	26.9	%%

22. How water moves in the soil

Per cent who teach this fact.....	94.3	%%
Per cent teaching in unit course.....	63.6	%%
Preference for various methods		

A. _____	11.1	%%
C. _____	10.4	%%
D. _____	20.2	%%
E. _____	24.0	%%
F. _____	24.6	%%

23. Kinds of bacteria that live in the soil

Per cent who teach this fact.....	62.8	%%
Per cent teaching in unit course.....	65.9	%%
Preference for various methods		

A. _____	24.0	%
B. _____	21.7	%
C. _____	7.3	%
F. _____	42.0	%

24. What makes alkali spots

Per cent who teach this fact.....	54.3	%
Per cent teaching in unit course.....	63.1	%
Preference for various methods		

A. _____	18.5	%
B. _____	14.2	%
F. _____	39.8	%
H. _____	14.6	%

25. How to correct alkali spots

Per cent who teach this fact.....	54.3	%
Per cent teaching in unit course.....	71.0	%
Preference for various methods		

A. _____	17.8	%
B. _____	14.3	%
F. _____	33.0	%
G. _____	11.9	%
H. _____	13.7	%

26. Estimating soil fertility by examination of soil profile

Per cent who teach this fact.....	47.1	%
Per cent teaching in unit course.....	60.6	%
Preference for various methods		

A. _____	6.4	%
C. _____	6.4	%
E. _____	6.4	%
F. _____	25.8	%
H. _____	41.1	%

27. How soil surveys are made

Per cent who teach this fact.....	52.3	%
Per cent teaching in unit course.....	72.9	%
Preference for various methods		

A. _____	43.5	%
B. _____	13.3	%
C. _____	8.7	%
F. _____	21.7	%

28. Soil classification and mapping

Per cent who teach this fact.....	50.0	%
Per cent teaching in unit course.....	74.2	%
Preference for various methods		

A. _____	25.1	%
B. _____	13.9	%
C. _____	12.3	%
F. _____	26.2	%
H. _____	11.1	%

Table II

Group of Facts Which Forty to Fifty-nine Per Cent of Teachers Taught as Part of Soils Unit Course

29. Effect of bacteria on structure

Per cent who teach this fact.....	74.3	%
Per cent teaching in unit course.....	53.9	%
Preference for various methods		

A. _____	16.5	%
B. _____	15.0	%
C. _____	10.2	%
F. _____	40.2	%
H. _____	9.1	%

30. Effect of soil texture on structure

Per cent who teach this fact.....	70.0	%
Per cent teaching in unit course.....	54.7	%
Preference for various methods		

A. _____	11.0	%
B. _____	12.2	%
E. _____	12.0	%
F. _____	31.6	%
H. _____	14.3	%

31. Effect of dry weather on structure

Per cent who teach this fact.....	77.1 %
Per cent teaching in unit course.....	52.9 %
Preference for various methods	
G. _____	8.3 %
D. _____	10.1 %
E. _____	11.2 %
F. _____	28.0 %
H. _____	24.0 %

32. Effect of working too wet on structure

Per cent who teach this fact.....	97.1 %
Per cent teaching in unit course.....	52.5 %
Preference for various methods	
D. _____	15.0 %
E. _____	12.1 %
F. _____	24.3 %
H. _____	30.9 %

33. Elements essential for plant growth

Per cent who teach this fact.....	94.5 %
Per cent teaching in unit course.....	53.0 %
Preference for various methods	
A. _____	19.3 %
B. _____	10.3 %
C. _____	9.5 %
E. _____	11.9 %
F. _____	40.6 %

34. What a compound is

Per cent who teach this fact.....	65.7 %
Per cent teaching in unit course.....	55.0 %
Preference for various methods	
A. _____	19.1 %
B. _____	12.5 %
C. _____	10.0 %
D. _____	12.0 %
E. _____	10.9 %
F. _____	34.0 %

35. Compounds of some of the more important elements are found

Per cent who teach this fact.....	78.6	%
Per cent teaching in unit course.....	52.7	%
Preference for various methods		
A. _____	17.3	%
B. _____	14.0	%
C. _____	11.1	%
D. _____	13.4	%
E. _____	10.8	%
F. _____	32.4	%

36. The nitrogen cycle

Per cent who teach this fact.....	91.4	%
Per cent teaching in unit course.....	46.8	%
Preference for various methods		
A. _____	18.9	%
B. _____	16.1	%
C. _____	15.4	%
F. _____	38.6	%

37. Work of nonsymbiotic nitrogen-fixing bacteria

Per cent who teach this fact.....	70.0	%
Per cent teaching in unit course.....	55.1	%
Preference for various methods		
A. _____	17.8	%
B. _____	20.0	%
F. _____	35.6	%
H. _____	18.0	%

38. Factors affecting nitrification

Per cent who teach this fact.....	81.4	%
Per cent teaching in unit course.....	47.3	%
Preference for various methods		
A. _____	15.4	%
B. _____	19.8	%
F. _____	44.0	%
H. _____	7.5	%

39. Effect of amount of nitrates on crop growth

Per cent who teach this fact.....	73.3	%
Per cent teaching in unit course.....	41.3	%
Preference for various methods		
A. _____	7.3	%
B. _____	15.4	%
C. _____	9.3	%
F. _____	30.6	%
H. _____	24.0	%

40. Work of denitrifying bacteria

Per cent who teach this fact.....	57.1	%
Per cent teaching in unit course.....	57.5	%
Preference for various methods		
A. _____	16.9	%
B. _____	14.8	%
C. _____	8.1	%
F. _____	40.8	%
H. _____	8.1	%

41. Use of phosphorus in commercial fertilizers

Per cent who teach this fact.....	70.0	%
Per cent teaching in unit course.....	46.9	%
Preference for various methods		
A. _____	12.3	%
B. _____	14.4	%
F. _____	35.6	%
H. _____	10.7	%

42. Effect of potassium on crop yields

Per cent who teach this fact.....	70.1	%
Per cent teaching in unit course.....	46.0	%
Preference for various methods		
A. _____	14.6	%
B. _____	15.1	%
C. _____	10.8	%
F. _____	39.8	%
H. _____	9.9	%

43. Use of mixed fertilizer

Per cent who teach this fact.....	67.1 %
Per cent teaching in unit course.....	55.3 %
Preference for various methods	
A. _____	11.0 %
B. _____	10.4 %
C. _____	10.8 %
F. _____	32.4 %
G. _____	8.9 %
H. _____	17.1 %

44. Purchase of commercial fertilizer

Per cent who teach this fact.....	55.0 %
Per cent teaching in unit course.....	48.6 %
Preference for various methods	
A. _____	20.4 %
B. _____	13.4 %
F. _____	41.2 %
H. _____	7.5 %

45. How plants use water

Per cent who teach this fact.....	95.7 %
Per cent teaching in unit course.....	52.2 %
Preference for various methods	
A. _____	8.6 %
B. _____	9.7 %
C. _____	11.4 %
D. _____	16.2 %
E. _____	16.5 %
F. _____	35.3 %

46. How movement of soil water can be affected

Per cent who teach this fact.....	85.7 %
Per cent teaching in unit course.....	56.6 %
Preference for various methods	
A. _____	7.9 %
B. _____	7.6 %
C. _____	7.3 %
D. _____	23.0 %
E. _____	20.2 %
F. _____	26.7 %

47. Causes and effects of poor water drainage

Per cent who teach this fact.....	80.0	W
Per cent teaching in unit course.....	50.0	W
Preference for various methods		
B. _____	11.5	W
C. _____	8.9	W
F. _____	26.8	W
H. _____	26.8	W
G. _____	7.6	W
D. _____	7.2	W

48. Kind of land that should be surface drained

Per cent who teach this fact.....	61.4	W
Per cent teaching in unit course.....	51.1	W
Preference for various methods		
A. _____	9.2	W
B. _____	11.6	W
C. _____	6.8	W
F. _____	26.8	W
G. _____	10.0	W
H. _____	28.8	W

49. How to surface drain land

Per cent who teach this fact.....	61.4	W
Per cent teaching in unit course.....	48.8	W
Preference for various methods		
B. _____	9.3	W
C. _____	8.5	W
F. _____	26.8	W
G. _____	15.0	W
H. _____	31.4	W

50. Kind of land that should be tile drained

Per cent who teach this fact.....	54.3	W
Per cent teaching in unit course.....	57.9	W
Preference for various methods		
A. _____	10.8	W
B. _____	12.8	W
C. _____	6.9	W
F. _____	23.2	W

G. _____	9.4 %
H. _____	30.2 %

51. How to tile drain land

Per cent who teach this fact.....	52.8 %
Per cent teaching in unit course.....	56.7 %
Preference for various methods	

A. _____	7.4 %
B. _____	11.3 %
C. _____	7.9 %
F. _____	34.6 %
G. _____	8.4 %
H. _____	19.8 %

52. Conditions favoring helpful bacteria

Per cent who teach this fact.....	78.6 %
Per cent teaching in unit course.....	52.7 %
Preference for various methods	

A. _____	19.1 %
B. _____	18.5 %
C. _____	5.9 %
F. _____	44.3 %
H. _____	5.3 %

53. Effect of aeration on bacteria

Per cent who teach this fact.....	70.0 %
Per cent teaching in unit course.....	51.0 %
Preference for various methods	

A. _____	18.1 %
B. _____	20.0 %
C. _____	4.9 %
D. _____	4.1 %
E. _____	4.5 %
F. _____	41.1 %
H. _____	4.1 %

54. What soil acidity is

Per cent who teach this fact.....	91.4 %
Per cent teaching in unit course.....	45.3 %
Preference for various methods	

A. _____	13.0 %
B. _____	11.0 %
D. _____	12.7 %
E. _____	15.5 %
F. _____	33.6 %
H. _____	8.2 %

55. Relation of soil acidity to lime deficiency
in soil

Per cent who teach this fact.....	85.7 %
Per cent teaching in unit course.....	45.0 %
Preference for various methods	

A. _____	10.7 %
B. _____	13.7 %
D. _____	7.9 %
E. _____	8.2 %
F. _____	34.7 %
H. _____	11.9 %

56. How to interpret soil acidity tests

Per cent who teach this fact.....	80.0 %
Per cent teaching in unit course.....	46.4 %
Preference for various methods	

A. _____	7.2 %
D. _____	22.0 %
E. _____	25.7 %
F. _____	19.1 %
H. _____	10.7 %

57. Rich and poor soils and their relative
need for lime

Per cent who teach this fact.....	67.1 %
Per cent teaching in unit course.....	46.8 %
Preference for various methods	

A. _____	7.6 %
B. _____	9.6 %
C. _____	7.6 %
E. _____	12.4 %
F. _____	27.3 %
H. _____	

58. How to correct soil acidity and lack of calcium

Per cent who teach this fact.....	70.0	%
Per cent teaching in unit course.....	40.8	%
Preference for various methods		
A. _____	8.0	%
B. _____	12.5	%
D. _____	12.5	%
E. _____	10.2	%
F. _____	33.1	%
H. _____	12.8	%

59. Kind of limestone to use

Per cent who teach this fact.....	75.7	%
Per cent teaching in unit course.....	43.4	%
Preference for various methods		
A. _____	13.7	%
B. _____	10.1	%
C. _____	8.3	%
D. _____	8.6	%
E. _____	10.1	%
F. _____	32.8	%
H. _____	10.5	%

60. Effect of lime on availability of plant foods

Per cent who teach this fact.....	64.5	%
Per cent teaching in unit course.....	46.6	%
Preference for various methods		
A. _____	16.6	%
B. _____	19.5	%
C. _____	7.8	%
F. _____	35.4	%
H. _____	10.0	%

61. Where to get limestone

Per cent who teach this fact.....	62.8	%
Per cent teaching in unit course.....	43.1	%
Preference for various methods		

A. _____	25.2	%
B. _____	18.8	%
C. _____	5.5	%
F. _____	35.5	%
G. _____	6.4	%
H. _____	5.9	%

62. Tests for purity of limestone

Per cent who teach this fact.....	41.4	%
Per cent teaching in unit course.....	48.2	%
Preference for various methods		

A. _____	12.4	%
D. _____	26.2	%
E. _____	30.6	%
F. _____	20.0	%

63. Losses due to soil erosion

Per cent who teach this fact.....	87.1	%
Per cent teaching in unit course.....	50.8	%
Preference for various methods		

A. _____	10.1	%
B. _____	8.2	%
C. _____	9.5	%
F. _____	33.4	%
G. _____	7.2	%
H. _____	27.5	%

64. Controlling gullying

Per cent who teach this fact.....	84.3	%
Per cent teaching in unit course.....	50.8	%
Preference for various methods		

B. _____	8.3	%
C. _____	8.3	%
F. _____	24.2	%
G. _____	19.1	%
H. _____	28.7	%

65. Meaning of soil fertility

Per cent who teach this fact.....	88.6	%
Per cent teaching in unit course.....	58.0	%
Preference for various methods		

A. _____	15.6 %
B. _____	19.1 %
F. _____	44.7 %
H. _____	10.1 %

66. How to conduct a fertility test

Per cent who teach this fact.....	55.8 %
Per cent teaching in connection with job.....	42.1 %
Preference for various methods	

A. _____	13.4 %
B. _____	6.7 %
C. _____	8.2 %
D. _____	17.1 %
E. _____	10.8 %
F. _____	17.0 %
G. _____	9.7 %
H. _____	17.9 %

67. Illinois test for available phosphorus

Per cent who teach this fact.....	24.2 %
Per cent teaching in connection with job.....	47.0 %
Preference for various methods	

A. _____	9.8 %
B. _____	8.7 %
C. _____	6.6 %
D. _____	30.7 %
E. _____	24.1 %
F. _____	6.6 %
H. _____	10.9 %

Table III

Soil Facts Which Sixty Per Cent or More of
Teachers Taught in Connection With
a Job of Some Crop Enterprise

68. What good tilth is

Per cent who teach this fact.....	95.7 %
Per cent teaching in connection with job.....	68.7 %
Preference for various methods	

C. _____	7.2	%
D. _____	8.3	%
F. _____	28.0	%
G. _____	10.1	%
H. _____	30.7	%

69. Effect of nitrogen on plant growth

Per cent who teach this fact.....	95.7	%
Per cent teaching in connection with job.....	67.1	%
Preference for various methods		

B. _____	10.7	%
C. _____	8.2	%
D. _____	8.0	%
E. _____	10.1	%
F. _____	51.0	%
G. _____	8.2	%
H. _____	12.6	%

70. How nitrogen can be supplied to the soil

Per cent who teach this fact.....	95.7	%
Per cent teaching in connection with job.....	70.1	%
Preference for various methods		

A. _____	8.0	%
B. _____	14.3	%
C. _____	7.9	%
F. _____	38.9	%
G. _____	10.9	%
H. _____	12.0	%

71. Work of symbiotic nitrogen fixing bacteria

Per cent who teach this fact.....	90.0	%
Per cent teaching in connection with job.....	60.0	%
Preference for various methods		

A. _____	18.0	%
B. _____	16.1	%
C. _____	9.0	%
F. _____	54.5	%
H. _____	12.6	%

72. Effects of bacteria on nitrates in green manure crops

Per cent who teach this fact.....	57.1	%
Per cent teaching in connection with job.....	67.5	%
Preference for various methods		
A. _____	15.7	%
B. _____	20.0	%
F. _____	40.0	%
H. _____	9.0	%

73. Use of legumes for adding nitrogen to the soil

Per cent who teach this fact.....	98.6	%
Per cent teaching in connection with job.....	76.8	%
Preference for various methods		
B. _____	13.5	%
C. _____	7.2	%
F. _____	38.0	%
G. _____	7.4	%
H. _____	22.1	%

74. Use of legumes for increasing available nitrogen

Per cent who teach this fact.....	84.3	%
Per cent teaching in connection with job.....	76.6	%
Preference for various methods		
B. _____	14.7	%
F. _____	36.8	%
G. _____	9.3	%
H. _____	21.3	%

75. Commercial fertilizers that contain nitrogen

Per cent who teach this fact.....	72.8	%
Per cent teaching in connection with job.....	64.7	%
Preference for various methods		
A. _____	12.6	%
B. _____	16.2	%
C. _____	12.0	%
D. _____	9.0	%
E. _____	8.1	%

F. _____	27.1	%
H. _____	9.2	%

76. Effects of nitrates on available phosphorus

Per cent who teach this fact.....	44.2	%
Per cent teaching in connection with job.....	61.2	%
Preference for various methods		

A. _____	13.0	%
B. _____	20.4	%
C. _____	7.4	%
F. _____	35.4	%
H. _____	10.5	%

77. Effects of phosphorus on crop yields

Per cent who teach this fact.....	81.3	%
Per cent teaching in connection with job.....	73.6	%
Preference for various methods		

A. _____	11.3	%
B. _____	14.3	%
C. _____	10.3	%
F. _____	34.9	%
H. _____	17.9	%

78. Field indications of need for lime

Per cent who teach this fact.....	81.4	%
Per cent teaching in connection with job.....	70.3	%
Preference for various methods		

B. _____	8.7	%
D. _____	10.3	%
F. _____	18.7	%
G. _____	7.1	%
H. _____	38.4	%

79. Tests for soil acidity

Per cent who teach this fact.....	87.1	%
Per cent teaching in connection with job.....	65.5	%
Preference for various methods		

D. _____	24.3	%
E. _____	30.1	%
F. _____	9.0	%
G. _____	6.3	%
H. _____	22.1	%

80. When and how to apply limestone

Per cent who teach this fact.....	72.8	%
Per cent teaching in connection with job.....	66.6	%
Preference for various methods		
A. _____	11.5	%
B. _____	16.9	%
F. _____	37.6	%
G. _____	17.5	%
H. _____	17.1	%

81. Controlling erosion by cropping system

Per cent who teach this fact.....	84.3	%
Per cent teaching in connection with job.....	67.8	%
Preference for various methods		
A. _____	7.4	%
B. _____	9.9	%
C. _____	7.1	%
F. _____	32.2	%
G. _____	9.0	%
H. _____	24.2	%

82. Controlling erosion by contour farming

Per cent who teach this fact.....	70.0	%
Per cent teaching in connection with job.....	65.3	%
Preference for various methods		
B. _____	8.5	%
C. _____	9.7	%
F. _____	32.8	%
G. _____	14.1	%
H. _____	22.7	%

83. Controlling erosion by terracing

Per cent who teach this fact.....	80.0	%
Per cent teaching in connection with job.....	60.7	%
Preference for various methods		
B. _____	6.1	%
C. _____	7.4	%
F. _____	28.7	%
G. _____	20.6	%
H. _____	29.0	%

84. Estimating soil fertility by crops grown

Per cent who teach this fact.....	64.3	%
Per cent teaching in connection with job.....	66.6	%
Preference for various methods		
A. _____	8.5	%
B. _____	8.9	%
D. _____	6.8	%
F. _____	27.7	%
G. _____	7.2	%
H. _____	34.1	%

85. Value of barnyard manure

Per cent who teach this fact.....	98.5	%
Per cent teaching in connection with job.....	60.8	%
Preference for various methods		
A. _____	6.4	%
B. _____	14.6	%
C. _____	7.4	%
F. _____	37.5	%
G. _____	7.4	%
H. _____	21.6	%

86. Use of barnyard manure

Per cent who teach this fact.....	98.5	%
Per cent teaching in connection with job.....	72.4	%
Preference for various methods		
A. _____	8.4	%
B. _____	16.1	%
F. _____	34.4	%
G. _____	11.4	%
H. _____	19.6	%

87. Advantages of crop rotation

Per cent who teach this fact.....	97.1	%
Per cent teaching in connection with job.....	72.1	%
Preference for various methods		
A. _____	7.6	%
B. _____	15.1	%
F. _____	36.4	%
G. _____	7.1	%
H. _____	24.1	%

88. How to plan successful crop rotation

Per cent who teach this fact.....	94.2	%
Per cent teaching in connection with job.....	71.2	%
Preference for various methods		
A. _____	9.4	XXXX
B. _____	14.6	XXXXXXXX
C. _____	8.9	
E. _____	9.4	
F. _____	36.2	XXXXXXXX
G. _____	7.8	XXXX
H. _____	11.0	XXXX

89. Cropping systems adapted to local conditions

Per cent who teach this fact.....	82.8	%
Per cent teaching in connection with job.....	70.6	%
Preference for various methods		
A. _____	8.4	XXXX
B. _____	11.8	XXXXXX
F. _____	35.3	XXXXXXXX
G. _____	10.6	XXXXXX
H. _____	21.2	XXXXXX

Additional Soil Facts Submitted by Cooperators
(Data are not given on these because they were usually submitted by only one teacher.)

1. Soil types based on formation
2. Ways of preventing leaching
3. Effects of some crops on soils
4. Soil survey of home farm
5. Identify soil types of community
6. Organic test for soils
7. Effect of lime on puddled soils
8. Water holding capacity of soils
9. Capillary rise of water
10. Winogradsky azotobacter soil test

Preference of teachers for methods of teaching the twenty-eight soils facts of Group I. (Facts which over sixty per cent of teachers favor teaching in soils unit course).



Figure 1

Preference of teachers for methods of teaching the thirty-nine soils facts of Group II. (Facts which forty to sixty per cent of teachers favor teaching in soils unit course).

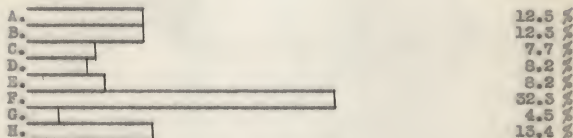


Figure 2

Preference of teachers for methods of teaching the twenty-two soils facts of Group III. (Facts which over sixty per cent of teachers favor teaching with job of some enterprise).



Figure 3

SUMMARY AND CONCLUSIONS

Soils material that should be included in a course in vocational agriculture.

The most commonly taught fact in the list was taught by 99.1 per cent of the teachers answering. The least taught fact was taught by 24.2 per cent of teachers answering. Material most commonly taught falls into two groups:

1. Definitions and facts pertaining to soil formation.
2. Soil management problems common to all sections and not involving a great deal of technical information.

Listed below is the soils material which is taught by eighty per cent or more of the seventy teachers answering. It seems reasonable to assume that this material is fundamental to a high school course in vocational agriculture.

Definition of soil
 Soil forming materials
 The effect of plants on soil formation
 How freezing and thawing help to form soils
 How action of water forms soils
 How action of wind forms soils
 How ice has formed soil
 What an element is

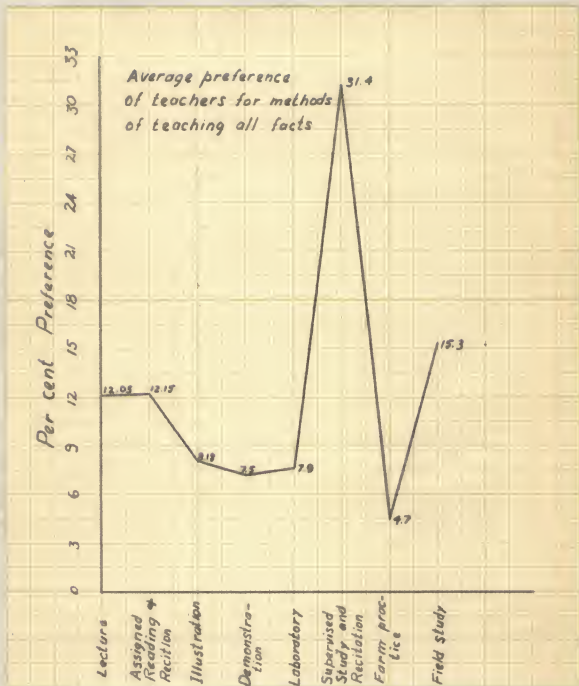


Figure 4

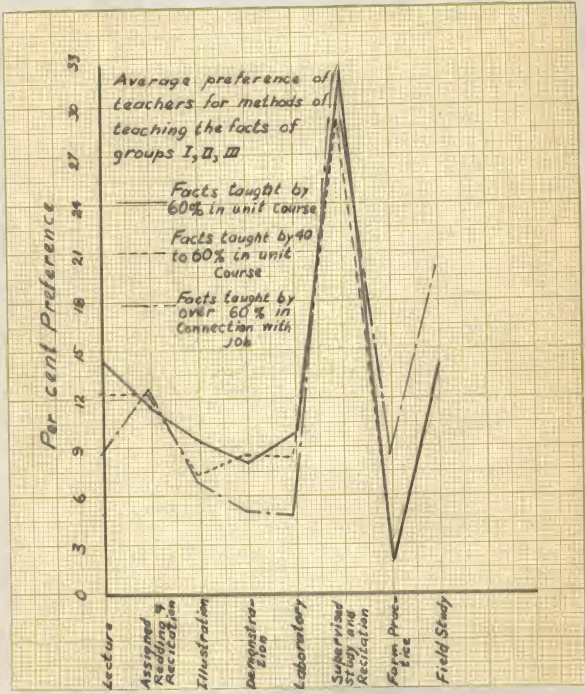


Figure 5

Elements essential for plant growth
 What a compound is
 Meaning of soil texture
 The soil separates what they are
 Classes of soil based on texture
 Meaning of soil structure
 What good tilth is
 Effects of working too wet on structure
 How water moves in the soil
 How movement of soil water can be affected
 How plants use water
 Causes and effects of poor water drainage
 The nitrogen cycle
 Effect of nitrogen on plant growth
 How nitrogen can be supplied to the soil
 Factors affecting nitrification
 Work of symbiotic nitrogen-fixing bacteria
 Use of legumes for adding nitrogen to the soil
 Meaning of soil fertility
 Use of legumes for increasing available nitrogen
 Value of barnyard manure
 Use of barnyard manure
 Effect of phosphorous on crop yields
 Reading fertilizer formulas
 Relation of soil acidity to lime deficiency in the soil
 Field indications of need for lime
 Tests for soil acidity
 How to interpret soil acidity tests
 Advantages of crop rotation
 Cropping systems adapted to local conditions
 Losses due to soil erosion
 Controlling erosion by cropping system
 Controlling erosion by terracing
 Controlling gullying

The above list would, of course, not be a complete one for any department. Other soil management problems and material dealing with other soil fundamentals will be included in any local program because of local conditions, the existence of a special opportunity for teaching, the needs of a particular group, or the qualifications of the instructor.

Unit course versus the related science method
of teaching soils material.

As shown in Table I, twenty-eight soils facts were taught by sixty per cent or more of teachers in a unit course. The range of choice for the unit plan of teaching is from 82.7 per cent to 60.3 per cent for the facts in this group. The median per cent choice for the unit plan is 73.7 and the mean 71.3 per cent. It will be observed that the material in this group tends to deal with definitions and facts about soil formation.

In thirty-nine soils facts the choice between unit and job procedure was about evenly divided. This is shown in Table II. The range of choice for the unit plan of teaching is from 58.7 per cent to 40.8 per cent for the facts in this group. The median is 54.4 per cent and the mean is 50.7 per cent. There is considerable variation as to type of material in this group. There are only a few definitions and facts about soil formation. The more technical phases of soil management and some of the less frequently taught phases of soil management seem to fall in this group.

Twenty-two of the soils facts listed are taught by over sixty per cent of those teaching them in connection with a job of some enterprise. The range of preference for teaching with a job is from 76.8 per cent to 60.0 per cent.

The median per cent is 67.0 and the mean 67.8 per cent. Examination of Table III will show that the material in this group consists mainly of the more commonly taught phases of soil management. The material in this group is taught more commonly than that of the other two groups. The mean percentage teaching the facts in Group I is 74.9, in Group II 71.8, and in Group III 82.0.

It is interesting to notice the choice of the various states between "unit" and "related to the job" teaching of soils material. Ten Kansas teachers marked every fact they taught as taught in connection with some job. Three marked every one as taught in unit course. All others divided between the two. There was a tendency as noted above for definitions, facts about soil formation, and fundamental principles to be taught in unit courses while soil management tended to be taught with jobs. Replies from other states showed the same tendency where both methods were used.

Four of the eight teachers replying from Ohio used the unit procedure altogether, and the others leaned heavily toward it. The lone cooperator from Iowa taught all facts in the unit course. Nebraska showed about equal division. None used either method exclusively. Two of the three replying from Missouri taught everything with jobs.

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Colorado was about evenly divided. One listed every fact under job while another one listed them all under unit.

Methods used in teaching soils material
in vocational agriculture.

The lecture method, as shown in Figure IV is given an average preference of 12.2 per cent for use in teaching all facts listed. Figure V shows a greater use of the lecture method in Groups I and II. These groups, it has been observed, contain more material dealing with definitions, facts about soil formation, and the more technical phases of soil management.

The assigned reading and recitation method gets 12.0 per cent of the choice of methods. There is no significant difference between the three groups in connection with this method.

Teaching by illustration received 8.2 per cent of the total choice of methods. This method, like lecture, is more used in connection with the more technical and fundamental material of Groups I and II.

The demonstration method is less used than any other with the exception of farm practice, the choice for demonstration being 7.5 per cent out of 100 per cent choice for all methods. Considering the emphasis placed on the demonstration method by science teachers, it would seem that more demonstration work might be done in teaching soils in

vocational agriculture.

The laboratory method is more favored for the material of Groups I and II. The relatively small amount of laboratory work done is due in part to the opportunity vocational agriculture teachers have for using field study. It is believed, however, that lack of soils laboratory equipment, lack of exercises suitable for correlating with vocational agriculture work, and lack of training on the part of instructors limits laboratory work.

Supervised study and recitation is most used of the eight methods listed. This method fits in well with project study. This helps to explain its popularity. Figure V shows that it is most used with those facts which are more often taught with jobs. In teaching many jobs, supervised study precedes such methods as laboratory, farm practice, or field study.

Farm practice ranks the lowest with 4.7 per cent choice. This is probably due to the relatively few soils jobs which are of such scope that a class can be taken out to perform them. Teachers have probably listed under "field study" those things which the class merely go out to observe. It would seem that more teaching by the instructor on his visits to the boys' farm would bring about greater use of the farm practice method. Farm practice

and field study, the natural setting methods, are both used more in connection with the facts of Group III.

Field study is the second most used method of teaching soils facts with 15.2 per cent preference. It is especially popular in teaching the facts of Group III. The fact that most of the states surveyed have the vocational half day, makes possible the general use of this natural setting method.

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