TEACHING DATA DEALING WITH CORN FOR THE USE OF TEACHERS OF AGRICULTURE IN VIRGINIA

BY

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Approved:

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INTRODUCTION

In 1927 H. W. Sanders, of the Agricultural Education Department at Virginia Polytechnic Institute conducted a study on "Growing Corn For Grain" which was submitted as the thesis requirement for a Master of Science degree in Agricultural Education. In approaching his problem the detailed write-up of the technical subject matter was largely in the form of written interpretation of experimental data and generally accepted opinions on successful corn growing. Tables of experimental data were only incidental to the thorough coverage of subject matter.

Factual Data - The need for factual data in present-day teaching is being recognized especially by leading educators in the field of vocational agriculture. Such a publication has been prepared and distributed by the Vocational Education Department at Virginia Polytechnic Institue on "Organized Teaching Data On Chickens". In introducing this publication Professor E. C. Magill, of the Virginia Polytechnic Institute Vocational Education Department, states: "Generalized information has proved of limited value. Telling by printed word or spoken word is not the whole of teaching ..... Only a study of the facts with attendant proof on which they are based will change belief. This makes necessary factual data - the data resulting from experimental, statistical and scientific observation - the raw data, not someone's interpretation of it".

Up to now there had been no complete compilation of experimental data on corn available in this or any other state as far as the writer has been able to ascertain. Fragmentary compilation on phases of corn growing in a few instances, such as Bulletin 312 of the Mississippi

Agricultural Experiment Station on "Corn Planting and Cultivation", have appeared in some states.

Furthermore agriculture teachers do not have the time nor the resources available to ferret out these experimental data individually for their own use.

The Problem - Therefore, the problem pursued was the production of organiz ed factual teaching data dealing with the production of corn for the use of teachers of agriculture in Virginia. The material has been collected in view of its' adaptability to Virginia conditions.

An effort has been made to bring up-to-date the findings of recent years as well as facts earlier established. A further objective has been to make the study cover the field of corn production completely so far as it effects Virginia corn production.

When the collected material is published it should facilitate and make possible a more effective program of teaching in Virginia when problems of a debatable nature concerning corn production are under consideration in the classroom.

Procedure - This material has been collected primarily from experiment station bulletins from various states. For Virginia much of the data were secured from unpublished reports of the Blacksburg Station and the other eight substations in the state. Some of the data had to be averaged and tabulated to meet the particular situation discussed. Other sources were text books and agriculture periodicals.

The Experiment Station Record proved to be the most helpful source in locating bulletins with experimental data dealing with corn.

The organization of material is based on the suggested list of jobs under "Corn Enterprises" as outlined by the Department of Agricultural

Education at Virginia Polytechnic Institute and used generally by the agriculture teachers in the state. The materials on rotations with corn and silage production were sub-divided and treated separately due to the volume of facts on these subjects.

Determining the cost of growing corn, corn growing equipment problems, improving corn by breeding, and liming were added to the outline. Controlling rodents and keeping records were omitted due to the lack of material and the fact that these subjects do not lend themselves to facility of treatment under the method followed in this study.

In the process of getting the information that is most pertinent to Virginia conditions, much material was discarded from the beginning while other tables were superseded as more complete and convincing data were discovered. An effort to bring the experimental evidence up-to-date was also an important consideration in the choice of data on a given subject.

The general arrangement of each topic is to present the tabulated facts, give the source, give a brief explanation of the conditions of the experiment and other pertinent facts, and lastly to raise questions to bring out the evidence in the table that has practical adaptation.

Analysis Of Material - In analyz ing the material gathered, a total of 167 tables has been presented from 101 different references. Source material was gathered from 23 state experiment stations and one Canadian station. Virginia led with forty subjects treated. Most of these had to do with fertilizer, lime, manure, rotation and variety tests. The corn-belt states were a fruitful source with Ohio, Illinois and Iowa leading. This is to be expected in the light of the importance of the corn crop in these states and many of the experiments there deal with the more detailed phases. Practically every state has conducted some experiments with corn

production. This is, of course, a tribute to the importance of the crop and universality of its' production.

Hybrid Corn - Hybrid corn varieties for Virginia are not treated in this thesis. Dr. T. B. Hutcheson, of the Virginia Polytechnic Institute Agronomy Department, advises that tests have not been conducted long enough at the Virginia stations to draw any definite yield conclusions. Then, too, there has been much inconsistency of yield during the two years that tests have been conducted. No Virginia-bred varieties have been developed to put on the market and many imported varieties from other states give no significant yields. However, some varieties are yielding well.

The Virginia Experiment Station is doing extensive testing of varieties and up-to-date information on hybrid corn may be had by writing to Blacksburg.

The possibilities of improving corn by hybrid seed is treated in this thesis under the main topic of "Improving Corn By Breeding".

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I. DECIDING THE ACREAGE TO GROW

1. Corn Requirements Of Different Animals Per Year.

	Bushels
Work horses	40
Colts, 2nd year	8
Colts, 3rd year	10
Dairy Cows (5,000-7,000 lbs. milk)	20
Dairy heifers, 1st year	7
Dairy heifers, 2nd year	10
Bulls	10
Baby beeves (12-16 months)	50
Beef heifers, 1st year	5
Feeding Cattle, per month	
Short fed, heavy	15
Short fed, light	10
Long fed, heavy	10
Long fed, light	8
Brood sows, 2 litters	30
Brood sows, 1 litter	25
Boars	20
Spring pigs to 225 lbs	13
Fall pigs to 225 lbs	15
Feeder pigs to 100 lbs	7
Ewes or rams	1
Lambs, raised	$\frac{1}{4}$
Feeding lambs, dry lot	2
Hens and roosters, per 100	84
Pullets raised to maturity, per 100	23
Broilers raised, per 100	7

SOURCE: Overton and Robertson, Farm Management and Marketing, Lippincott, 1936.

EXPLANATION: This table does not give the total feed requirements of these various animals but the amount of corn usually reckoned in a balanced ration. Corn is generally thought of as a basic feed and other concentrates and roughages are added to balance the ration. Corn may be substituted to some extent by equivalent feeds, based on relative prices, the livestock involved, and other factors.

QUESTIONS: 1. How many acres of corn would one have to raise on a farm producing forty bushels to the acre to feed six work horses, twenty dairy cow, 200 hens, and six sows producing two litters per year which you intend to market at 225 pounds?

2. How many beef cattle would forty acres of corn support where the yield was fifty bushels per acre?

2. Relation Of Production To Price Of Corn.

Percent production is above or below normal	Percent which the price per bushel is above or below normal at:		
	Iowa farms	Chicago No. 2 cash	Georgia farms
50	-47	-35	-19
40	-41	-30	-16
30	-34	-24	-12
20	-25	-17	- 9
10	-14	-10	- 5
Normal	0	0	0
-10	18	12	6
-20	42	26	12
-30	75	45	20
-40	124	71	30

SOURCE: N. Y. State Agr. Col. (Data taken from Overton and Roberts' Farm Management and Marketing, Lippincott, 1936.)

EXPLANATION: This table gives the relative size of the United States corn crops and the manner in which prices are affected in three different sections.

QUESTIONS: 1. Does the price fluctuate as much in the corn deficit area of Georgia as it does in the surplus area of Iowa?

2. How does the Chicago price respond in relation to Georgia and Iowa?

3. Is your county or state a corn deficit area? If so how do the prices respond in comparison to Chicago and Iowa?

4. Does this information suggest any profitable readjustments on your farm as to corn production?

3. Corn Production Yield And Price, By States.

State	Ave. Acreage corn harvested (1927-1931)	Ave. yield per acre 1922-1931 bus.	Price for crop of 1933 (cents)
Iowa	11,279,000	38.0	50
Nebraska	9,506,000	24.1	41
Illinois	8,965,000	35.2	50
Kansas	6,644,000	19.8	44
Missouri	6,088,000	26.6	45
South Dakota	4,977,000	21.3	47
Indiana	4,476,000	34.5	47
Minnesota	4,461,000	31.0	44
Ohio	3,489,000	36.2	50
Oklahoma	3,162,000	16.4	55
Kentucky	2,900,000	23.2	58
Tennessee	2,854,000	21.2	60
Wisconsin	2,006,000	32.8	53
Virginia	1,502,000	22.9	68
Michigan	1,277,000	29.6	55
Pennsylvania	1,232,000	40.0	62
North Dakota	1,028,000	21.5	43
Maryland	507,000	31.6	61
West Virginia	439,000	26.4	69
North Carolina	2,139,000	18.6	73

SOURCE: U. S. D. A. Yearbook, 1935.

EXPLANATION: Several Southern states have larger corn acreages than a few of the states in this table. The central and eastern portions of the United States produce seventy percent of the total corn crop. The Annual production of the United States is usually two and one-half to three billion bushels.

QUESTIONS; 1. How does Virginia rank in average yield per acre? What State has the highest yield?

2. What accounts for the higher price in Virginia and the East in general as compared to the Mid-West?

3. What accounts for the low yield in Virginia as compared to Pennsylvania, a short distance to the North?

4. What factors determine the price of corn?

4. How The Nation Consumes Its' Corn Crop.

	Percent
Fed to hogs	40.0
Fed to horses and mules on the farm	20.0
Fed to cattle on farms	15.0
Fed to poultry on farms	4.0
Fed to sheep on farms	1.0
Human food on farms	3.5
Fed to stock not on farms	5.5
Ground in merchant flour mills	6.5
Exports	1.5
Other uses	3.0
Total	100.0

SOURCE: Overton and Robertson, Farm Management and Marketing, Lippincott, 1936.

EXPLANATION: This tabulation suggests the possible outlets for the yearly corn crop of the United States based on present consumption.

QUESTIONS: 1. What percentage of the corn crop goes to feed livestock?

2. What part of the crop leaves the farm and enters commercial lanes?

3. What percentage of the crop is exported?

4. Is there any reason to believe that any of these outlets for corn will be materially changed in the near future?

5. Relation Between Size Of U. S. Corn Crop, Price Per Bushel And Total Value Of Crop.

Corn crop size in percent of average	Corn price in percent of average	Total value in percent of average
120	50	60.0
110	75	82.5
100	100	100.0
90	125	112.5
80	150	120.0
70	175	122.5
60	200	120.0

SOURCE: Iowa Exp. Sta. Rpt. 1937.

EXPLANATION: This table shows the relationship between the size of the United States corn crop, the Iowa farm price and the total value of the crop. While this table is based on Iowa prices in relationship to the total United States crop, the same principle holds good in Virginia.

QUESTIONS: 1. What does this table point out in reference to the total value of a small crop as over against a large crop?

2. Does this same principle hold good for each individual farm?

3. What about the percentage rate of decrease in value with a large crop as compared to the percentage rate of increase in value with a small crop?

4. Would the value of a series of average sized crops be worth more or less than a series of large and small crops?

5. Would a storage plan smooth out fluctuations in crop sizes, increase total crop values and stabilize prices?

6. Virginia Corn Crop Statistics From 1928 to 1938.

Year	Acreage (000)	Yield Bus. per A.	Production (000) bus.	Farm price per bus.	Value	
					Total (000)	Per acre
1928	1,499	23.0	34,477	$1.09	$37,580	$25.07
1929	1,454	24.0	34,896	1.05	36,641	25.20
1930	1,498	11.0	16,478	0.97	15,984	10.67
1931	1,527	26.0	39,702	0.44	17,469	11.44
1932	1,466	18.0	26,388	0.52	13,722	9.36
1933	1,539	22.5	34,628	0.68	23,547	15.30
1934	1,416	22.0	31,152	0.87	27,102	19.14
1935	1,501	24.5	36,774	0.81	29,787	19.84
1936	1,396	21.5	30,014	1.06	31,815	22.79
1937	1,480	25.5	37,740	0.68	25,663	17.34
1938	1,391	25.0	34,795	0.61	21,213	15.25

SOURCE; Va. Farm Statistics 1937-38, Richmond, 1939.

EXPLANATION: These figures were compiled by the Virginia Cooperative Crop Reporting Service and cover eleven yea rs (1928-1938).

QUESTIONS: 1. If it costs approximately fifteen dollars to raise a bushel of corn, what has been the circumstance of the average Virginia farmer in respect to profit on his corn crop since 1930?

2. Is there a ny profit on an average for the farmer raising 25 bushels per acre?

3. What is an adeq uate price for the farmer per bushel?

7. Virginia Production Statistics For Corn And Associated Crops In 1938.

Crop	Acreage (000)	Yield in bus. per A.	Production in bus.(000)	Farm price	Value	
					Total (000)	Per acre
Corn	1,391	25.0	34,795	$0.61	$21,213	$15.25
Wheat	609	14.0	8,526	0.70	5,968	9.80
Oats	92	21.5	1,978	0.39	771	8.38
Barley	55	24.0	1,320	0.55	726	13.20
Rye	38	11.5	437	0.74	323	8.50
Buckwheat	13	12.5	162	0.72	117	9.00
Tame hay	1,052	1.08 Ts.	1,138 Ts.	11.30 Per T.	12,859	12.22

SOURCE: Va. Farm Statistics 1937-38, Richmond, 1939.

EXPLANATION: The above figures were compiled by the Virginia Cooperative Crop Reporting Service at Richmond.

QUESTIONS: 1. How does corn rank in importance as a Virginia crop?

2. What small grain crop would be the most profitable in a rotation with corn?

II. DETERMINING COST OF GROWING CORN.

1. Cost Of Producing An Acre Of Corn In Missouri As Compared To Other Crops

Crop	Average cost per acre
Corn	$15.98
Oats	11.11
Wheat	13.31
Rye	10.67
Clover hay	7.22
Timothy hay	6.71
Alfalfa hay	19.80
Soybeans for seed	14.28
Cowpeas for hay or silage	13.53

SOURCE: Mo. Agr. Exp. Sta. Bul. 165, 1919.

EXPLANATION: These figures are not given as exact costs but are given as approximate differences in costs of producing different crops in the state of Missouri.

QUESTIONS: 1. Is the net value of a crop more important than the gross value? Explain.

2. How do these crop costs compare in your community? On your farm?

2. Cost Of Growing Corn In Mississippi.

Rent on land	$4.00
Fall plowing	1.00
Harrowing and planting	1.00
Seed	0.50
Six cultivations	3.00
Hoeing	1.00
Harvesting	2.00
Total	$12.50

SOURCE: Miss. Agr. Exp. Sta. Bul. 170, 1915.

EXPLANATION: These data have been assembled by the Mississippi Experiment Station and are based on a one-acre unit. No cost for fertilizer is included.

QUESTIONS: 1. Do these figures coincide with the cost in your community?

2. What is your opinion as to the cost of growing corn in comparison to other crops in your community?

3. What is the main cost in producing corn: rent of land, seedbed preparation and planting, cultivation, or harvesting?

3. Planting And Cultivating Costs.

Operation	Labor per acre			Cost per acre in dollars
	Man hours	Horse hours	Tractor hours	
	One-animal power unit			
Planting	3.09	3.09		$0.70
Two cultivations	5.71	5.71		1.28
Total	8.80	8.80		1.98
	Two-animal power unit			
Planting	0.67	1.33		0.31
Two cultivations	2.33	4.66		0.76
Total	3.00	5.99		1.07
	Tractor power unit			
Planting	0.50		0.50	0.24
Two cultivations	0.79		0.79	0.23
Total	1.29		1.29	0.47

SOURCE: Fifty-first Ann. Rpt. S. C. Exp. Sta. Clemson, S. C. 1938.

EXPLANATION: This study revealed the comparative labor costs for planting and cultivating corn with different power units at the Clemson College Farms in 1938. The one-animal unit consisted of the usual one-horse equipment, the two-animal unit consisting of a two-row planter and a riding cultivator, and the tractor equipped unit with a two-row planter and a two-row cultivator. The above figures were computed for planting costs and two cultivations. The fields used were bottomland and well prepared before planting. The one-animal unit was based on four and two-tenths acres; the two-animal unit on nine acres; and the tractor unit on 22.25 acres. Labor costs were figured at the rate of 12.5 cents per hour for the one-animal and two-animal units and 17.5 for the tractor unit. Horse labor was computed at ten cents an hour. Charges for the tractor were

figured on fuel at eleven cents per gallon and oil at forty cents per gallon. No allowances were made for depreciation and upkeep.

QUESTIONS: 1. What factors should determine the kind of power to use in corn cultivation?

2. What is the trend in kind of power being used? Why?

3. Under what circumstances does it pay to use horse power? Tractor power?

4. If depreciation had been figured, what affect would it have had on these figures?

4. Comparison Of Work Units Per Acre For Corn And Other Crops.

Kind of work per acre	Man units	Horse units
Corn for grain husked from standing stalks	3	5
Corn cut by hand and husked from stalks	4.5	5
Corn hogged down	2	4
Corn for silo	3.5	6
Wheat and rye	1.5	3
Oats and barley	1	2
Hay, per cutting, alfalfa, timothy, clover	1	1
Soybeans and cowpeas for seed	3	5
Grains cured for hay, including soybeans	2	3
Seeds, alfalfa, clover, timothy	1	1

SOURCE: Overton and Robertson, Farm Management and Marketing, Lippincott, 1936.

EXPLANATION: This table gives a comparison of the labor units required for certain farm crops, particularly corn and affiliated rotation crops. A man work unit is the amount of work done by one man in ten hours. A horse unit is a ten-hour day for one horse.

QUESTIONS: 1. How does the amount of labor for corn husked on the standing stalk compare with that cut by hand and husked in the shock?

2. How does the labor requirement of the small grains compare to corn?

5. Comparison Of Cost Of Corn And Other Crop Seeds In Relation To Returns.

Crop	Quantity of seed per acre, bu.	Market price per bu., cts.	Cost of seed per acre	Average yield per acre, bus.	Value of crop per acre	Cost of seed as percentage of returns
Corn	0.3	64.4	$0.19	25.8	$16.65	1.14
Beans	0.5	600.0	3.00	15.0	90.00	3.33
Oats	2.0	43.8	0.88	29.7	12.99	6.77
Barley	2.0	54.3	1.09	25.8	14.00	7.79
Wheat	1.5	98.6	1.48	16.6	16.41	9.02
Potatoes	10.0	48.9	4.89	109.5	53.56	9.13

SOURCE: Hutcheson, Wolfe and Kipps, Production of Field Crops, McGraw-Hill, 1936.

EXPLANATION: This shows comparative costs of seed of different crops per acre and its relation to the total crop value.

QUESTIONS: 1. Does seed cost constitute a large or small percentage of the total crop value?

2. How does the cost of seed for corn compare to the other crops?

III. CORN-GROWING EQUIPMENT PROBLEMS.

1. Floor Space And Head Room Required By Various Machines For Corn Production On An 160 A. Farm.

Implement	Floor space, feet	Height, feet
Corn planter (2-row, tongue off)	6 x 6	3½
Two riding cultivators (tongue off)	5 x 8	4
Silage cutter	5 x 12	7
Corn binder	13 x 6	7
Spike tooth harrow (hung on wall)		
Tractor	7 x 14	7
Tractor disk	6 x 12	4
Wagon with box	5½ x 11	6½
Corrugated roller (tongue off)	4 x 9	4
3-bottom engine gang plow	5 x 9	5
Sulky plow	3 x 8	3
Disk harrow (tongue off)	6 x 9	4

SOURCE: Ind. Ext. Bul 84, 1919.

EXPLANATION: This table is supplied to enable a farmer to plan for space needed for an implement shed, emphasizing certain machinery used on an 160-acre farm where corn is a major crop.

QUESTIONS: 1. How much minimum floor space would one want to house a tractor, corn planter, two riding cultivators, a corn binder and a tractor disk?

2. How much corn acreage justifies the investment suggested in question one?

2. Percentage Distribution Of The Total Annual Expense Of Implements Used In Corn Production.

Kind of implement	Number of implements	Original cost of implement	Percent of original cost			
			Total annual expense	Annual depreciation	Annual repair expense	Other annual expense
Corn sheller	29.0	$ 12.10	8.3	4.0	0.2	4.1
Ensilage cutter	8.7	287.93	11.7	5.2	3.0	3.5
Two-horse corn planter	95.5	61.09	11.1	5.6	1.5	4.0
Manure spreader	38.2	126.74	11.1	6.3	1.0	3.8
Lime spreader	18.0	59.73	11.5	6.3	1.5	3.7
Two-horse cultivator	176.0	56.45	19.0	6.4	2.9	9.7
Rotary hoe	12.5	76.32	14.8	8.8	1.9	4.1
Cultipacker	30.0	62.27	8.9	4.3	0.8	3.8
Roller	28.2	35.00	8.7	4.1	0.8	3.8
Spike harrow	150.0	17.70	15.2	6.4	5.0	3.8
Disk harrow	132.0	47.69	13.0	5.3	3.6	4.1
Sulky plow	33.0	52.64	14.3	5.1	5.5	3.7
Three-horse plow	151.0	19.74	21.6	4.8	13.0	3.8
Tractor	42.5	830.56	17.8	10.4	1.9	5.5
Tractor plow	27.5	128.55	11.6	6.1	1.9	3.6
Tractor disk	40.5	122.28	12.0	6.6	1.7	3.7
Tractor cultivator	8.5	141.94	12.6	7.6	1.0	4.0

2. Cont'd.

Kind of implement	Number of implements	Original cost of implement	Percent of original cost			
			Total annual expense	Annual depreciation	Annual repair expense	Other annual expense
Corn husker				8.84		
Corn binder				7.80		
Corn grader				10.85		

SOURCE: Ky. Agr. Exp. Sta. Bul. 345, 1933.

EXPLANATION: Data on the last three implements came from Minn. Agr. Exp. Sta. Bul. 179. The fractions referred to in the column "number of implements" indicate some machines owned in partnership. This column gives the number of machines entering into the study. The figures in all cases were based on original cost. The last three columns on the right equal the column entitled "total annual expense".

QUESTIONS: 1. How can these data be put into practical use?

2. Do you think it would pay a farmer to buy a corn husker if he has only ten acres of corn to husk?

3. How do these costs compare with costs in your community?

3. Standard Day's Work By Different Tillage Practices.

	Acres
Plowing with horses:	
Walking, 14-inch, one man, two horses	1.9
Sulky, 14-inch, one man, four horses	2.6
Gang, 24-inch, one man, four horses	4.1
Gang, 24-inch, one man, six horses	4.9
Plowing with tractor:	
Two-plow	6.7
Three-plow	8.2
Four-plow	10.4
Disking with horses:	
Eight-foot single disk, well-packed land, one man, four horses	17.1
Eight-foot single disk, freshly plowed land, one man, four horses	15.2
Harrowing with horses:	
Sixteen-foot spike-tooth, one man, four horses	38.7

SOURCE: U. S. D. A. Yearbook 1922.

EXPLANATION: This table gives the average amount of work done in a ten-hour day on an average Corn Belt farm.

QUESTION: 1. How long would it take to plow a forty-acre field with a 14-inch walking-plow? Two-plow tractor?

IV. SELECTING LAND FOR CORN

1. Yield Of Corn As Related To Depth Of Top-Soil.

Soil type	Depth of top soil					
	None	1"-4"	5"-7"	8"-11"	12"-15"	16" or more
	Average yield of bushels, 1936					
Tama silt loam	24	27	42	48	51	58
Tama silt loam (lt. col. phase)	15	19	27			
Carrington loam	21	25				

SOURCE: Iowa Agr. Exp. Sta. Rpt. 1937.

EXPLANATION: This test was for the purpose of determining whether depth of top soil had any bearing on the yield of corn. The average yields were from 43 farms representing different soil series and depths of top soil.

QUESTIONS: 1. Does this datum indicate that depth of top soil has a definite relation to yield of corn?

2. Of what importance does this information lend to the necessity of soil conservation?

2. Soil Losses From Erosion Under Corn And Other Cropping Systems.

Cropping system	Soil loss in tons per acre
Continuous cotton	19.7
Cotton in rotation	9.3
Continuous corn	46.7
Corn in rotation	18.4
Average for rotation plots	10.9
Grass	0.5
Fallow	65.1

SOURCE: Agr. Edu., Vol. 13, No. 7 and 8; Clemson, S. C.

EXPLANATION: These data were computed from controlled plots of the nine experiment farms of the Federal Soil Conservation Experiment Stations located at different points in the United States. The figures represent averages. The different stations had different soil types and the rainfall varied from 20 to 45 inches. Degree of slope was 3.75% to 16%. Rotations varied, such as, corn, oats, cotton; corn, wheat grass, grass; cotton, wheat, sweet clover; cotton, corn, wheat, lespedeza; and so on. All the different systems were tested on the various degrees of slope.

QUESTIONS: 1. Should certain tillable soil be retired from corn and planted to grass?

2. Is a rotation system the only solution to the erosion problem?

3. Compare fallow land with grass land for the affect that soil erosion has on each?

3. Soil Losses At Various Slopes From Continuous Corn And Cotton.

Slope group	Degree of slope in percent	Soil loss in tons per acre	
		Continuous cotton or corn	Av. for rotations
B	Above 3-7	18.8	8.3
BB	Above 7-10	29.9	10.2
C	Above 10-14	36.2	5.3
D	Above 14	88.3	25.3

SOURCE: Agr. Edu., Vol. 13, No. 7 and 8, Clemson, S. C.

EXPLANATION: These data were averaged from controlled plots at nine different experiment stations of the Federal Soil Conservation Experiment Stations scattered at various points in the United States. The rotations varied such as corn, oats, cotton; corn, wheat, grass, grass; cotton, wheat, sweet clover; cotton, corn, wheat, lespedeza; and so on. Soil types varied also. Rainfall varied from 20 to 45 inches.

QUESTIONS: 1. What do these data indicate as to the general effectiveness of rotations as compared with continuous row crops?

2. Do you consider rotation as the sole solution to the erosion problem?

3. Is corn adapted to the steeper slopes?

V. SELECTING VARIETY.

1. Variety Tests At Blacksburg.

Variety	Years in test	Av. yield in bus.
Improved White Dent	8	59.59
Improved Leaming	8	57.30
Virginia Ensilage	8	57.19
Silver King	6	56.98
Improved Golden Dent	7	55.17
Boone County White	8	54.14
Golden Queen Va.	7	53.93
Dixie	8	53.27
Cocke's Prolific	7	52.02
Reid's Yellow Dent	8	51.68
Snowflake	8	51.64
Va. Yellow Dent	7	50.63
Bigg's Seven Ears	6	47.46
Pamunkey Ensilage	8	47.25
Mosby's Prolific	6	46.77
Lancaster Sure Crop	7	46.00
Eureka Ensilage	8	42.77
Hickory King	8	45.44

SOURCE: Unpublished data of Va. Agr. Exp. Sta. at Blacksburg.

EXPLANATION: These tests were conducted at the Blacksburg Station during the period 1931 to 1938 inclusive. The varieties were obtained from many sections of the country, especially commercial seed companies.

This experiment is being continued. Tennessee Red Cob has given a fine yield but has been tested for but two years. A number of other varieties are on test including many hybrids but the yields have not been impressive or have not been tested long enough to draw any conclusions so they have been omitted.

QUESTIONS: 1. What varieties yielded the highest?

2. How did these yields compare with those on your farm?

3. What objections are there to taking variety tests as literal indications as to corn yield?

2. Variety Tests At Glade Spring.

Variety	Years in test	Av. yield per acre		Days to mature
		Grain, bus.	Stover, tons	
Johnson Co. White Dent	8	62.69	1.81	144
Mountain White Dent	9	60.37	1.82	141
Boone Co. White Dent	9	60.13	2.02	145
Leaming	7	59.39	1.70	140
Cocke's Prolific Ensilage	9	58.06	2.33	142
Golden Queen	8	57.78	1.63	138
Wood's Golden Prolific	5	57.71	2.23	145
Lancaster Co. Surecrop	9	57.32	1.53	136
Reid's Yellow Dent	9	57.25	1.64	141
Pamunkey Ensilage	8	56.44	2.60	146
Virginia Ensilage	9	56.26	2.48	147
Golden Dent	9	55.60	1.79	142
Jarvis Golden Prolific	7	54.92	1.84	147
Eureka Ensilage	9	54.26	2.76	147
Highland King	9	53.13	1.29	130
Trucker's Favorite	7	48.88	1.31	135

SOURCE: Unpublished data of the Va. Agr. Exp. Sta. at Glade Spring.

EXPLANATION: These tests on corn varieties were conducted at the Glade Spring Substation for the number of years stated up to and including 1938. This is in the mountain area in lower Southwest Virginia.

QUESTIONS: 1. What three varieties were the highest yielding?

2. What three varieties should yield the most stover for ensilage?

3. What three varieties should be best adapted to a short growing season?

3. Variety Tests At Appomattox.

Variety	Yrs. on test	Av. yield in bus. per acre	Av. yield of stover, tons per acre
Latham's Double	6	58.7	2.08
Va. White Dent	10	52.2	1.55
Collier's Excelsior	6	49.7	1.49
Va. Yellow Dent	16	48.5	1.35
Reid's Yellow Dent	16	45.4	1.34
Golden Dent	9	44.6	1.27
Casey's Purebred	11	44.0	1.21
Leaming	16	43.9	1.32
Boone County White	16	43.5	1.43
Va. Ensilage	15	41.1	1.26
Blount's Prolific	12	41.0	1.26
Johnson County	11	37.8	1.31
Cocke's Prolific	14	37.0	1.34
Gold Standard	12	37.0	1.18
Trucker's Favorite	15	34.7	1.13
Silver King	16	34.2	1.05

SOURCE: Unpublished data of Va. Agr. Exp. Sta. at Appomattox Substation.

EXPLANATION: These tests were started in 1922 and while some have been on test up to 1938, others have been added. Some good varieties are not reported because they have been on test for less than six years. As with the other stations in Virginia hybrid trials are all-important at the present time but in most cases only one or two year's results are available. The soil at this station is Cecil clay loam. Fertilizer was applied at the rate of 200 pounds of 3-8-3 in the corn variety tests. Appomattox is in the Piedmont area of

Southern Virginia.

QUESTIONS: 1. Considering the number of years on test, what two varieties would you consider the surest bet for a good yield in the Piedmont area?

2. Does the yield of stover tend to be in ratio to the yield of grain?

4. Variety Tests At Caroline County Substation.

Variety	No. years tested	Yield per acre bus.	Stover yield per acre, lbs.
Biggs Seven Ears	11	47.3	3050
Collier's Excelsior	7	46.0	3129
Leaming	10	45.5	2977
Boone County White	11	43.0	3520
Johnson County White	7	42.5	3256
Va. White Dent	11	42.3	3741
Woodburn W. D.	11	41.3	3327
Reid's Yellow Dent	11	40.9	3129
Cocke's Prolific	11	40.4	4007
Va. Golden Dent	11	39.8	3325
Va. Ensilage	11	39.4	3709
Hickory King	10	38.6	3741
Silver King	11	33.6	2402

SOURCE: Unpublished data Va. Agr. Exp. Sta. at Caroline County Substation, 1939.

EXPLANATION: These tests were started in 1927 and most of them continued until 1937. Two crops were thrown out of the tabulated averages because of drouth one year and worm damage another. This station is located in the Coastal Plain area.

QUESTIONS: 1. What varieties gave good yields in the Coastal region?

2. How did these yields compare with yields on your farm?

5. White vs. Yellow Corn For Feeding Hogs.

Item	Yellow corn, tankage	White corn, tankage
Number of pigs	8	8
Average days on experiment	183	211
Weights		
Average initial weight	69	68
Average final weight	230	229
Average daily gain	0.88	0.75
Average daily ration		
Corn	3.78	3.67
Tankage	0.39	0.37
Total	4.17	4.04
Feed per 100 pounds gain		
Corn	428	487
Tankage	44	50
Total	472	537

SOURCE: Ill. Agr. Exp. Sta. Bul. 281, 1926.

EXPLANATION: This table gives the results from using white and yellow corn rations for pigs of seventy pounds weight. All weights are expressed in pounds. Each pig was taken from the experiment when it weighed approximately 225 pounds. One pig on the white corn ration died after 232 days. It had convulsions every few days for two weeks preceding death. Two other pigs on white corn staggered during the last month of the experiment. The test was on strictly dry lot and tankage was fed with the corn in each instance.

QUESTIONS: 1. How many more days did it take to reach 225 pounds with the white corn?

2. Which method took the least feed for 100 pounds gain? Does this experiment throw light on the problem of what color corn to raise?

3. How did the two methods compare in health? (Lack of vitamin A in white corn is apparently responsible for the lower feeding value).

VI. DETERMINING BEST METHODS OF SELECTING SEED.

1. Effect Of Rows Of Kernels On Yield.

Number of rows of kernels	3 year av. in bus.
14 and below	43.5
16	45.0
18	44.1
20	43.9
22	43.5
24	40.6

SOURCE: Iowa Agr. Exp. Sta. Bul. 257, 1929.

EXPLANATION: This experiment was conducted at the Iowa station and the average covers three years.

QUESTIONS: 1. Did ears with the higher number of rows of kernels yield more than the lesser number?

2. What number of rows yielded the most?

2. Type Of Ear As Related To Yield.

Relative Yields of Various Types of Seed Ears of the Same Variety of Corn.

Type of ears	Yields in bushels per acre			
	1906	1907	1908	Average
Cylindrical, rough dented	64.1	72.0	26.9	54.3
Cylindrical, smooth dented	60.8	73.3	21.8	51.9
Tapering moderately rough	54.2	66.7	22.3	47.7
Long and thin moderately rough	55.9	71.1	24.8	50.7
Short and thick, moderately rough	56.1	73.8	25.9	51.9

SOURCE: Ind. Agr. Exp. Sta. Cir. 2, 1909.

EXPLANATION: Five distinct types of ears were chosen from the same lot of corn. The selected ears of each of the five types were shelled together and planted in separate blocks, the sets of five blocks being repeated four times so as to eliminate the affects of soil and situation. The average yield of the four blocks of each of the five types was determined.

QUESTIONS: 1. From the above table which type of ear is a farmer justified in selecting for seed purposes?

2. Did the tapering ears compare favorably with the other types?

3. What Kernels On The Ear Should Be Planted?

No. of kernels dropped	Middle kernels only	Whole ear	Deep and shallow kernels mixed	Deep kernels only	Shallow kernels only
1		1 time			2 times
2	8 times	6 times	5 times	4 times	2 times
3	92 times	66 times	75 times	92 times	95 times
4		25 times	18 times	4 times	1 time
5		1 time	2 times		
6		1 time			

SOURCE: Ind. Agr. Exp. Sta. Cir. 2, 1909.

EXPLANATION: This table shows the result of dropping tests with graded and ungraded corn. The corn was run through a planter for one hundred drops and carefully recorded.

QUESTIONS: 1. Does it pay to discard the butt and tip kernels if a uniform stand is desired?

2. How would you proceed if you desired a uniform drop of three grains to the hill? (95 out of 100 should drop three to the hill).

3. Is there any relationship between ungraded seed and a poor stand?

4. Relation Of Luster To Viability.

Color	Percentage viability	Percentage of ears testing disease-free	Percentage of ears testing badly diseased
Very bright golden yellow	97.4	44.3	19.8
Bright golden yellow	96.9	38.7	28.4
Dull lemon color	96.9	30.9	32.8
Smooth	94.6	28.3	33.6

SOURCE: Tieman, O. P., "Physical Characteristics of Disease-Free Seed Corn". Jour. Am. Soc. Agron., Jan. 1924.

EXPLANATION: This test was conducted by Tieman. He states that the same results were experienced for white corn, the pearly white being more desirable than the milky white kernels. He concludes that mature, firm seed ears of average size, which show very bright color or luster, medium or smooth indentation, and fairly good depth of kernel, should be selected for seed.

QUESTIONS: 1. Did bright ears have a higher viability and were they freer from disease?

2. Are the characters described in the concluding statement of the explanation observed easily and quickly? Can they be ascertained by the average farmer?

5. Effect Of Kernel Indentation On Yield.

Station	No. of years	Smooth, bus.	Medium, bus.	Rough, bus.
Iowa	3	45.08	43.8	43.7
Ohio	7	65.30		63.6
Nebraska	6	59.10		54.1 Long
Nebraska	6	57.10		57.3 Short
Nebraska	2	69.60		64.0
Nebraska	6	57.30		53.3
Minnesota	1	21.40	21.9	20.6

SOURCE: Hughes and Henson, Crop Production, MacMillan, 1930.

EXPLANATION: This is a summary of tests conducted at various experiment stations to determine if the indentation on the kernel of corn affected the yield. The above terms, rough, medium and smooth are relative. Varieties offered considerable differences also, so that each variety had to be classified as to its mean degree of roughness.

QUESTIONS: 1. Generally, did smooth kernels outyield rough kernels in a given variety?

6. Effect Of Kernels With Starchy, Medium And Horny Endosperm On Yield.

Starchy	41.7 bus.
Medium	44.1 bus.
Horny	46.0 bus.

SOURCE: Iowa Agr. Exp. Sta. Bul. 257, 1929.

EXPLANATION: An excessive proportion of soft starch as seen on the backs and tips of kernels causes opaque, irregular shaped patches in the center and back of the kernel and crown. This may be hereditary or it may indicate immaturity. The horny starch is the semi-transparent, flinty textured starch on either side of the kernel. The above test covered a three-year period. A total of 1276 mother ears was observed. The corn was Reid Yellow Dent.

QUESTIONS: 1. Did starchy or horny ears yield the most?

2. Was the difference in yield significant?

7. Effect Of Yield-Tested And Selected Seed Corn On Corn Yields.

	No. of farms	Av. corn yields
Seed corn not tested in a state or county test plot and not of a high yielding variety.	152	46.6
Seed corn not tested in a state or county test but of a high yielding variety.	100	51.1
Seed corn tested in a state or county test plot and a high yielding variety.	110	54.8

SOURCE: Iowa Agr. Exp. Sta. Bul. 360, 1937.

EXPLANATION: These data were compiled in answer to a section in a questionnaire sent to 400 farmers in Iowa on certain farm practices. The corn yields are expressed in terms of bushels.

QUESTIONS: 1. Does it pay to plant a known high yielding variety that has been plot tested?

2. What was the difference in yield of these various practices?

8. Value Of Using Local Adapted Seed.

	Strain	Treatment	Yield in bushels per acre	Increase, percent
1.	(Home-grown	Detasseled	52.30	31.7
	(Halifax County	Not detasseled	39.70	
2.	(Home-grown	Not detasseled	69.75	7.6
	(Halifax County	Detasseled	64.80	
3.	(Home-grown	Not detasseled	64.20	13.2
	(Halifax County	Not detasseled	56.70	

SOURCE: Va. Agr. Exp. Sta. Bul. 202, 1913.

EXPLANATION: This was the result of crossing strains of Boone County White corn. An unrelated strain of Boone County White was planted in alternate rows with a local strain. Three different plots were planted far enough apart so that there would be no intercrossing of corn. The purpose was to determine the relative producing power of the two strains. The test was at Blacksburg.

QUESTIONS: 1. Did local adapted seed out-yield the strain of corn from Halifax County?

2. Of what significance was this test to the farmer?

VII. IMPROVING CORN BY BREEDING.

1. Does Crossing Strains Of Corn Result In Increased Yield?

Variety	Source of seed	Yield of grain in bus. per acre.	Yield of fodder in tons per acre.
Leaming	Indiana	27	1.2
Leaming	Illinois	32	1.2
Leaming	Virginia	35	1.4
Leaming	Nebraska	33	1.2
Mixture of all 4 strains Leaming		40	1.5
Boone County White	Kentucky	30	1.3
Boone County White	Indiana	34	1.4
Boone County White	Illinois	32	1.7
Boone County White	Virginia	34	1.2
Mixture of 4 strains of B. C. W.		37	1.5

SOURCE: Va. Agr. Exp. Sta. Bul. 202, 1913.

EXPLANATION: These were supposedly pure strains and had been grown in the localities for a number of years. In the mixtures equal amounts of each strain were used. This sort of breeding is a form of hybrid and its' vigor is good for but one year; thus seed from the mixtures would not yield as high another year.

QUESTIONS: 1. How did the mixed strains yield in comparison with the other pure strains?

2. Is this method of increasing yield a practical farm method?

2. Comparison Of Open-Pollinated vs. Hybrid For Disease Resistance, Vigor And Yield.

	Percent field stand	Percentage of plants:			Percentage of ears:		Yield per acre, bus.
		Inclined over 30 degrees	Smutted	Barren	Rotted	Immature	
Open-pollinated	88.5	12.8	2.5	14.2	3.3	0.6	90.5
Hybrid F1	94.7	0.1	0.1	0.1	1.8	3.9	117.2

SOURCE: Ill. Agr. Exp. Sta. Bul. 255, 1924.

EXPLANATION: The purpose of this experiment was to test the disease resistance of hybrid seed over the parent stock. In this case the hybrid was the first generation of the open-pollinated variety used in this test. In doing so the increased yield was in evidence. Ten duplicate tests were used in this experiment.

QUESTIONS: 1. How did the hybrid compare with the open-pollinated for crop stand? Straight plants? Disease-free plants? Barren plants? Yield?

Note: Hybrids for Virginia are strictly in the experimental stage but interested persons may secure data on the present status of these investigations by writing to the Experiment Station at Blacksburg.

3. Breeding High And Low-Eared Plants.

Year	Position of ear	Days tasseling difference	Days silking difference	Height of: Ears	Height of: Plant	Difference in height of ears	Yield per acre: Grain, bus.	Yield per acre: Stover, lbs.
1910	High	3	3	4' 2"	8' 6"	1' 2"	33.21	4,330
	Low			3' 0"	7' 3"		45.44	2,740
1911	High	8	9	5' 1"	9' 8"	1' 8"	62.43	4,230
	Low			3' 5"	8' 2"		67.23	3,370
1912	High	10	11	4' 4"	8' 11"	2' 2"	69.77	4,489
	Low			2' 2"	6' 8"		53.02	2,289
1913	High	9	9	4' 6"	9' 10"	2' 2"	64.75	3,880
	Low			2' 4"	7' 8"		66.23	2,730
1914	High	8	10	5' 4.6"	10' 2.5"	2' 7"	55.87	5,240
	Low			2' 9.5"	8'		63.89	3,200
Five-year average						High	57.21	4,434
						Low	59.16	2,866

SOURCE: Ohio Agr. Exp. Sta. Bul 282, 1915.

EXPLANATION: The difference in days of tasseling and silking was in favor of the low-eared stalks since they matured earlier. The purpose of this test was to test the production of low-eared stalks as compared to high-eared stalks but it was apparent that earliness goes hand in hand with the low-eared stalks. The same variety of corn was used.

QUESTIONS: 1. How did the two types of stalks compare in yield of grain? Stover?

2. By continuous selection does it seem possible that an early, low-eared variety with light stover, can be developed?

4. Selection And Breeding As A Means Of Reducing Ear Rots And Increasing Yield.

Kind of corn	Year 1932	1933	1934	1935	1936	Average
	Commercial damage from rot					
Old type	16.9%	16.5%	17.0%	3.4%	4.0%	11.6%
Imp. Reid Yellow Dent	7.2%	13.1%	10.7%	2.0%	3.5%	7.3%
Ill. Hybrid 172	3.4%	4.1%	6.5%	1.5%	1.5%	3.4%
	Acre-yields of sound corn					
Old type	61.6 bus.	32.0 bus.	31.5 bus.	54.4 bus.	28.9 bus.	41.7 bus.
Imp. Reid Yellow Dent	69.3 bus.	34.4 bus.	42.9 bus.	57.1 bus.	29.4 bus.	46.6 bus.
Ill. Hybrid 172	76.8 bus.	45.1 bus.	56.9 bus.	67.7 bus.	32.2 bus.	55.7 bus.

SOURCE: Ill. Agr. Exp. Sta. Cir. 484, 1938.

EXPLANATION: These results were averages of tests made at several places in Illinois. The "old type" corn was an unimproved strain of Reid's Yellow Dent. This test does not recommend Illinois Hybrid 172 for growing in Virginia but rather it sets forth the possibilities of locally developed and adapted hybrids.

QUESTIONS: 1. What was the result of this test from the standpoint of freedom from commercial ear rot? Total yield per acre?

5. Comparison Of Crossed Corn With Its Parent Varieties And Inbred Strains.

Variety or Cross	Yield per acre, bus.
Century Dent 110	47.5
Leaming 112	44.4
Inbred Century Strain 110-2	15.3
Inbred Century Strain 110-4	16.8
Inbred Leaming Strain 112-1	42.7
Inbred Leaming Strain 112-4	11.1
Single Cross 110-2 x 110-4	51.2
Single Cross 112-1 x 112-4	45.6
Double Cross (110-2 x 110-4) x (112-1 x 112-4)	69.8

SOURCE: Conn. Agr. Exp. Sta. Bul. 207, 1918.

EXPLANATION: This illustrates the method used to produce hybrid seed corn. Here we have the single-cross hybrid and the double-cross hybrid.

QUESTIONS: 1. How did the inbred strains compare in yield to the parent strain?

2. How did the various crosses compare with the parent strain? Inbred strains?

VIII. TESTING SEED CORN.

1. Does It Pay To Run A Germination Test?

	No. of ears tested	Percentage of ears germinating					
		100%	80%	60%	40%	20%	0%
High testing lot	261	98.5		1.5			
Lowest testing lot	1231	22.7	28.7	23.6	15.4	7.30	2.40
Av. of 46 lots of ears from different sources	19751	51.1	25.0	12.8	6.6	2.88	1.42

SOURCE: Ind. Agr. Exp. Sta. Cir. 2, 1909.

EXPLANATION: The corn was selected from seed that was being offered for sale from varied sources and subjected to a germination test and the results tabulated. The seed came from farmers and seed companies.

QUESTIONS: 1. What was the outcome of this test as to the advisability of testing seed corn before planting?

2. How much seed corn is tested before planting in your community?

2. Importance Of High Germination.

Seed dropped per hill	When corn germinates 75 percent		When corn germinates 65 percent	
	Percent such hills	Total number such hills	Percent such hills	Total no. such hills per acre
4 sound	31.588	1024	17.845	578
3 sound, 1 dead	42.258	1370	38.454	1246
2 sound, 2 dead	21.105	684	31.059	1007
1 sound, 3 dead	4.664	151	11.143	361
4 dead	0.385	12	1.499	49
Total	100.000	3241	100.000	3241

SOURCE: Neb. Agr. Exp. Sta. Bul. 163, 1918.

EXPLANATION: This shows the chance distribution of plants when seed germinating 75 and 65 percent is planted four kernels per hill in hills 44 inches apart. This is an application or illustration of the law of chance. It is understood that these figures would be varied somewhat in farm practice to the extent that the mechanical planter varies somewhat in its' planting rate.

QUESTIONS: 1. Of what value is the application of the information developed by this experiment?

2. What is the value of knowing the germination of seed corn? If the germination is low should the planting rate be higher or lower?

3. How may the germination be determined?

4. When should corn be tested for germination?

IX. STORING, CURING, CARE OF SEED.

1. Yielding Power Of Seed Corn Stored In Different Ways.

Methods of Storage	1913	1914	1915	1916	1917	Five-year average
In rack over crib	97.50	94.33	97.83	92.33	99.50	96.30
In pile on floor over crib	92.00	89.00	97.00	92.17	98.33	93.70
In crib	88.17	92.67	95.33	72.33	98.50	89.40
In rack in warm room	96.67	95.50	98.83	95.83	99.17	97.20
In furnace room hung up	98.67	94.33	97.33	98.33	99.00	97.53
In bin of oats	87.17	94.83	98.83	85.00	98.33	92.83
	Yield of corn per acre in bushels					
In rack over crib	81.54	59.21	55.97	60.10	106.06	72.58
In pile on floor over crib	79.07	58.86	54.85	61.12	106.53	72.09
In crib	74.25	62.86	59.86	50.00	108.14	71.02
In rack in warm room	78.64	65.29	59.64	60.02	103.89	73.50
In furnace room, hung up	77.89	68.07	62.59	59.87	106.89	75.06
In bin of oats	72.32	66.57	55.88	53.75	107.50	71.20

SOURCE: Wallace and Bressman, Corn and Corn Growing, John Wiley & Sons, 1928.

EXPLANATION: This table illustrates the results of various storage methods on yields of corn as conducted at the Ohio Experiment Station. All corn was harvested the same time.

QUESTIONS: 1. What method of storage yielded best over the five-year period? Which the poorest?

2. Did this experiment suggest the desirability of farmers fixing a place in their furnace room, attic, or similar warm place for seed corn storage? It should be noted that ventilation is also important.

2. Relative Germination Of Corn Of Varying Moisture Content.

Moisture content of grain (percent)	10 to 15	15 to 20	20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	50 to 55	55 to 60	60 to 65
Temperature ranges in degrees F.											
32 to 28	100	100	100	85	75	71	69		33	31	0
24 to 20	100	100	96	77	67	13	12	12	6	0	0
16 to 12	100	100	88	34	12	0	0	0	0	0	0
8 to 4	100	98	47	7	0	0	0		0		
0 to -5	97	63	0	0	0	0	0	0	0	0	0

SOURCE: Neb. Agr. Exp. Sta. Bul. 188, 1923.

EXPLANATION: This table illustrates the results of tests for germinative ability in corn under various moisture conditions when subjected to various degress of freezing. The blank spaces in the table represent no tests. Corn standing in the field, when it has reached the hard glazed and well dented state, usually contains about forty percent moisture.

QUESTIONS: 1. In what way did this experiment illustrate why it is so important to protect seed corn from freezing until grain moisture has been reduced to less than 15 percent?

X. SELECTING AND APPLYING FERTILIZER AND MANURE.

A. Fertilizing

1. Effect of Different Fertilizer Depositor Designs on Yield.

Year	Type of depositor	Amount of fertilizer (4-12-4) per acre	Stand as percent of unfertilized	Increase in yield
		lbs.		bus.
1929	Old type-no deflector, no hood, fertilizer dropped in contact with seed	100	64	-1.7
		200	68	-2.3
		300	42	-18.0
		400	30	-29.1
1930	Same as above except fertilizer dropped midway between hills	100	91	0.4
		200	108	-2.4
		300	100	-0.1
		400	101	-3.7
1931	Improved type deflector and hood, fertilizer placed in narrow bands on each side of the seed	100	127	11.1
		200	97	16.9
		300	88	13.9
		400	90	21.4
1932	Same as above (1931)	150	95	19.9
		300	117	28.8

SOURCE: Ohio Agr. Exp. Sta. Spec. Cir. 53, 1938.

EXPLANATION: A 4-12-4 fertilizer was used. The deflector split the stream of fertilizer and threw half on one side of the row and half on the other. Thus none was brought into contact with the seed. The purpose of the hood is to widen the furrow made by the planter shoe and to hold back incoming soil until the fertilizer has reached the bottom of the furrow.

QUESTIONS: 1. Which method gave the best yields?

2. How much fertilizer gave the most profitable yield?

3. What adverse affect does the fertilizer have on the seed when it comes in direct contact with it?

2. Effect Of Fertilizer Placement On Yields Of Corn.

Method	Yield of corn		Stover, lbs. per acre
	Bushels per acre	Percent sound corn	
In hill	48.4	72.9	4663
Beside hill	51.1	80.4	5086
Deferred	29.8	50.7	4568
Broadcast	40.6	53.7	4663
No fertilizer	18.8	46.2	3815

SOURCE: Del. Agr. Exp. Sta. Bul. 192, 1935.

EXPLANATION: All the corn was planted June 1. The deferred application was made July 10 and was applied by hand as a side dressing. A 2-8-10 fertilizer was used. For the broadcast 400 pounds were used; other methods used 200 pounds. The "in hill" and "beside hill" treatments were applied by means of the corn planter at planting time.

QUESTIONS: 1. Which method gave the greatest yield?

2. How did the amount of fertilizer used compare with the "beside hill" method and the broadcast method?

3. Which methods took the most time and labor?

3. How Much Fertilizer To Use.

Response of Corn to Increasing Amounts of Fertilizer Applied in the Hill with Improved Type Corn Planter Fertilizer Attachment.

Year	Rainfall, ins.		Pounds of fertilizer treatment per acre						
	May	June	75	100	150	200	240	300	400
			Increase or decrease in bushels						
1929	8.84	4.10		6.2		12.0		11.4	-0.5
1930	1.59	2.86		-6.8		-2.3		-0.9	-5.2
1931	4.45	3.49		15.5		19.3		16.8	13.1
1932	1.93	3.44			14.4			24.5	
1933	4.77	1.67			0.2		-3.2	-4.1	
1936	2.53	1.80		0.7		0.7			
1937	3.52	4.98	15.0		22.0			32.8	

SOURCE: Ohio Agr. Exp. Sta. Spec. Cir. 53, 1938.

EXPLANATION: A 4-12-4 analysis was used until 1934; from then on a 2-12-6 fertilizer was used. This experiment was conducted at Wooster. The years 1934 and 1935 were left out of the table because treatments did not correspond to above.

QUESTIONS: 1. How important was the rainfall during May and June as a factor in determining the value of fertilizer to a crop?

2. What amount would you recommend for a wet growing season? Dry season?

3. What amount seemed to be most practical for an average season?

4. Does it take less fertilizer with this method of application than the broadcast method?

4. Fertilizer, Manure and Lime Test.

Treatment	Yields on Carrington loam		Yields on Tama silt loam	
	Yield of corn bus. per acre	Increase for treatment, bus. per A.	Yield of corn, bus. per acre	Increase for treatment, bus. per A.
Check	65.1		86.3	
Manure	76.3	11.2	93.1	6.8
Manure, lime, rock phosphate	87.1	22.0	96.4	10.1
Manure, lime, superphosphate	93.6	28.5	94.9	8.6
Manure, lime	86.3	21.2	95.7	9.4
Manure, lime, complete fertilizer	90.2	25.1	96.6	10.3

SOURCE: Iowa Exp. Sta. Rpt., 1938.

EXPLANATION: These tests by the Iowa Station in 1937 were for the purpose of determining the value of these various treatments. Iowa Hybrid 942 was the corn used. The complete fertilizer used was 2-12-6. Two check plots were averaged for Carrington loam and three for the Tama silt loam.

QUESTIONS: 1. Did the Carrington loam experiment show the value of manure, lime, and phosphorus fertilizer?

2. With the Tama silt loam experiment what method gave the best results?

5. Sodium Nitrate: When And How Much To Apply.

Amount of nitrate of soda, lbs.	Time of application	Bushels of grain per acre			
		1928	1929	1930	Av.
None		17.9	24.8	13.0	18.2
200	At planting	24.7	32.2	26.6	27.8
200	Knee high	30.1	40.3	29.1	32.9
200	Bunching to tassel	24.2	34.6	28.5	29.1
50 150	At planting Knee high	29.2	39.7	26.9	31.6
100 100	Knee high Bunching to tassel	28.5	36.2	28.3	30.8

SOURCE: S. C. Agr. Exp. Sta. Bul. 283, 1932.

EXPLANATION: The soil was of average fertility on the Clemson College farm. The figures for 1930 were for seven plots while for the other two years there were five plots each. The fertilizer was applied as a side dressing.

QUESTIONS: 1. What amount of nitrate of soda gave the best yield?

2. Which time of application effected the highest yield?

3. Did it pay to side-dress with nitrate of soda in this experiment?

6. Commercial Nitrogen Sources For Corn.

Nitrogen used	Increase, bus. per acre (av. 9 yrs.)
Nitrate of soda	11.6
Sulphate of ammonia	8.7
Leunasal peter	8.8
Calcium Cyanamid	10.2
Calcium nitrate	13.8
Urea	12.2
Av. yield of no nitrogen	22.4 total bus. per acre

SOURCE: Ann. Rpt. of Raymond Branch Exp. Sta., Miss., 1936.

EXPLANATION: This experiment was conducted from 1926 to 1935 inclusive, except 1932. The soil was bottom land of the Vicksburg silt loam series. The corn was planted around May 15. Cocke's Prolific was used. Fertilizer was applied as follows: 1926, 200 pounds 0-8-4 plus nitrogen at the rate of 22.5 pounds per acre; 1927-33, 300 pounds of 16 percent superphosphate, 200 pounds of Kainit, and nitrogen at the rate of 30 pounds per acre. In 1934 and '35, 300 pounds of 0-8-4 and 22.5 pounds of nitrogen were applied. No cover crop was grown any year. The fertilizer was applied in water furrow and bedded on. The "no fertilizer" treatment was the average of three averages.

QUESTIONS: 1. What nitrogen source gave the greatest increase in yields?

2. Does it pay to use nitrogen on this type of soil and under similar conditions?

7. Nitrate Of Soda vs. Ammonium Sulphate Test.

Amount of nitrogen applied	Source of nitrogen	Yield of corn	
		Yield per acre (2 yrs.)	Increase over check
Pounds		Bushels	Bushels
0	No nitrogen	37.7	
8	Nitrate of soda	20.6	-17.1
8	Sulphate of ammonia	31.3	-6.4
16	Nitrate of soda	49.0	11.3
16	Sulphate of ammonia	47.5	9.8
24	Nitrate of soda	51.6	13.9
24	Sulphate of ammonia	53.5	15.8
32	Nitrate of soda	55.6	17.9
32	Sulphate of ammonia	57.8	20.1

SOURCE: Va. Agr. Exp. Sta. Bul. 292, 1933.

EXPLANATION: This experiment was conducted at the Augusta County branch station on Berks silt loam. This information was taken for corn out of a rotation of corn, wheat and hay (3 yrs.). It was started in 1924. All plots received an annual application of three hundred pounds of sixteen percent superphosphate and fifty pounds of muriate of potash per acre. The nitrogen was applied to corn as a side dressing.

QUESTIONS: 1. Which source of nitrogen seemed to be most affective on this soil?

2. What amount of nitrogen gave the best results?

8. Effect Of Different Phosphate Carriers.

Material used	Av. yield in bushels for 14 years	
	Limed	Unlimed
No phosphate	36.00	25.47
Gypsum	38.06	27.59
Sulphur	38.86	28.97
Superphosphate	41.06	33.00
Bone meal	39.84	34.75
Basic slag	40.69	37.17
Raw rock	39.89	33.60

SOURCE: Unpublished data of Va. Agr. Exp. Sta. at Staunton, 1939.

EXPLANATION: This experiment on Berks silt loam in Augusta County is part of a rotation experiment involving corn, wheat and red clover. It is still going on and the above data includes the results for 1938. Lime on the limed plots is applied each six years. Phosphate is applied at the rate of 32 pounds of P_2O_5 annually. In addition each plot gets 20 pounds of nitrogen and 20 pounds of K_2O annually.

QUESTIONS: 1. What phosphate carrier gives the highest yield on the limed plots? Unlimed plots?

2. Does the addition of phosphate give higher yields in all cases?

9. Manufactured Nitrate Of Soda vs. Chilean.

Test	Av. yield for six replications, bus. per acre of corn			
	1938	1937	1936	3-year av.
American nitrate	40.2	43.7	54.4	46.1
Chilean nitrate	39.3	41.4	55.2	45.3
No nitrate	18.9	27.0	44.6	30.2

SOURCE: Unpublished data of the Va. Agr. Exp. Sta. at Holland, 1939.

EXPLANATION: Corn was treated with 400 pounds of 2-8-4 per acre at planting and the nitrate of soda was applied at the rate of 75 pounds per acre as a side dressing when it was 18 inches high and again when the tassels started showing. The three-year average represents 36 trials. This was in the Coastal Plain area.

QUESTIONS: 1. Did this experiment answer the farmers' question as to the value of these two types of nitrate of soda?

2. Did this test bring out the importance also of applying some form of readily available nitrogen to corn if most profitable yields are expected?

10. New Sources Of Phosphate For Corn.

Source of phosphate	Yield of corn in bus. per acre, av. of 2 series					
	1934	1935	1936	1937	1938	Av.
Super	44.30	45.40*	40.00	39.72	49.44	43.77
Di-calcium	46.05	43.10*	45.43	44.86	50.57	46.00
Triple	44.05	42.90*	43.14	44.00	52.86	45.39
Check	42.30	29.40*	42.86	44.57	47.15	41.26
Tri-calcium	43.90	32.90*	42.00	44.85	52.57	43.24
Raw rock		30.90*	40.00	46.85	47.44	41.30
Triple and gypsum	43.85	42.60*	40.29	42.57	49.72	43.81
Calcium-meta		32.00*	32.57	43.61	46.29	38.62
Triple and dolemite		50.60	40.00	43.71	47.72	45.51
Triple and ground slag		53.15	38.86	45.43	48.86	46.58
Triple and granular slag		46.55	39.43	42.85	48.86	44.42
Check		33.85	33.14	41.71	36.86	36.39

SOURCE: Unpublished data of Va. Agr. Exp. Sta. at Williams burg, 1939.

EXPLANATION: *Yield from one plot only. This experiment was conducted on Norfolk sandy loam in the Coastal Plain area. Fertilizer was applied at the rate of 300 pounds of 4-12-4 per acre with the phosphate source given. This corn was grown in a rotation of corn, potatoes and alfalfa (2 or 3 years). The potatoes got 1500 pounds of 5-8-5 per acre and alfalfa 800 pounds of 4-12-12 at seeding.

QUESTIONS: 1. Which phosphate yielded 45 bushels per acre or more?

2. How did the superphosphate compare with raw rock phosphate?

3. Was the raw rock much better than the check plot?

11. Rate Of Phosphate Per Acre.

Application of phosphate, lbs.	Yield of corn per acre	
	Grain, bus.	Stover, tons
None	27.6	0.74
100	38.3	0.93
200	44.6	1.09
300	43.9	1.06
400	44.1	1.13
500	44.6	1.17

SOURCE: Tenn. Agr. Exp. Sta. Bul. 149, 1933.

EXPLANATION: This experiment was conducted on Cumberland Plateau soil of good type. This table represents averages for limed and unlimed plots of four different crops of corn in a rotation of corn, oats, clover and grass.

QUESTIONS: 1. What rate of phosphate gave the best yield of corn at the least cost?

2. Does the evidence prove the value of phosphate for corn on this type of soil?

12. Minor Element Test At Williamsburg.

Treatment	Yield of corn per acre	
	Grain, bus.	Stalks, tons
60 lbs. Mg S O_4	32.2	0.88
50 lbs. Mn S O_4	40.0	1.00
50 lbs. Cu S O_4	35.4	0.82
30 lbs. Zn S O_4	42.2	1.02
Check	42.8	1.02
Special mono-Ca. Phos.	47.4	1.16
30 lbs. Flowers of Sulphur	45.4	1.16
5 lbs. K I	44.5	1.14
All elements	37.5	1.02

SOURCE: Unpublished data of the Va. Agr. Exp. Sta. at Williamsburg, 1939.

EXPLANATION: This test is being conducted on Norfolk sandy loam soil of the Coastal Plain area to determine the value of the addition of minor elements to a standard fertilizer. The above treatments were added to 400 pounds of 5-8-5 per acre.

QUESTIONS: 1. Was there any evidence in this test to point to the need of adding minor elements to the fertilizer for this type of soil?

2. Did some treatments seem to reduce yields?

13. Colloidal Phosphate Experiment.

Treatment per acre	Corn, bus. per acre	Stover, lbs. per acre
Superphosphate, 300 lbs.	29.63	2035
Colloidal phosphate 240 lbs.	27.77	1843
Colloidal phosphate, 300 lbs.	29.15	2081

SOURCE: Unpublished data of Va. Agr. Exp. Sta. at Blacksburg, 1939.

EXPLANATION: This was conducted for four years commencing in 1934 to compare the value of colloidal phosphate (20% $P_2 O_5$) with superphosphate (16% $P_2 O_5$).

QUESTIONS: 1. Was there any marked difference between this new phosphate and regular superphosphate?

2. How do prevailing prices of these fertilizers compare?

14. Nitrogen, Phosphorus And Potash Experiment.

Treatment per plot	Corn yields per acre, 14-year av.	
	Limed, bus.	Unlimed, bus.
Phosphorus	26.84	24.06
Phosphorus, potash	35.15	26.93
Nitrogen, phosphorus	29.43	26.65
None	23.05	16.83
Nitrogen, potash	36.00	25.47
Nitrogen, phosphorus, potash	41.06	33.00
2 Nitrogen, 2 potash	38.50	26.15

SOURCE: Unpublished data Va. Agr. Exp. Sta. at Staunton, 1939.

EXPLANATION: This is a 14-year tabulation up to 1938. The soil was Berks silt loam in Augusta County. The soil treatments were phosphorus, 32 pounds $P_2 O_5$ per acre; nitrogen, twenty pounds per acre; and potash, twenty pounds of $K_2 O$ per acre.

QUESTIONS: 1. How did the addition of potash affect yields?

2. What treatment gave the highest yield?

3. Did the addition of lime on unfertilized plots stimulate yields?

15. Fertilizer Tests On Limed And Unlimed Areas.

Treatment	Yield on unlimed plots, bus. per acre	Yield on limed plots, bus. per acre
Check (av. of 3 check plot avs.)	28.70	34.73
300 lbs. 16% superphosphate	52.97	58.61
300 lbs. 2-12-2	51.44	59.94
300 lbs. 4-12-4	51.94	59.83
300 lbs. 4-12-4 broadcast	50.21	54.19
300 lbs. 4-16-4	59.20	61.04
300 lbs. 4-16-0	53.41	56.92
300 lbs. 0-16-4	46.28	51.17
120 lbs. 10-30-10	53.49	56.48
300 lbs. 16-20-0	53.14	57.92
300 lbs. 16% superphosphate plus sodium nitrate*	48.95	55.78
300 lbs. 16% superphosphate plus Cyanamide*	53.91	58.16
300 lbs. 16% superphosphate plus ammonium sulphate*	51.80	51.17

SOURCE: Unpublished data of Va. Agr. Exp. Sta. at Glade Spring Substation, 1939.

EXPLANATION: This experiment was conducted from 1930 to 1938 inclusive and averages are given. *The nitrogen was applied as a side dressing at the rate of 22 pounds per acre. The soil was Dunmore silt loam.

QUESTIONS: 1. Did this experiment bring out the value of lime on corn?

2. Was the value of fertilization emphasized? What fertilizer gave the best results when the original cost is considered?

3. How did Cyanamide compare with the other nitrogen carriers? Ammonium Sulphate?

4. What three treatments gave the best yields on the limed plots?

5. Did the concentrated analysis fertilizer give impressive results?

16. Corn Yield Increase From Lime And Fertilizer.

Fertilizer treatment per acre	Yield of grain per A., bus.		Increase in bus. for	
	Lime	No lime	Lime	Fertilizer
No fertilizer	26.6	21.4	5.2	
400 lbs. 0-8-0	28.0	26.2	1.8	4.8
400 lbs. 0-8-5	35.2	29.3	5.9	7.9
400 lbs. 5-8-0	31.4	28.0	3.4	6.6
400 lbs. 5-0-5	35.3	30.0	5.3	8.6
400 lbs. 5-8-5	39.1	33.6	5.5	12.2

SOURCE: Va. Agr. Exp. Sta. Bul. 292, 1933.

EXPLANATION: The above figures represent the average of eight years of corn crops grown in a rotation of corn, wheat and red clover. It was conducted on Berks silt loam at the Augusta County Substation. Lime was applied at the beginning and once each six years, thereafter.

QUESTIONS: 1. What did this experiment show as to the value of lime and fertilizer in growing corn?

2. Which fertilizer analysis gave the best yields?

3. Do you think the legume clover in the rotation contributed to increased yields?

B. Manuring

1. Annual Application vs. Once in Four Years.

Treatment	7-year average	
	Bus. per acre	Increased bus. due to manure
Four tons manure annually	65.52	20.39
Sixteen tons once in four years	61.94	16.71
No manure	45.23	

SOURCE: Va. Agr. Exp. Sta. Bul. 221, 1919.

EXPLANATION: These data are compiled from results obtained from applying the same total manure annually as compared with once each four years in a four-year rotation of corn, wheat, clover, and grass.

QUESTIONS: 1. Which is the best method of applying barnyard manure? Annually or once every four years?

2. Did it pay to use manure?

2. Value Of Manure To Corn.

Treatment	Average yield of corn for 21 years Grain, bus.	Stover, tons
Manured	43.3	1.70
Unmanured	27.0	.99
Manured	44.8	1.69
Unmanured	28.5	1.07

SOURCE: Tenn. Agr. Exp. Sta. Bul. 149, 1933.

EXPLANATION: This was conducted at the West Tennessee Station on a silt loam soil of moderate productivity. It was commenced in 1910 and continued until 1930. Corn was grown on the same plots continuously for 21 years. The manured plots received five tons of manure per acre annually.

QUESTIONS: 1. What is the value of a ton of manure for growing corn on the basis of gross value of increased yield?

2. What was the increase in yield where manure was used?

XI. LIMING PRACTICES.

1. Effect Of Fertilizer And Lime On Yield Of Corn.

Treatment, per acre	Av. yield of corn per acre in bus.
No fertilizer, no lime	10.8
One ton of limestone once in rotation	20.2
Fertilizer, 300 lbs. 4-9 1/3-4	29.9
Fertilizer and lime (2 and 3 combined)	37.4

SOURCE: From unpublished data of the Piedmont Station at Statesville, N. C. Taken from "Suggestive Helps To Teachers", No. 6.

EXPLANATION: This test was conducted at the Statesville Station on Cecil clay loam from 1918 to 1934. The rotation was cotton, corn, wheat and red clover.

QUESTIONS: 1. Which treatment gave the best yield?

2. Did fertilizer or lime effect the higher yield of corn?

3. What was the result when both fertilizer and lime were applied?

2. Lime, Green Manure And Fertilizer Test.

Plot treatment	Av. in yield of bus. per acre (1922-1929)
Green manure and 200 lbs. of fertilizer	31.8
Lime, green manure and 200 lbs. of fertilizer	29.2
Lime and 200 lbs. of fertilizer	24.2
Green manure and 300 lbs. of fertilizer	35.0
Lime, green manure and 300 lbs. of fertilizer	35.4
Lime and 300 lbs. of fertilizer	27.1
Green manure and 400 lbs. of fertilizer	39.9
Lime, green manure and 400 lbs. of fertilizer	36.9
Lime and 400 lbs. of fertilizer	28.1
Check (no green manure or fertilizer)	15.4

SOURCE: Ga. Coastal Plain Bul. 14, 1930.

EXPLANATION: This represents the average yield of corn over a period of eight years with varying types of soil treatment as designated. On the limed plots one and one-half tons of ground limestone per acre were applied each three years. The rotation on these plots was cotton, corn and oats. Previous to 1926 a cover crop of cowpeas was turned under following oats. From 1926 to 1929 a winter cover crop of Austrian winter peas was used in addition to the cowpeas. The soil plots were in the Coastal Plain area.

QUESTIONS: 1. Did green manure crops increase the yield of corn?

2. What affect does fertilizer have on yield? Lime?

3. What practice would be most logical on your farm?

3. Effect Of Lime On Yield Of Corn In Rotation.

Location of experiment	No. of crops	Lime, 1 ton per acre	No lime	Increase due to lime
Appomattox	4	45.80 bus.	29.30 bus.	16.50 bus
Bowling Green	3	42.60	37.10	5.50
Blacksburg	1	52.12	48.77	3.40
Chatham	9	47.00	31.00	16.00
Holland	10	48.90	44.93	3.07

SOURCE: Va. Agr. Exp. Sta. Bul. 237, 1924.

EXPLANATION: This is a summary of how lime affects the yield of corn at the various Virginia experiment stations. A rotation of tobacco, wheat, two years of clover and timothy, and corn was followed at Appomattox, Bowling Green and Chatham. Fertilizer was applied only to the tobacco crop and lime was applied to the wheat crop. The plots not limed produced practically no clover while the limed plots had a very good stand.

The rotation at Blacksburg was wheat, clover and timothy, clover and timothy, corn, and soybeans. Fertilizer and lime was applied to the wheat crop. At Holland the rotation was peanuts, cotton and crimson clover, soybeans, and corn and crimson clover. At each of these stations the limed plots had better clover stands.

QUESTIONS: 1. What influence did lime have on the yield of corn when applied in the rotation?

2. Would you recommend the regular use of lime as being beneficial in the production of corn?

3. How much do you think the better clover crops on the limed plots increased corn yields?

4. Oyster Shell vs. Limestone As A Lime Source.

Kind of lime and amount	7-year av. yield of corn in bus.	Soil pH
One ton ground shells	53.9	5.90
One ton ground limestone	55.6	6.00
No lime	50.7	5.55
Two tons ground shells	50.8	6.40
Two tons dolomitic limestone	52.9	6.75

SOURCE: Unpublished data of the Va. Agr. Exp. Sta. at Holland, 1939.

EXPLANATION: This experiment was conducted at Holland in the Coastal Plain area in 1932 and continued until 1938, inclusively. The corn was treated with 400 pounds of 2-8-4 fertilizer at planting and 150 pounds of nitrate of soda, divided in two equal side dressings. Rye was planted for a winter cover crop. The soil was fine sandy loam. The pH was determined from samples of soil taken April 28, 1938. The limestone used contained 24 percent magnesium carbonate and 66% calcium carbonate while the oyster shells contained 84% calcium carbonate and 1% magnesium carbonate.

QUESTIONS: 1. Has the corn responded favorably to use of lime?

2. Which amount gave the best results?

3. Considering the results and cost of lime, which kind seemed to be the better to use?

5. Lime Removed From Soil By Corn And Other Crops.

Crop	Yield per acre	Pounds removed per A. annually
Corn	50 bushels	27
Wheat	25 bushels	14
Oats	50 bushels	21
Clover	2 tons	146
Total		208

SOURCE: Ill. Cir. 375, 1931.

EXPLANATION: This chart merely emphasizes the amount of lime removed from the soil annually by the above crops at the indicated yields.

QUESTIONS: 1. When these crops are grown in rotation, what is the annual average lime removal?

2. How do you think this removal compares with the amount lost by erosion and leaching?

3. Do these facts point to the importance of regular lime replacement for crops demanding a neutral soil?

6. Approximate Amount Of Lime Needed To Change pH Values.

Soil class	Pounds required per acre to change reaction onepH		
	Burnt lime	Hydrated lime	Ground limestone, marl or oyster shells
Light sandy	840	1,110	1,500
Sandy loams	1120	1,480	2,000
Loams	1680	2,220	3,000
Silt loams and clay loams	1960	2,590	3,500

SOURCE: Va. Agr. Ext. Bul. 97, 1938.

EXPLANATION: For soils low in organic matter this should be reduced about 25 percent while for soils high in organic matter the amount should be doubled. This table is approximate and is based on experimental evidence.

QUESTIONS: 1. How much ground limestone would be required to raise the pH from 5.4 to 6.8 on a Norfolk sandy loam soil? Dunmore silt loam?

2. How much burnt lime would be needed to change the pH from 6 to 6.6 on a muck loam?

XII. DETERMINING WHEN AND HOW TO PLOW

1. Spring vs. Fall Plowing And Depth Of Plowing.

Manner of seedbed preparation	Yield of shelled corn per acre								
	1924	1925	1926	1927	1928	1929	1930	1931	1932
Surface planted (checked) Early spring plowing:	Bus.	Bus.	Bus.	Bus.	Bus.	Bus.	Bus.	Bus.	Bus.
4 inches	29.3	28.9	1.0	43.7	37.4	50.9	2.4	17.5	39.2
5½ inches	29.8	32.2	1.3	46.5	39.0	49.1	2.3	17.5	41.9
7 inches	32.6	33.8	1.1	47.4	34.9	49.7	2.7	21.2	42.0
10 inches	31.0	33.5	0.7	49.9	34.5	51.0	2.8	22.5	39.1
Late spring plowing: 7 inches	29.8	28.6	1.9	44.6	41.8	52.6	4.5	19.9	41.0
7 inches preceded by disking	32.9	24.4	0.9	45.2	37.1	53.9	2.9	21.3	40.7
Fall plowing: 7 inches	27.9	19.1	8.5	50.0	28.9	33.7	0.6	13.5	37.2

SOURCE: Neb. Agr. Exp. Sta. Bul. 293, 1935.

EXPLANATION: The experiment was conducted on the station farm at Lincoln. The soil was average fertility. All spring-plowed land was harrowed after plowing and the disk and harrow immediately preceded all planting.

QUESTIONS: 1. What method gave the best results?

2. Was fall or spring plowing best?

3. How deep should one plow for corn?

4. What are the advantages and disadvantages of fall and spring plowing?

2. Depth Of Plowing And Subsoiling Test.

Crop	Ordinary plowing 7½ inches	Spalding disk 15 inches	Ordinary 7½ in. plowing plus 7½ inch subsoil plowing
Corn, bushels	61.1	59.5	61.3
Oats, bushels	49.0	49.3	49.0
Wheat, bushels	31.5	31.5	31.6
Clover, tons	2.65	2.53	2.60

SOURCE: Ohio Agr. Exp. Sta. Cir. 53, 1938.

EXPLANATION: This was conducted at Wooster and is a 12-year average. The soil was Wooster silt loam of good drainage. Similar results were obtained at the Cuyahoga County farm on a very heavy silty clay loam.

QUESTIONS: 1. Did deep plowing increase the yields of any of the crops?

2. Was subsoiling a practical procedure?

XIII. PREPARING SEEDBED.

1. Methods Of Seedbed Preparation.

Method	Bushels
Seed, smoothing harrow	45.0
Disk, seed, smoothing harrow	49.1
Disk, smoothing harrow, seed, smoothing harrow	50.9
Double disk, smoothing harrow, seed, smoothing harrow	50.5
Smoothing harrow as early as possible, double disk, smoothing harrow, seed, smoothing harrow	45.0
Double disk, smoothing harrow, seed, smoothing harrow roll	54.2
Double disk, smoothing harrow, seed, smoothing harrow, roll when plants were 4 to 5 inches high	48.0
Spring harrow, then double angle spring harrow, smoothing harrow, roll, seed, smoothing harrow	53.6
Double disk, smoothing harrow, seed, roll smoothing harrow	51.1
Double disk, smoothing harrow, roll, seed, smoothing harrow	45.6
Disk, roll, disk, smoothing harrow, roll, seed, smoothing harrow	37.5

SOURCE: P. E. I. Agr. Exp. Sta. Rpt., Charlottestown, Can., 1922.

EXPLANATION: These data cover a period of seven years study on seedbed preparation for corn at the Prince Edward Island Station. The average production for the period is given. Corn was planted after potatoes in a rotation of hoed crop, grain and clover.

QUESTIONS: 1. Which two plots returned the highest average yield?

2. Which three plots had the lowest yields?

3. While a good seedbed is desirable, was the added expense justifiable with the extraordinary seedbed preparation?

XIV. PLANTING

1. Drilled vs. Checked Planting.

State	Drilled yield per acre			Checked yield per acre		
	Method	Grain, bus.	Stover, lbs.	Method	Grain, bus.	Stover, lbs
Md.	1 ker. every 22"	50.70	2618	2 ker. every 45"	47.60	2394
Ohio	1 ker. every 12"	46.88	2827	3 ker. every 36"	42.33	2168
Ohio	2 ker. every 24"	46.28	2417	4 ker. every 48"	42.85	2180
Minn.	1 ker. every 18"	50.57		2 ker. every 44"	49.90	
Minn.				3 ker. every 44"	55.15	
Ark.*	1 ker. every 22"	42.10		2 ker. every 44"	42.70	
Ark.	1 ker. every 14 2/3"	47.40		3 ker. every 44"	40.30	
Ark.	1 ker. every 11"	46.10		4 ker. every 44"	46.30	

SOURCE: Hughes and Henson, Crop Production, MacMillan, 1930

EXPLANATION: *The Arkansas tests were averaged for nine years. This study is a comparison of drilled vs. checked as methods of planting corn. It is a tabulation of several state experiment stations.

QUESTIONS: 1. What method seems to have a slight advantage?

2. Did the checked or drilled corn tend to produce more fodder?

2. Relation Of Stand To Yield.

	Plants per hill				
	1	2	3	4	5
Total shelled corn, bus.	31.9	51.3	62.9	66.6	65.8
Marketable ears (shelled), bus.	30.0	48.0	57.3	56.2	50.0
Nubbins (shelled), bus.	1.9	3.3	5.6	10.4	15.8
Av. weight of ears per stalk, oz.	10.4	10.0	8.8	7.4	6.5
Good-eared plants, pct.	79.4	76.9	69.6	56.9	44.3
Nubbin plants, pct.	13.5	12.9	15.7	22.7	28.6
Barren plants, pct.	7.1	10.2	14.7	20.4	27.1
Two-eared plants, pct.	17.2	5.6	3.1	1.7	1.3

SOURCE: Ohio Agr. Exp. Sta. Cir. 53, 1938.

EXPLANATION: The yields and percentages were computed on an acre basis. This experiment was conducted for 21 years at Wooster and the above figures are averages for that number of years. The corn hills were three and one-half feet by three and one-half feet apart. The soil was silt loam.

QUESTIONS: 1. What effect did the increased number of plants to the hill have on the yield of nubbins?

2. What factors determine the number of plants per hill to plant?

3. Of what practical value is this experiment?

3. Effect Of Depth Of Planting On Yield.

Station	No. of yrs.	Depth in inches						
		1"	2"	3"	4"	5"	6"	7"
Ill.	5	77.5	71.5	65.1	68.7	61.3	60.0	40.5
Ind.	8	42.8	42.4	42.6	37.9			
Ohio	7	63.4	57.1	46.8				
N. Dak.	4		33.4	33.7	29.2	28.6	23.2	17.9

SOURCE: Hughes and Henson, Crop Production, MacMillan, 1930.

EXPLANATION: This is a summary of depth of planting comparisons at various experiment stations. The yields are expressed in bushels.

QUESTIONS: 1. What was the optimum depth of planting in this experiment?

2. At what depth did yield drop appreciably?

4. Fertility Of Soil As Influencing Planting Rate.

Station	Thousands of plants per acre											
	1	2	3	4	5	6	7	8	9	10	11	12
Knoxville (rich)	15.2	25.7	29.6	40.0	46.5	50.5	51.7	50.8	46.7	41.2	43.5	37.8
Jackson (poor)	9.8	14.6	17.8	13.2	14.2	14.0	9.9					

SOURCE: Mooers, C. A., "Planting Rates and Spacing of Corn under Southern Conditions." Jour. Am. Soc. Agron., Jan. 1920.

EXPLANATION: This test was to determine the planting rate on poor soil and rich soil. The Knoxville soil was rich while the Jackson soil was poor.

QUESTIONS: 1. Should the richness of the soil be a factor in determining the planting rate of corn?

2. What was the optimum planting rate for corn on the Knoxville soil? Jackson soil?

XV. CULTIVATING.

1. Effect Of Depth Of Cultivation On Yield.

Year	Deep-4 to 5 inches		Ordinary- 2 to 3 ins.		Shallow-1 to 2 inches	
	Ear corn	Stover	Ear corn	Stover	Ear corn	Stover
	Bushels	Pounds	Bushels	Pounds	Bushels	Pounds
1925	114.5	4884	115.2	5175	112.7	5544
1926	89.9	3523	101.4	4520	93.3	3673
1927	78.4	5152	77.4	4676	78.6	4620
1928	50.1	4408	79.1	3612	37.0	3176
1929	38.7	2548	39.6	2760	23.5	2243
1930	39.4	4652	34.2	4732	36.8	3860
1931	74.7	5256	77.0	5412	74.2	5828
1932	50.2	4080	53.8	4072	55.9	3784
8-yr. av.	67.0	4313	72.2	4370	64.0	4091

SOURCE: Ohio Agr. Exp. Sta. Cir. 53, 1938.

EXPLANATION: This experiment tested the yield of corn when deep, ordinary and shallow cultivation was used. The test was conducted at Wooster on a silt loam and the average for the eight years was tabulated.

QUESTIONS: 1. Generally, which was the more desirable, deep, ordinary or shallow cultivations?

2. Why did deep cultivations give a smaller yield?

2. Do Late Cultivations Pay?

Year	Yield in bushels per acre	
	Cultivation	
	Ordinary	Late
1913	73.7	75.1
1914	46.5	52.0
1916	59.3	58.7
1917	93.9	93.5
1921	94.1	95.0
1922	83.9	75.1
1923	78.9	82.1
Average	75.7	75.9

SOURCE: Ohio Agr. Exp. Sta. Cir. 53, 1938.

EXPLANATION: This table shows the effect of three extra cultivations on corn in July and August with a one-row cultivator. It was conducted at the Wooster Station.

QUESTIONS: 1. Did extra cultivations after the time it was ordinarily discontinued have much affect on yield?

2. Although late weeds may be controlled by late cultivations might not the injury to corn roots near the surface counteract the good affect of weed control?

3. What Type Of Implement To Use.

Kind of cultivation	Total bus. per acre				Av. percent nubbins
	1921	1922	1923	Av.	
Scraping with hoe	35.6	44.8	49.5	43.3	10.9
Spring tooth cultivator	38.7	46.4	45.7	43.6	9.4
Ordinary cultivation	40.8	46.8	53.0	46.9	8.6
Deep shovel cultivation	40.9	46.0	48.2	45.0	8.8

SOURCE: Miss. Agr. Exp. Sta. Inf. Sheet 62, 1935.

EXPLANATION: All plots were thinned and hoed when the plants were three to six inches high. Cultivating plows were not used on plots scraped with a hoe. The use of the spring tooth cultivator required more cultivations and more hoeing than did ordinary and deep shovel cultivation. Ordinary cultivation consisted of the use of narrow cultivating blades early and sweeps later. Deep shovel cultivation consisted of the use of new eight-inch and ten-inch shovels run deep at each cultivation. All cultivations were stopped shortly before the appearance of silks.

QUESTIONS: Which type of cultivation was the most practical?

2. Since scraping with a hoe gave almost as good a yield as the rest, does it suggest that the elimination of weeds is one of the main objectives in cultivating corn?

4. Does It Pay To Sucker Corn?

Practice	Yield in bushels per acre		
	1910	1912	Average
Suckered 4 ft. high	29.5	38.5	34.0
Suckered 6 ft. high	29.4	38.0	33.7
Unsuckered	37.8	40.5	39.1

SOURCE: Miss. Agr. Exp. Sta. Bul. 170, 1915.

EXPLANATION: This experiment was an effort to determine what affect suckering corn had on the yield as against leaving it unsuckered.

QUESTIONS: 1. Did the practice of suckering corn yield dividends?

2. What would be the money loss per acre at current corn prices for the suckered corn irrespective of the extra labor?

5. Type Of Machine For Early Cultivation.

Machine used for early cultivation	Yields, bus. per A. Surface planted
Spike tooth harrow	37.8
Spring tooth weeder	42.1
Rotory hoe	38.4
Cultivator	46.2
Check, no early cultivation	34.7

SOURCE: Iowa Agr. Exp. Sta. Bul. 365, 1937.

EXPLANATION: This experiment compared various machines for early cultivation of small corn plants. The test was for 1935. The average yields are given. Tractor power was used. Between June 5 and 14, the spike tooth harrow, the weeder and the rotary hoe were used twice and the cultivator once on respective plots. Check plots were not cultivated this first time. The next cultivation was June 18 when all plots were cultivated, including check plots.

QUESTIONS: 1. Which type of cultivation caused the highest yield?

2. Compare the various types of cultivations as to yield of corn.

6. Yields Of Corn From Different Cultural Methods.

Cultural method	Percentage affectiveness
Cultivated three times	100.00
Cultivated five times	98.74
Weeds cut with hoe only	82.52
Weeds allowed to grow (no cultivation)	13.75

SOURCE: Va. Agr. Exp. Sta. Bul. 214, 1917.

EXPLANATION: The average yields for three cultivations were taken as a standard and this was represented by one hundred percent. The other cultural methods were compared to this standard. The soil plots were of average fertility. The land was plowed in March to a depth of about eight inches and was disked and harrowed until a good seed bed was formed. Boone County White corn was used and was planted about May 15.

QUESTIONS: 1. Did it pay to cultivate corn in excess?

2. Comparing the test plots where weeds were eliminated with a hoe with those where the weeds were allowed to grow, how important is it to eliminate weeds in the corn field?

3. What is the chief reason for cultivating corn?

7. Acres Cultivated Per Day.

	Acres
One-row riding (first or second cultivation), one man, two horses	5.5
One-row riding (third cultivation), one man, two horses	7.0
Two-row riding, one man, three or four horses	13.0

SOURCE: Wallace and Bressman, Corn and Corn Growing, John Wiley and Sons, 1928.

EXPLANATION: This tabulation applies to Corn Belt conditions, giving the average number of acres per ten-hour day.

QUESTIONS: 1. How nearly does this tabulation compare with your experience as a Virginia farmer?

2. How many total working days would be required to cultivate forty acres of corn three times during a season with a one-row riding cultivator?

8. Effect Of Root Pruning On Yield Of Corn.

Treatment	Yield in bus. 4 yr. average
Roots not pruned; shallow, ordinary cultivation	84.1
Roots pruned; shallow, ordinary cultivation	68.2
Roots not pruned; weeds scraped with a hoe	80.7
Roots pruned; weeds scraped with a hoe	63.8

SOURCE: Ill. Agr. Exp. Sta. Bul. 181, 1915.

EXPLANATION: Roots were pruned to a depth of four inches at a distance of six inches on all sides of the hills.

QUESTIONS: 1. Did this experiment indicate that the pruning of roots has a very definite effect on yield?

2. Is it important to use a tillage implement that disturbs the roots as little as possible?

3. At what stage of growth are roots more susceptable to cultivation injury?

XVI. PROVIDING GREEN MANURE.

1. Effect Of Different Cover Crops On Yield.

Cover crop	Yield of corn per acre, bus.	Increase due to cover crop, bus.
Crimson clover	35.8	14.7
Vetch	37.5	16.4
Red clover	34.2	13.1
Soybeans	30.9	9.8
Sweet clover	28.8	7.7
Cowpeas	26.6	5.5
Rye	17.9	-3.2
Buckwheat	12.8	-8.3
None	21.1	
None but 100 lbs. of nitrate of soda	35.3	14.2

SOURCE: Va. Agr. Exp. Sta. Bul. 292, 1933.

EXPLANATION: This experiment was conducted over a six-year period (1924-29) at the Augusta County Substation. The soil was Berks silt loam. It was relatively low in organic matter and is a poor moisture holder. The cover crops were planted in the corn at the last cultivation. They were turned under the next spring for corn again. All plots got two tons of ground limestone per acre at the beginning. Fertilizer was applied uniformly to each plot at the rate of 300 pounds of 16 percent superphosphate and forty pounds of muriate of potash.

QUESTIONS: 1. How did the legume crops compare with the non-legumes in affecting the yield of corn?

2. Which cover crop gave the highest corn crop yield?

3. How did rye perform?

4. Did nitrate of soda seem to be a substitute for a cover crop?

2. Effect Of Cover Crops With Fertilizer On Yield.

Cover crop	Fertilizer treatment	Av. yield of corn for 8 yrs. bus.
Austrian Winter peas	0-10-4	56.5
Monantha vetch	0-10-4	50.0
Hairy vetch	0-10-4	47.6
Rye	0-10-4	34.4
No cover crop	0-10-4	37.6
Austrian Winter peas	2-10-4	52.7
Monantha vetch	2-10-4	52.5
Hairy vetch	2-10-4	51.1
Rye	2-10-4	38.8
No cover crop	2-10-4	39.7

SOURCE: Miss. Agr. Exp. Sta. Bul. 303, 1934.

EXPLANATION: The soil was Ochlockonee loam. Five hundred pounds of the designated fertilizer was applied per acre at planting time. The cover crop was turned under March 15 and the corn planted about the first week in April. This experiment was conducted from 1926 to 1933, inclusively. Whatley's Prolific corn was grown.

QUESTIONS: 1. Did the addition of nitrogen in the fertilizer increase the yield of corn?

2. What cover crop gave the highest corn yield in the experiment?

3. How did rye compare with the no-cover plot yields?

4. Did it pay to plant cover crops? What are the merits of it?

3. Green Manure Tests With Fall And Spring Seeded Crops

Crop	2-yr. av. yield of corn per acre	
	Grain, bus.	Stover, tons
Fall seeded - Low vetchling	40.5	1.22
Hairy vetch	52.6	1.68
Crimson clover	56.2	1.74
Austrian peas	49.6	1.63
Rye and vetch	58.9	1.66
Abruzzi rye	38.3	1.41
No cover crop	24.2	1.10
Spring seeded - Crotalaria	56.7	1.72
Dalia clover	57.6	1.72
Hubam clover	59.0	1.70
White sweet clover	57.3	1.71
Yellow sweet clover	55.6	1.58
Korean lespedeza	59.5	1.57
No cover crop	52.9	1.33

SOURCE: Un published data of Va. Agr. Exp. Sta. at Williamsburg, 1939.

EXPLANATION: This test was conducted for 1936 and 1937. The soil was Norfolk sandy loam in the Coastal Plain area. The cover crops were treated with 300 pounds of 0-12-4 at the time of seeding. The corn got the same treatment. The purpose of the experiment was to compare the value of new leguminous plants as sources of organic material with some of those in common use.

QUESTIONS: 1. Which two crops caused the highest yields of corn in the fall-seeded class? The lowest?

2. How did cover crops affect the yield of corn compared to no cover crop?

3. What spring-seeded cover crop gave the best results?

4. Effect Of Fertilizers And Legumes On Yield.

Treatment	Following sweet clover as a green manure crop	Following sweet clover as hay	Following alfalfa as hay	Following red clover as hay
Check	76.1	72.9	60.9	65.6
80 lbs. per A. superphosphate	76.9	68.9	70.6	63.4
500 lbs. per A. rock phosphate	77.8	74.5	59.0	57.9

SOURCE: Iowa Agr. Exp. Sta. Ann. Rpt., 1936.

EXPLANATION: This experiment dealt with the relative value of red clover, alfalfa and sweet clover as soil building crops. The figures are in terms of bushels per acre in 1935.

QUESTION: 1. What is the indication as to the beneficial affects of sweet clover as a green manure crop?

5. Legumes As A Nitrogen Supply.

	Bus. per acre increase over no nitrogen				
	1931	1932	1933	1934	Av.
Nitrogen, 30 pounds	14.5	10.9	11.1	13.5	12.5
Soybeans	-8.8	-.5	6.9	1.3	-.3
Austrian winter peas	26.6	13.3	6.1	13.4	14.9
Soybeans and Austrian peas	14.3	12.1	9.7	10.4	11.6
Yield, no fertilizer nor legume	38.3	26.2	25.8	28.0	29.6

SOURCE: Miss. Agr. Exp. Sta. Inf. Sheet 69.

EXPLANATION: This experiment was conducted at Mississippi State College on bottom land. Nitrogen was used for the fertilizer test in the first plot at the rate of two hundred pounds per acre. The soybeans were planted in the drill with the corn. The soil is classed as Ochlockonee loam.

QUESTIONS: 1. How did the nitrogen treatment compare with the other treatments?

2. How did soybeans alone rate with the other treatments?

3. Did legumes serve as a good substitute for nitrogen fertilizer?

6. Effect Of Lespedeza On Yield.

State	Area in corn	Yield of corn before and after lespedeza was grown			Increase in yield	
		Before	Period in lespedeza	After	Bushels	Percent
	Acres	Bus.	Yrs.	Bus.		
North Carolina	20	10	1	25	15	150
North Carolina	21	20	2	40	20	100
Kentucky	35	25	2	40	15	60
Tennessee	30	20	2	40	20	100
North Carolina	6	16	3	62	46	287
Tennessee	24	25	3	40	15	60
Average	22.6	19.3		41.1	21.8	113

SOURCE: U. S. D. A., F. Bul., 1724.

EXPLANATION: The above compilation was made from six farms in the respective states mentioned, indicating the yield of corn before lespedeza had been grown and the yield afterwards. The fields ranged from a sandy loam to a heavy clay loam.

QUESTIONS: 1. What does this chart point out concerning the soil building properties of lespedeza?

2. Was the increase greater where the corn yield had previously been lower?

3. How would lespedeza fit into the farming system on your farm?

7. Green Manure Crops And Their Equivalent In Barnyard Manure.

Green manure crop plowed under	Seed per acre lbs.	Total nitrogen per acre in green manure lbs.	Equivalent of green manure crop in fresh farm manure		Relative yields of shelled corn following green manure crops
			Equivalent in weight, tons.	Equivalent in nitrogen content	
				Tons	Percent
Winter vetch	40	133.0	9.53	14.45	127.8
Crimson clover	40	92.4	7.62	10.04	115.6
Red clover	15	50.4	4.46	5.48	114.7
Sweet clover	15	39.5	3.59	4.29	113.7
Alsike clover	10	53.1	4.96	5.77	104.4
Winter wheat	90	34.1	5.22	3.71	99.7
Winter rye	84	31.8	6.16	3.46	95.3
Weeds only		18.9	3.16	2.05	100.0

SOURCE: N. J. Agr. Exp. Sta. Bul. 609, 1936.

EXPLANATION: The cover crops were seeded in standing corn the latter part of August. The soil was Sassafras loam. At the time of plowing the cover crop under in the spring for corn it was analyzed and converted into manure equivalent. The fresh barnyard manure was figured on a basis of eighty percent moisture and 0.46 percent nitrogen content. The experiment was averaged for five years having been conducted from 1929 to 1933.

QUESTIONS: 1. Which cover crop gave the best results?

2. Is green manure a good substitute for barnyard manure?

3. What would you conclude about rye as a green manure crop?

4. Under what circumstance is a cover crop desirable?

XVII. CONTROLLING DISEASE.

1. Important Disease Affecting Corn Crops.

Disease and Organism	Symptoms	Control
Smut (Ustilago Zeae)	Grayish white galls on any part of plant, filled with mass of black spores at maturity.	Crop rotation helps
Mosaic (visis)	Curled and deformed	Insect control
Root, stalk and ear rots: Diplodia Zeae	Kills seedlings, weakens plants, weak root system, internal discoloration of nodes. Mold on ear velvety white mold on germination	Select seed free disease, test and discard infected ears. Treat seed with mercury compounds and rotate crops.
Giberella saubinettii	As for diplodia except mold on germinator is pink or red	
Basissporium	Ears with shredded shank, cob blackened at kernel tips. Kernel tips show black on germinator.	

SOURCE: Hughes and Henson, Crop Production, MacMillan, 1930.

EXPLANATION: This gives a digest of the important diseases affecting corn crops, the symptons and suggested control.

QUESTION: 1. How would you control root, stalk and ear rots? Smut?

2. Does It Pay To Plant Disease-Free Seed?

A Summary of Five Year's Data on Field Performance of Corn From Healthy and Diseased Seed as Determined by the Modified Rag Doll.

Factors	Healthy	Diseased	Farmers	Difference between healthy and Diseased	Difference between healthy and Farmers'
Percent Stand	77.20	66.80	72.80	10.40	4.40
Percent Barrenness	5.15	7.35	6.0	2.20	0.85
Percent Nubbins	10.00	13.20	12.50	3.20	2.50
Yield bus. per A.	63.80	54.50	58.80	9.30	5.00

SOURCE: Iowa Agr. Exp. Sta. Cir. 108, 1928.

EXPLANATION: Healthy and diseased seed were determined by germinator tests. Plantings in 25 counties composed the experiment. Each of ten farmers in a given county furnished one hundred seed ears from which ten healthy and ten diseased ears were selected. The healthy ears produced six good sprouts for each six kernels tested on the rag doll. The Diplodia dry rot infected ears selected the first year showed an average of one dead and two weak diseased kernels. Later, only live kernels were selected which showed one to three diseased. These infected ears showed no visible signs of infection. The "farmers' seed corn" were samples furnished by farmers for their own planting. The above samples were planted by hand, three grains to the hill. Three replications from each sample was planted and an average taken in the computation. Dry weather, insects and other influences cut down on perfect stands.

QUESTIONS: 1. From the table did it pay to plant healthy seed?

2. What is the best method to secure healthy seed?

3. Can healthy seed be designated by visual inspection of the seed?

3. How To Control Dry Rots.

Summarized Results of Experiments with Commercial Dust Fungicides on Four Lots of Seed Corn, Ames, Iowa 1927.

Treatments	Acre Yield In Bushels							
	Lot 1 Good Seed		Lot 2 Dry rot Basisporium		Lot 3 Dry rot Gibberella		Lot 4 Dry rot Diplodia	
	Actual Yield	Increase over check	Actual Yield	Increase over check	Actual Yield	Increase over check	Actual Yield	Increase over check
Check (no treatments)	34.7		26.5		37.2		28.1	
Bayer dust 2 oz. per bu.	34.8	0.1	31.7	5.2	38.5	1.3	36.5	8.4
Semesan Jr. 2 oz. per bu.	34.4	-0.3	30.6	4.1			36.1	8.0
Merko 2 oz. per bu.	34.9	0.2	30.9	4.4	40.4	3.2	37.8	9.8

SOURCE: Iowa Agr. Exp. Sta. Cir. 108, 1928.

EXPLANATION: The field used was one adjoining the Agronomy Farm, Ames, Iowa; a field of only fair fertility. Stand and yield data were obtained by growing ten replications of thirty hills each. No comparison can be made of the different lots (1,2,3,4) because of the variability of the soil fertility.

QUESTIONS: 1. What are the advantages of using dust in treating seed?

2. Did the commercial dust increase the yield of diseased seed in all cases? Of what significance was this?

3. Was there any advantage in using a fungicide on good seed?

4. Was there any indication in this experiment to show that dust is non-injurious to live kernels?

4. Treating Seed Corn For Dry Rots.

Corn Seed Treatment Trials at Iowa Station in 1925,
Using Good, Fair and Poor Seed.

	Yield in bushels per acre		
	Good Seed	Fair Seed	Poor Seed
Dry, check (no treatment)	88.2	77.3	67.8
Wet, check (no treatment)	85.8	76.8	68.3
Uspulum (0.25 percent soak for 1½ hours)	89.0	79.6	72.5
Bordeaux mixture paste	85.3	79.5	70.2
Formaldehyde (1 pt. in 15 gals. of water for 2½ min. at 125° F and covered 1 hr.)	83.0	72.0	63.5

SOURCE: Iowa Agr. Exp. Sta. Cir. 108, 1928.

EXPLANATION: The good seed was nearly free from dry rots, the fair seed having some dry rot, and the poor seed showing considerable disease. Uspulum is an organic mercury. The bordeaux mixture paste was made by dissolving one pound each of bluestone (copper sulphate) and burned lime (calcium oxide) separately in one gallon of water. The bordeaux mixture was made by pouring these two solutions simultaneously into a third container. The corn was soaked for a few minutes and then allowed to dry before planting.

QUESTIONS: 1. One of the difficulties in using a fungicide is to get it strong enough to kill the rot, yet not injure the seed. Does this offer some explanation to the decreased yield of the Bordeaux and Formaldehyde treatment in comparison to Uspulum?

2. Which of these treatments gave the best results?

3. What explanation is there to the fact that good seed soaked in water had a lower yield than the dry? Does this suggest the use of a dry or wet treatment in using fungicides for seed treatment?

5. Yield Of Disease-Free vs. Diseased Seed On Clean vs. Infested Soil.

Character of seed	Acre yields in bushels				Reduction in marketable corn on heavily infested soil	
	Comparatively clean soil		Heavily infested soil			
	Total	Sound	Total	Sound	Bus.	Perct.
Nearly disease free seed from apparently disease free plants.	85.6	81.7	79.4	75.0	6.7	8.2
Nearly disease free seed from root and stalk rotted plants.	81.6	76.9	66.8	55.6	21.3	27.7
Standard diseased composite used in 1920 (mostly scutellum rot)	74.8	69.7	61.8	53.2	16.5	23.7
Seed selected from standing, apparently disease free plants; 100% viability but 20% of seedlings showed scutellum rot.	79.6	75.2	62.7	55.2	20.0	26.6

SOURCE: Ill. Agr. Exp. Sta. Bul. 255, 1924.

EXPLANATION: This test was for the purpose of determining the susceptibility of different seed selections as determined by growing on comparatively clean and on heavily infested soil. Yellow dent corn was used; planted May 17 on brown silt loam near Bloomington.

QUESTIONS: 1. Did this experiment bring out the fact that disease-free seed selected from diseased plants is very likely to produce plants more or less susceptible to corn-rot diseases?

2. Is there a suggestion as to the desirability of growing corn on disease-free soil?

6. Diplodia Control By Seed Treatment With Fungicides.

Fungicide	Acre yield in bus.		Increase from treatment	
	Untreated	Treated	Bushels	Percent
S.F.A. 225, dust	41.4	52.2	10.8	26.1
Semesan 13 ug, dust	41.4	50.7	9.3	22.5
Semesan Jr., dust	41.4	52.2	10.8	26.1
Bayer Dust	40.9	51.6	10.7	26.2
Dupont 12 Bel.	40.9	53.4	12.5	30.6
Abavit B, dust	40.9	47.7	6.8	16.6
Mercuric chloride 1-3000, 1½ hr. (soak)	40.6	49.3	8.7	21.4
Uspulum, 1-200, 1½ hr. (soak)	40.6	54.5	13.9	34.2
Semesan 1-200, 1½ hr. (soak)	40.6	52.2	11.6	28.6

SOURCE: Iowa Agr. Exp. Sta. Res. Bul. 124, 1930.

EXPLANATION: This test gives the effect of treatment on diplodia infected seed corn, using six dust and three liquid fungicides, ten replications of thirty hills each. A check plot of nearly disease-free seed, untreated, yielded sixty bushels per acre.

QUESTIONS: 1. What was the range of increase with treated seed?

2. How did the dust treatments compare with the liquid treatments as affecting yield of corn?

XVII. CONTROLLING INSECTS

1. How To Control The Corn Earworm.

Results of Insecticide Tests on Corn Earworm, 1935

Treatment	Infested Ears	Total Ears	% Infested
Checks	598	624	95.3
Lead Arsenate Dust	47	146	32.1
155 A - Dust	130	142	91.5
Dutox Dust	29	134	21.5
155 A - Spray	109	117	93.1

SOURCE: Md. Agr. Exp. Sta. Bul. 399.

EXPLANATION: All of these materials were applied as dust. Dutox is a commercial name for barium fluosilicate dust. 155 A. is a rather recent development in nicotine. Applications of these dusts totaled ten. They were made August 23, 25, 27, 29 and 31. September 2, 4, 6, 8 and 10; results were observed September 12.

QUESTIONS: 1. Which dust gave the best results? Which the poorest?

2. Did the result of this test indicate that this is an effective means of control of the earworm?

2. Protecting Stored Grain Against Insects

Results of Tests in Treating Seed Corn on the Ear With Oils and Potassium Oleate: 1930.

Treatment	Total Grains	Infested Grains	Infested Grains	Germination			Dead
				Strong	Weak	Total	
	No.	No.	Perct.	Perct.	Perct.	Perct.	
Homemade Oil Emulsion							
Homemade boiled Lubricating Oil (1-10)	1065	200	18.8	81	14	95	5
Homemade boiled Lubricating Oil (1-8)	1143	103	9.0	77	14	91	9
Commercial Oils							
Volck (1-10)	1135	35	3.1	87	6	93	7
Volck (1-12)	1365	200	14.7	78	10	88	12
Oil formula L-43(1-10)	1002	217	21.6	81	14	95	5
Oil formula L-43(1-12)	1000	288	28.8	77	17	94	6
Dendrol (1-10)	1000	5	.5	43	11	54	46
Potassium Oleate	1130	487	43.1	70	17	87	13
Unprotected check	1000	1000	100.0	7	6	13	87
Protected check	1000	0	0	88	8	96	4

SOURCE: Ill. Agr. Exp. Sta. Bul. 359, 1930.

EXPLANATION: (1-10) indicates one part oil to ten parts water. Ears of corn were dipped in the various emulsions. Five to ten ears were treated with each material and placed on screen bottom trays that allowed insects to have access to the corn from all sides. The room was very heavily infested with Angoumois grain moths. Moderate numbers of Indian meal moths, granary weevils, rice weevils,

confused flour beetles and saw-toothed grain beetles were also present. The temperature of the room was kept between 75° and 85° F. and a humidity of approximately 40 to 50%. The grain was exposed for five months to the insects, then the ears were shelled and a composite sample of 1000 to 5000 grains of each treatment was taken and carefully examined for insect infestation. It seems improbable that treated corn should cause injury to horses, cattle, hogs, or chickens but further tests are necessary.

QUESTIONS: 1. What three materials gave the best results in this experiment? What three materials gave the poorest results?

2. Is there any indication to show that any of these treatments destroyed the germinating qualities of the kernels?

3. Is it practical to treat seed corn against insect infestation?

3. Digest Of Important Information On Insects Damaging Corn Crops.

Insect	Adult	Larva	Damage	Control
White grub	June bug or May beetle, heavy robust, yellow to brown, beetle one-half inch long.	Grub worm. White soft, stout brown headed. Curls up.	Grubs eat roots	Rotation of crops, pasturing with hogs, fall plowing. Avoid sod with susceptible crops.
Wire worm	Click beetle. Flat slender, brown beetle, 1/3 in. long	Hard, cylindrical. Yellowish brown, from $\frac{1}{2}$ to $1\frac{1}{2}$ in. long.	Worms eat seed and stem below ground.	Plow early. Crop rotation avoid putting susceptable crops on sod land.
European corn borer	Yellowish brown moth. Wing spread 3/4 in., lined and bordered with redish brown.	Dirty white or pinkish worm; 1 in. long. Brown dots along each side.	Bores, into stalk, ear, eats kernels, causes breakage.	Destroy stubble, ensile or shred stover. Destroy weeds.
Corn hill bug	Black, dirty coated; $\frac{1}{2}$ in. long with a snout.	Whitish grub. Brown head; $\frac{1}{2}$ in. long.	Feeds on young corn; punctures rolled leaves, making row of holes. Larva bores in stem of base.	Fall plow. Rotate crops. Deep plowing.
Southern corn root worm	Beetle yellowish green; twelve black spots on wing covers; $\frac{1}{4}$ in. long.	Slender, yellowish white worm. Brown head. About $\frac{1}{2}$ in. long.	Bores into stems and feeds on roots. Plants lodge.	Plant very late.
Corn root louse	Aphid blue green, round, winged or wingless	Nymph	Sucks juice from roots.	Crop rotation. Plow to break up ant colonies.
Green bug	Yellowish green aphid.	Nymph	Suck sap. Weakening and killing plant.	Destroy volunteer grain in the south.

2. Cont'd.

Insect	Adult	Larva	Damage	Control
Chinch bug	Soft bodied bug. Black with white wings with spot on them. 1/5 in. long.	Nymph	Sucks juices from plants.	Destroy trash; prevent migration from grain field by barriers.
Grasshoppers	Grasshopper (several species)	Nymph	Eats foliage, stripping leaves.	Cultivation to destroy eggs. Poison bait.
Army worm	Moth. Brownish gray; 1½ in. wing expanse.	Caterpillar. Greenish; 3 stripes on side. 1½ in. long.	Eats foliage, stripping field.	Barriers when marching. Poison bran mash.
Fall army worm	Moth. Gray, white or dull colored. 1¼ in. wing expanse.	Caterpillar, green to black with inverted white Y on head. 1½ in. long.	Eats foliage; often completely destroying crop or pasture.	When feeding and marching. Poison bran mash. Spray infested spots.
Corn ear worm	Moth. Yellowish green or drab. Wing expanse of 1 3/5 in.	Caterpillar varies from green to almost black. Striped. 2 in. long.	Cuts through husks; eats and tunnels through kernels.	Sweet corn silks dusted with calcium arsenate helps.
Cutworm (several species)	Moth. Wing spread 1½ in. Vary in color with species.	Caterpillar. Pole brownish to grayish white worms. Vary with species.	Plants cut off near ground.	Poison bate. Rotate crops.
Larger corn stalk borer	Moth. White to smoky yellow; 1¼ in. wing spread. At rest wings held close, making acute triangle.	Thick, dirty white caterpillar. Covered with many dark spots. 1 in. long.	Eats unfolding leaves, then bores into base of stalk.	Crop rotation. Destroy stubble.

Insect	Adult	Larva	Damage	Control
Granary weevil	Chestnut brown beetle, similar to rice weevil; 1/6 in. long.	Similar to rice weevil.	Similar to rice weevil, cannot fly.	Fumigate seed. Heat between 122 to 140° F.
Angoumois grain moth	Grayish moth; ½ in wing expanse.	White larva with brown head. 1/5 in. long.	Feeds in grain in storage. Infests in field and bin.	Same as Granary weevil
Rice weevil	Black snouted beetle. Dull reddish brown. 1/8 in. long.	Short, fat, whitish larva, 1/8 in. long.	Adults and larva eat grain. Flies to field.	Same as Granary weevil

SOURCE: Henson and Hughes, Crop Production, MacMillan 1930.

EXPLANATION: This table has been compiled on important insects affecting corn losses. It is a brief summary of known facts concerning the various insects.

QUESTIONS: 1. What insects cause the most damage to corn in your community?

2. Is crop rotation an important control in many cases?

XIX HARVESTING PROBLEMS

1. When To Cut To Get The Best Yield.

Weekly harvesting period	Maturity of ears	Usual farm work in community	7-yr. Ave yield		Test weight per bu., lbs.
			Shelled corn, Bus.	Stover, lbs.	
First	Well dented	Silo filling starts	46.9	3530	51.4
Second	Glazing	Silo filling under way	50.9	3690	52.0
Third	Glazed	Corn cutting starts	55.8	4100	53.1
Fourth	Glazed to mature	Corn cutting under way	60.5	4170	53.8
Fifth	Mature	Corn cutting finished	60.8	4140	54.5
Sixth	Mature		60.3	4140	54.6

SOURCE: Ohio Agr. Exp. Sta. Cir. 53, 1938,

EXPLANATION: This experiment was conducted at the Wooster station for a period of seven years. It was noted that corn does not continue to ripen in the shock but merely dries out.

QUESTIONS: 1. Was the yield of corn reduced if cut before the well-glazed stage?

2. Did the test weight per bushel indicate that the plumpness and weight of the kernels increased with the approach of maturity?

3. What appeared to be the best stage to harvest corn?

4. How did the yield of stover coincide with the yield of corn?

2. How Soon Does Corn Acquire Germinative Ability ?

Germinative Ability of Corn Harvested at Various Stages of Maturity.

Date of selection	Condition of grain	Days since fertilization	Wt. of 100 kernels (grams)	Ratio wt. of embryo to wt. of kernel	Per cent germination
Aug. 24	Milk stage	20	12.2	.078	80
Aug. 31	Late milk stage	27	17.0	.105	92
Sept. 7	Roasting-ear	34	20.4	.110	94
Sept. 14	Late Roasting-ear	41	24.2	.103	97
Sept. 21	Denting	48	27.9	.106	97
Sept. 28	Glazing	55	30.7	.112	96
Oct. 5	Mature	62	31.4		96

SOURCE: Neb. Agr. Exp. Sta. Bul. 163, 1918.

EXPLANATION: This experiment was carried on for three seasons and the above averaged results, tabulated. Hogue's yellow Dent corn was used. The germination test was made late in the winter after the grain had thoroughly dried. Immediately after harvest, the seed was hung in a dry, airy place and thus cured free from mold or other injury. The ratio weight of embryo to weight of kernels was for one year only.

QUESTIONS: 1. Would it be considered desirable to select seed corn before the stiff dough stage of development ?

2. At what stage was corn harvested to get maximum weight of grain ?

3. When To Harvest To Get Best Germination Of Seed.

Moisture Content and Germination of Corn Harvested at Various Dates During Fall and Winter of 1917-18.

Condition of corn at time of first frost, Oct. 8	Moisture in grain of corn gathered on:				
	Oct 8	Nov 19	Dec 11	Dec 29	Jan 17
Shocked corn:					
1. Fairly well matured, ears solid	30	17	15	16	14
corn Standing in field					
1. Fairly well matured, ears solid	35	17	16	15	14
2. Somewhat rubbery, ears twist	39	21	18	16	17
3. Very rubbery, grain meduim soft	43	26	23	19	19
4. Grain Very Soft	47	27	26	21	22
5. Late dough stage	50	34	28	28	27
Condition of Corn at time of first frost, October 8	Per cent perfect germination of corn gathered on.				
	Oct 8	Nov 19	Dec 11	Dec 29	Jan 17
Shocked Corn:					
1. Fairly well matured, ears solid	98	85	93	87	86
Corn Standing in field					
1. Fairly well matured, ears solid	98	83	87	93	88
2. Somewhat rubbery, ears solid	94	56	79	59	61
3. Very rubbery, grain medium soft	92	34	20	14	20
4. Grain very soft	92	14	17	5	6
5. Late dough stage	82	10	10	0	0
6. Milk stage	44	1	1	0	0
Min. temp. degrees F.	24	17	-16	-18	- 21

SOURCE: Neb. Agr. Exp. Sta. Bul. 163, X 1918.

EXPLANATION: Hogue's yellow Dent corn was used in this experiment. This table shows the relationship

3. Cont'd.

between moisture content and freezing injury of corn when selected at various dates from the field in the fall and winter of 1917-18. The selections were based on outward appearance and solidity of ears. The first selection was made after the first killing frost on October eight.

QUESTIONS:

1. Under what conditions did most of the damage occur ?
2. Was there much injury from Nov. 19 to Jan 17 ?
3. Was the shocked corn injured to any great extent ?
4. How did the driest standing-corn withstand the freezes ?

4. Does It Pay To Top Corn And Pull Fodder ?

Comparative Effect of Harvesting Methods on Yields of Corn for Grain and Roughage.

Number Comparisons	Fodder not pulled grain bu.	Fodder Pulled		Corn Cut		Tops Cut	
		Grain Bu.	Fodder Lbs.	Grain Bu.	Stover Lbs.	Grain Bu.	Tops Lbs.
16	27.31	26.07	530	[illegible]	[illegible]		
10	31.51			30.69	2102		
9	25.95					25.37	570
7	32.64	32.37	570	32.28	2220		

SOURCE: Miss. Agr. Exp. Sta. Bul. 312 (Revised), 1938

EXPLANATION: The results shown in this chart were summarized to show comparative results from various harvesting methods. These tests were made at several southern agriculture experiment stations, a section where the practice of topping and pulling fodder is most predominate.

QUESTIONS: 1. What conclusions can be drawn from this table as to the economics of pulling fodder and topping corn versus cutting the whole stalk ?

2. Were there any gains in bushels of grain where topping was practiced ?

3. Aside from lower yield how was the labor cost affected when corn was topped ?

5. Time Required For Husking.

	Bushels
From shock, by hand, one man	45.0
From standing stalks, by hand, one man, two horses	85.0
* Corn-husking machine, two men, seven horses, two wagons	300 to 375

SOURCE: U.S.D.A. Year book 1922

EXPLANATION: *The latter statement is by a leading machine manufacturing company as recorded in "Corn and Corn Growing" by Wallace and Bressman, 1928. The figures are the amount husked in a ten-hour day.

QUESTION: 1.How do these figures compare with the actual experience of farmers in your community ?

6. Time Required For Cutting And Shocking.

Cutting;

	Acres
Binder, 40 bus. corn, one man, three horses	8.0
Platform cutter, 40 bus. corn, two men, two horses	6.0

Shocking and Cutting by hand;

After binder, two men	3.6
Cut and shock by hand, one man	1.4

SOURCE; Bressman and Wallace, Corn and Corn Growing, John Wiley and Sons, 1928.

EXPLANATION: The figures are the acres harvested in a ten-hour day.

QUESTIONS: 1. How many men would it take to cut and shock a forty-acre field in four days ?

7. Comparison Of Hours Of Labor To Produce An Acre of Corn When Harvested In Different Ways.

When grain is harvested by	Number of fields	Average size of fields	Hours of labor per acre		Horse hours used per hour of man labor.
			Man	Horse	
Picking	108	12.97	48.18	55.44	1.15
Hogging off	17	6.91	23.38	41.21	1.76
Put in Silo	16	7.24	57.21	68.52	1.20
Part labor contracted*	36	19.11	43.96	55.45	1.26

SOURCE: Ohio Agr. Exp. Sta. Bul. 266, 1914.

EXPLANATION: This table was compiled from data at the Ohio station.

* Contracted labor cost $ 1.27 per acre additional.

QUESTIONS: 1. How does the labor requirement for hogging down corn compare to other methods of harvesting ?

2. Why isn't more corn hogged down ?

8. Harvest Labor Requirements For Different Operations

Operation and Implement used	Labor per acre		Acres covered in 10-hr. day.
	Man Hours	Horse hours	
Cutting by hand	6.5		1.6
Shocking after a binder	2.5		4.0
Husking from stalk, 1 team 1 man 50 bu. yield	6.3	12.6	1.6
Husking from shock, 50 bu. yield	10.0		1.0
Hauling and cribbing, 1 man and 1 team	2.0	4.0	5.0
Picking up corn knocked off by binder, 1 man and team 2.3 bu. per acre	.7	1.5	13.7
Shredding, 50 bu. yield	10.0	12.0	1.0
*Filling silo 7.3 ton yield	17.2	10.0	.6

SOURCE: Ohio Agr. Exp. Sta. Bul 396, 1926

EXPLANATION: *Time to cut with binder not included in silo filling tabulation. This table was computed from a study in variations in costs of producing corn and other associated crops in Greene county, Ohio. It reports the labor required per acre for different harvesting operations.

QUESTIONS: 1. How long would it take to cut 25 acres by hand with two men cutting ?

2. Did it take more labor to harvest corn by husking from the shock or by shredding it ?

9. Ralation Between yield Of Corn And Amount Of Labor Used Per Acre And Speed Of Husking.

Yield per acre, bus.	No. of fields	Area, acres	Corn husked per hour, bu.	Man labor per acre, hrs.
25.0 - 34.4	36	1,073.2	7.92	4.00
35.0 - 44.9	93	3,074.9	8.58	4.60
45.0 - 54.9	149	4,478.6	9.27	5.38
55.0 - 64.9	85	2,472.8	10.28	5.72
65.0 - 74.9	29	735.6	10.83	6.23

SOURCE: Ill. Agr. Exp. Sta. Bul. 373.

EXPLANATION: These figures were compiled fram a study in champaign and Piatt Counties, 1920 - 28. Hand husking from the stalk was the method used.

QUESTIONS: 1. As the yield increased how did it affect the amount of corn husked per hour ?

2. While the labor used per acre increased with the yield, was the rate of increase slower or faster than yield ?

3. Did this test indicate the importance of high yield from the standpoint of cheaper production costs per bushel ?

4. When hired labor is paid by the bushel or barrel for husking is there liklihood of difficulty in getting labor when the production is less than the average for the community ?

10. Labor Used And Estimated Cost Of Harvesting Corn By Different Methods.

Method of harvesting	Total Acres	Av. Yield bus.	Labor used, hrs.		Estimated Cost			
			Man	Horse	Labor	Power	Equipment and materials	Total
Hand Husking	11,945	48.8	5.23	10.19	$ 3.34	$ 1.43	$ 0.34	$ 5.11
Machine husking:								
One-row husker	10,747	42.9	2.72	3.28	.90	1.61	1.04	3.55
Two-row husker	10,162	45.0	2.21	2.86	.73	1.29	.96	2.98
Cutting for silage: Stationery Cutter	822	44.3	13.44	16.02	4.43	3.82	1.60	9.85
Cutting and shocking	135	28.7	16.60	16.90	3.61	1.71	.29	5.61

SOURCE: Ill. Agr. Exp. Sta. Bul. 373.

EXPLANATION: This study was conducted in Illinois and the averaged results are on acre units. Total harvesting costs were included for the operation mentioned. The average for the one-row huskers was 100 acres: 150 for the two-row huskers.

QUESTIONS: 1. Which method cost the most from a labor standpoint ? Second-highest?

2. How did the total cost of harvesting by the cutting and shocking method compare with the others ? (This method did not include cost of husking and cribbing.)

11. Comparisons Of Hogging Down With Harvesting And Feeding Corn.

Items	No forage		Forage	
	Standing Corn and tankage	Harvested corn and tankage	Standing corn and tankage	Harvested corn and tankage
Number of trials	3	3	1	1
Total number of pigs	20	20	6	6
Initial weight per pig	140.65	141.33	126.67	127.83
Final weight per pig	218.30	221.07	211.25	205.25
Average daily gain	1.61	1.66	1.97	2.04
Feed:				
Corn	7967.39	7022.09	2035.76	1640.98
Tankage	384.80	384.80	77.40	68.40
Daily feed per pig:				
Corn	8.28	7.30	7.89	7.20
Tankage	.40	.40	.30	.30
Feed per 100 lb. gain:				
Corn	513.03	440.30	401.14	353.28
Tankage	24.78	24.13	15.25	14.73
Gain per bu. corn	10.92	12.72	13.96	15.85
Tankage per bu. corn	2.70	3.07	2.13	2.33
Value of gains per bu.*	$ 0.83	$ 0.97	$ 1.11	$ 1.25
Difference		$ + 0.14		$ + 0.15

SOURCE: Ohio Agr. Exp. Sta. Bul 398, 1926.

EXPLANATION: * Tankage deducted. This is a summary of experiments conducted at Wooster.

QUESTIONS: 1. Did hogs fed standing corn or harvested corn make more rapid gains ?

2. For a given amount of feed which method produced greater gains ?

3. How do you think hogging down would rate as a method of harvesting corn if the cost of harvesting and feeding were added to the expense of the harvested corn method ?

4. Did this experiment point to the value of forage for hogs ?

Continued from 11.

12. Carrying Capacity Of An Acre Of Standing Corn In Number of Shotes.

Bus. to the acre	30 Days	60 Days	90 Days	120 Days
40	14-15	6-7	4-5	3
50	18-19	8-9	5-6	4
60	21-22	10-11	6-7	4-5
70	26-27	12-13	7-8	5-6

SOURCE: Iowa Agr. Exp. Sta. Bul. 143, 1913.

EXPLANATION: The average weight of pigs when turned into the corn was 125-150 pounds.

QUESTIONS: 1. How many pigs weighing 130 pounds will a ten-acre field of corn carry for sixty days if the field will yield fifty bushels to the acre ? 2. Is it better to hog down a whole field at one time or to divide into smaller acres and proceed over the field as the hogs finish up a lot ?

XX MARKETING

1. Federal Grades Of Corn

Grade No.	Minimum Test weight per bushel	Maximum Limits of			
		Moisture	Foriegn material and cracked corn	Damaged corn	
				Total	Heat Damage
	Lbs.	%	%	%	%
1	54	14.0	2	3	.1
2	53	15.5	3	5	.2
3	51	17.5	4	7	.5
4	48	20.0	5	10	1.0
5	44	23.0	7	15	3.0

SOURCE: Field Crop Enterprises, Pub. by Lippincott, 1937.

EXPLANATION: This table illustrates the established U.S. standards for the five main grades for yellow, white and mixed corn.

In addition sample grade shall include corn which does not come in any of the above classifications; or which contains stones or cinders; or which is musty sour, heating or hot; or which may be commercially objectionable because of foriegn oder; or which is otherwise of distinctly low quality.

QUESTIONS: 1. What is the practical value of standard grades of corn ?

2. What is the maximum moisture content of grade one corn ?

2. Seasonal Advances In The Price Of Corn When The December Price Is High, Low Or Averag

Purchasing power of December prices	Number of Years	Advance in prices				
		March over Dec.	May over Dec.	July Over Dec.	Sept. over Dec.	Following Dec. over Dec.
		cents	cents			
Very low	11	0.8	4.9	6.3	7.6	8.6
Low	11	2.0	5.6	6.6	11.8	9.7
High	11	-1.5	1.9	2.4	1.3	4.3
Very high	11	-2.3	4.1	1.6	-2.4	-12.7
Average	44	-0.2	4.1	4.3	4.6	0.3

SOURCE: N.Y. State Agr. Col. (Data taken from Overton and Robert's Farm Management and Marketing, Lippincott, 1936)

EXPLANATION: These data are a summarization of the corn market price for a 44-year period and give some helpful suggestions as to whether to sell or hold corn under different circumstances.

QUESTIONS: 1. When corn is cheap in December would you advise selling or holding ? If it is high in December ? (It should be noted that in determining whether corn is high or low in price, an index number of purchasing power, such as is published by the U.S. Bureau of Economics, should be used rather than the price per bushel in order to eliminate the affect of the fluctuating value of the dollar.)

1. Shrinkage Of Shelled Corn.

Moisture in corn when cribbed	Grade, if moisture is limiting factors	Amount of shelled corn remaining at end of storage when moisture content is; (in bushels)					
		12%	13%	14%	15%	16%	17%
Perct. 32.0	Sample	750	760	770	780	790	801
30.0	Sample	775	785	795	806	817	828
28.0	Sample	799	810	821	832	843	854
26.0	Sample	825	836	847	858	869	881
24.0	Sample	850	861	872	884	895	907
23.0	6	462	873	885	896	908	920
21.5	5	881	892	904	916	928	940
19.5	4	906	918	930	942	954	967

SOURCE: ILL. Agr. Exp. Sta. Bul. 295.

EXPLANATION: If enough ear corn to shell out 1,000 bushels is placed in cribs when it contains the percentage of moisture shown in the left column of this table, and is allowed to dry down to a moisture content corresponding to that shown at the tops of the other columns, the number of bushels of shelled corn which will remain is shown in the body of the table. In general, the percentage of shrinkage on a shelled basis will range between two-thirds and three-fourths as much as will the percentage of shrinkage for ear corn

QUESTIONS: 1. If one thousand bushels of corn was cribbed with a moisture content of 26 per cent and taken out of the crib at 14% how many bushels would there be ?

2. Shrinkage Of Ear Corn Stored In Cribs.

	Total shrinkage to date, per cent	Av. for the month per cent
November	5.2	5.2
December	6.9	1.7
January	7.5	.6
February	7.8	.3
March	9.7	1.9
April	12.8	3.1
May	14.7	1.9
June	16.3	1.6
July	17.3	1.0
August	17.8	.5
September	18.2	.4
October	18.2	.0

SOURCE:: Warren, Farm Management, MacMillan, 1919.

EXPLANATION: This experiment represents an average of eight years study at Ames, Iowa.

QUESTION: 1. What was the total shrinkage for one year ?

2. What would be the shrinkage of a crop of 3,000 bushels by May one ?

3. After November what month had the greatest shrinkage ?

3. Capacities Of Combined Corncribs And Granaries.

Height of studding in outside walls	Crop stored in:	Capacity per foot of lenght, bus.
	Bins	34.6
	Cribs	75.1
10 feet	Total	109.7
	Bins	52.0
	Cribs	86.9
12 feet	Total	138.9
	Bins	69.3
	Cribs	98.2
14 feet	Total	167.5
	Bins	86.6
	Cribs	109.6
16 feet	Total	196.2
	Bins	104.0
	Cribs	121.0
18 feet	Total	225.0

SOURCE: U. S. D. A. F. Bul. 1701, 1933

EXPLANATION: This is for the double type of corncrib. Width of each crib, eight feet; width of driveway, 11 feet; grain bin measured from ten feet above crib floor (height of driveway) to four feet above outside plate; average height of ear corn measured to two and one-half feet above outside plate.

QUESTIONS: 1. How much corn will a fourteen-feet high, studding crib hold that is twenty feet long ? Bin capacity ?

XXll EROSION PROBLEMS

A Controlling Erosion

1. Rainfall Lost by Runoff and Tons of Soil Eroded When Continuous Corn and Other Systems Were Used.

Cropping Plan	Per cent of rainfall lost by runoff	Tons of soil eroded in 6 yrs.	Years required to erode 7 inches
Corn annually	27.38	106.5	56
Rotation-corn, wheat, and clover	14.14	13.7	437
Wheat, annually	25.19	39.9	150
Sod	11.55	1.7	3,547
Plowed 8" deep, cultivated	28.36	214.2	28
Plowed 4" deep, cultivated	31.26	247.3	24
Not cultivated (weeds scraped)	48.92	207.8	29

SOURCE: Mo. Agr. Exp. Sta. Res. Bul. 63, 1923

EXPLANATION: This table represents a period of six years; the study began in 1917 and ended in 1923. The soil was a rather poor phase of Shelby loam having a dark gray surface soil about eight inches deep with a moderately heavy subsoil lying on glacial material. The slope was 3.68 feet per hundred. This soil would produce about thirty bushels of corn per acre on an average season.

QUESIONS: 1. How does continuous corn growing compare to a rotation or a sod, for rainfall runoff ?

2. Compare the tons of soil eroded under different systems.

3. Does it pay to leave land exposed to the rain and wind without having some sort of crop on it ?

2. Plant Nutrients Lost By Erosion When Corn And Other Cropping Methods Were Used.

Cropping	Pounds nitrate lost annually	Pounds phosphorous lost annually	Pounds calcium lost annually
Corn, annually	40.36	8.14	103.37
Rotation-corn, wheat, and clover	5.94	2.22	41.47
Wheat, annually	29.58	10.83	75.99
Sod	0.55	0.09	0.64
Plowed 8" deep, cultivated	73.87	33.26	225.63
Plowed 4" deep, cultivated	95.40	45.47	337.89
Not cultivated (weeds scraped)	98.88	47.47	379.38

SOURCE: Mo. Agr. Exp. Sta. Res. Bul. 63, 1923.

EXPLANATION: This is a two-year average at the Missouri station. The loss per acre in eroded material is given. Over fifty per cent of the erosion was caused by the comparatively few heavy rains. The surface seven inches of soil was found to contain 0.112 per cent nitrogen, 0.05 per cent phosphorus, 1.24 per cent of potassium, a soil which in an average season would produce a little under thirty bushels of corn per acre.

QUESTIONS: 1. From the standpoint of plant food lost does it pay to conserve the soil ?

2. What cropping method conserves the most plant food ?

3. How does corn compare with the other cropping methods?

4. Is a rotation a practical procedure to conserve plant food in the soil ?

B. Determining Crop Rotations With Corn
1. Does It Pay to Rotate Corn ?

Treatment and system	Corn, bus.	Stover, lbs.
Corn continuously, treated each 4 yrs. with 16 tons of manure and annually with 219 lbs. of floats	32.93	2466
Corn continuously with no fertilizer or manure.	16.87	1420
Corn in 4-yr. rotation with no fertilizer or manure treatment.	32.66	1926
Corn in 4-yr, rotation with 16 tons of manure each 4 yrs. and 219 lbs. of raw rock phosphate annually.	58.00	3547

SOURCE: Adapted from unpublished data of the Va. Agr. Exp. Sta. at Blacksburg, 1939.

EXPLANATION: These data represent 25 years of experimentation, commencing in 1914. The yield is in terms of acre units. The four-year rotation was corn, wheat, clover, and grass and clover hay.

QUESTION: 1. How did corn grown continuously on the same land yield in comparison to the corn grown in rotation ?

2. What does this prove concerning the value of crop rotation ? Over a period of years how does the value of rotating compare with the cost of manure and fertilizer when corn is grown continuously ?

2. Effect Of Crop Rotation On Corn Yield.

Crop rotation	Fertilizer treatment	Av. yield of corn per acre, bus.
1-yr. rotation, continuous corn.	300 lbs. fertilizer	15.4
2-yr. rotation, corn and wheat	300 lbs. fertilizer	21.4
2-yr. rotation, corn and wheat.	No fertilizer	13.8
2-yr. rotation, corn and cowpeas, wheat and cowpeas.	No fertilizer	17.2
2-yr. rotation, corn and cowpeas, wheat and cowpeas.	300 lbs. fertilizer	30.9
3-yr. rotation, corn and cowpeas, wheat and red clover	300 lbs. fertilizer	37.2
3-yr. rotation, corn and cowpeas, wheat, and red clover	No fertilizer	19.2

SOURCE: From unpublished data of the N. C. Agr. Exp. Sta. Taken from "Suggestive Helps to Teachers of Agriculture," No. 6.

EXPLANATION: This experiment was conducted at the Piedmont Station at Statesville over a period of years from 1918 to 1934, inclusively. The soil was Cecil clay loan. The fertilizer used analyzed 4-9½-2. The treatment was per acre unit.

QUESTIONS: 1. What system gave the best yield and what do you think accounted for it ?

2. Does it pay to use fertilizer in the rotation ?

3. Does a one, two, or three-year rotation appear best?

3. Eight Rotation Test With Corn.

Type of rotation	Duration of rotation	Av. yield of corn, bus.	Av. yield of wheat, bus.	Av. yield of hay lbs.
Corn, wheat, clover and timothy, 1 yr.	3 years	59.58	22.82	4115
Corn, barley, clover and timothy, 1 yr.	3 years	59.03	22.49	4260
Corn, wheat, clover and timothy, 2 yrs.	4 years	54.00	20.26	3021
Corn, wheat, clover and timothy, 3 yrs.	5 years	51.15	19.30	2713
Corn, clover and timothy, 2 yrs.	3 years	47.42		3520
Corn, wheat 2 yrs, clover and timothy 2 yrs.	5 years	47.15	19.50	3209
Corn, alfalfa and timothy 4 yrs.	5 years	53.14		2248
Corn, 2 years, alfalfa and timothy 4 yrs.	6 years	57.72		3218

SOURCE: Unpublished data Va. Exp. Sta. at Glade Spring Substation, 1939.

EXPLANATION: These rotations were started in 1930 and are averaged up to 1936 inclusive. The plots were limed at the rate of three tons of ground lime per acre and two tons per acre every six years thereafter. Grain and clover rotations received three hundred pounds of 4-12-4 fertilizer per acre to corn and small grain up to 1936. Beginning with 1937 all plots were treated with 200 pounds of 0-14-6 annually. Alfalfa had to be given an additional treatment of three tons of lime per acre in 1934 and 400 pounds of 4-16-8 at each seeding.

QUESTIONS: 1. Which two rotations gave the best yields ?

2. Do the extended hay rotations increase or decrease hay yields?

3. Why is it objectionable to keep land in continuous corn for an extended period on hilly land?

4. Do long or short rotations give the best results?

4. Rotation Tests In Augusta County.

Rotation	Crop	Yields per acre	Years tested
5 - Year	Corn	34.42 bus.	10
	Wheat	15.17 bus.	12
	Wheat	13.25 bus.	12
	Grass	2444 lbs.	12
	Grass	2679 lbs.	11
5 - Year	Corn	32.65 bus.	10
	Soybeans	3188 lbs.	12
	Wheat	14.97 bus.	12
	Grass	2320 lbs.	11
	Grass	2392 lbs.	12
4 - Year	Corn	32.60 bus.	10
	Wheat	18.14 bus.	12
	Grass	3285 lbs.	12
	Grass	2546 lbs.	11
3 - Year	Corn	34.80 bus.	10
	Wheat	19.06 bus.	12
	Red Clover	2550 lbs.	11
3 - Year	Corn	36.36 bus.	10
	Wheat	21.20 bus.	12
	Sweet Clover	3026 lbs.	11

SOURCE: Unpublished data of Va. Agr. Exp. Sta. at Staunton, 1939.

EXPLANATION: This experiment is recorded for twelve years up to 1938. The soil is Berks silt loam. The purpose is to compare the effeciency of various rotations in maintaining soil fertility with corn as the key crop. The soil was limed with two tons of ground limestone in 1926 and each six years thereafter.

4. Cont'd.

All plots are fertilized annually with two hundred pounds of 16 per cent superphosphate and fifty pounds of muriate of potash.

QUESTIONS: 1. Which rotation is giving the largest yield of corn ? Wheat ?

2. Is a short or long rotation better ?

5. Results Of Cross-Cropping Experiment.

Preceding Crops	Average yield in bushels per acre 1922-1938			
	Corn	Soybeans	Oats	Wheat
Corn	48.8	24.6	49.1	22.4
Soybeans	51.2	23.6	52.9	25.3
Oats	49.1	24.1	42.2	21.6
Wheat	48.6	22.9	43.7	19.5
Clover	56.4	24.4	53.2	30.9
Timothy	50.3	23.2	41.7	21.6

SOURCE: Ind. Agr. Exp. Sta. Cir. 242, 1939

EXPLANATION: The purpose of this demonstration is to study the effect of the commonly grown field crops upon the yields of crops that follow. The crops are systematically rearraged on three series of plots so as to eliminate the effect of soil variation and cumulative effect of any crop or combination of crops. All crops were removed except second growth clover, and the land was all uniformily fertilized for two years. The crop harvested to determine the effect of the prededing crop receiver no fertilizer. This table indicates the trend of results of seventeen crop years.

QUESTION: 1. What preceding crop gives the highest yields of grain ?

2. Which crop seems to be most independent of the preceding crop ?

3. How do corn and soybeans compare with oats and wheat following oats ?

4. Does corn as a preceding crop cause higher yields of small grains than do other preceding non-legume?

6. Clover vs. Timothy With Corn And Wheat.

Rotations	Average yields per acre			Annual value of grain and hay.
	Corn, bus. 1920-1938	Wheat, bushels 1920-1938	Hay, lbs. 1920-1938	
Corn, wheat, clover	40.6	22.5	2753	$ 16.44
Corn, wheat, timothy	35.3	20.2	2196	$ 14.20

SOURCE: Ind. Agr. Exp. Sta. Cir. 246, 1939

EXPLANATION: This experiment was conducted at the Huntington Experiment Field which has a mixture of Crosby, Brookston, and Clyde silt loams. The purpose of the experiment was to test the value of clover in the crop rotation in comparion with timothy which is the standard non-legume hay crop. Both rotations got five tons of manure per acre for corn and 300 pounds of 2-12-6 fertilizer for wheat.

QUESTIONS: 1. What was the average increase per bushel of corn where clover was in the rotation ? For wheat ?

2. What was the hay increase between the two systems ?

7. Rotation Influence On Soil Nitrogen And Organic Matter

Cropping system	Years	Lbs. per acre in surface soil	
		Organic matter	Nitrogen
Corn continuous	32	12,516	820
Oats Continuous	32	21,722	1,300
Wheat continuous	32	21,826	1,320
Corn, oats, wheat, clover, timothy rotation	32	26,515	1,540
Corn, wheat, clover, rotation	29	29,549	1,760
Organic soil (approximate)		36,825	2,240

SOURCE: Ohio Exp. Sta. Bul. 402, 1927.

EXPLANATION: This study in Ohio showed the effect of rotations on the organic matter and nitrogen in the soil, as compared with the continuous culture of corn, oats and wheat. The land was limed and drained but received no fertilizer.

QUESTIONS: 1. How did the organic matter of the soil compare when corn was grown continuously as against the rotations ? Wheat ? Oats ?

2. Which cropping method depleted the soil nitrogen most ? The least ?

8. Effect Of Preceding Hay Crop On Corn Yield.

Preceding Crop	Av. yield of grain per acre in bus.					Total
	1922	1923	1925	1926	1929	
Sweet clover	79.9	49.3	50.2	46.0	47.0	272.4
Orchard grass	59.6	47.3	32.3	42.0	39.4	220.6
Lespedeza	61.4	40.5	53.2	43.0	43.3	241.4
Corn	48.2	31.7	26.0	30.3	18.7	154.9

SOURCE: Tenn. Agr. Exp. Sta. Bul. 142, 1930

EXPLANATION: These tests were conducted at the Jackson Station on silt loom soil of good productivity but lacking in nitrogen. Two tons of ground limestone were applied at the beginning of the experiment.

QUESTIONS: 1. What crop gave the greatest corn yield ? How effective was lespedeza ?

2. How did continuous corn cropping affect the yield ?

3. Is it important to include a good legume hay crop in a rotation involving corn ?

9. Effect Of Other Hay Crops Preceding Corn

Year	Yields of Corn following					
	Alfalfa		Red Clover		Clover & Grass	
	Grain	Stover	Grain	Stover	Grain	Stover
	Bus.	Tons	Bus.	Tons	Bus.	Tons
1920	73.2	1.64	58.4	1.40	42.0	1.25
1921	63.0	2.15	51.3	1.96	55.9	2.03
1922	45.5	1.24	34.8	1.01	37.5	1.20
1923	34.5	1.20	28.3	1.05	31.1	1.13
Average	54.1	1.56	43.2	1.36	41.6	1.40

SOURCE: Tenn. Agr. Exp. Sta. Bul 142, 1930

EXPLANATION: Corn was grown continuously on these plots for four years after the preceding hay crop indicated. The experiment was conducted at Jackson. The soil was a brownish silt loam of average fertility with a good supply of phosphorus and potash but low in nitrogen.

QUESTIONS: 1. Which hay crop caused the best yield of corn ?

2. Why did alfalfa cause the greater yield ?

10. Corn Yields Following Soybeans Turned Under And Soybeans Cut For Hay.

Year	Bushes corn and mature corn plants per acre					
	Beans plowed under		Beans cut for hay		No beans grown	
	Yield, bus.	Corn plants	Yield, bus.	Corn plants	Yield, bus.	Corn plant
1930	30.5	56.0	24.1	53.8	19.6	51.3
1932	50.2	45.8	33.3	44.2	19.1	48.2
1934	21.0	45.1	19.5	49.0	10.6	43.3
Average	33.9	48.9	25.8	48.3	16.4	47.8

SOURCE: La. Agr. Exp. Sta. Bul. 265, 1935.

EXPLANATION: The soil for this experiment was classed Denham silt loam of fair fertility and had been heavily tilled for anumber of years. The figures represent averages of plots. All plots were fertilized each year with three hundred pounds of 16 per cent superphosphate, fifty pounds of nitrato of soda, and fifty pounds of muriate of potash per acre. The soybeans were Otootan. The beans were planted in alternating rows with the corn and in hills 27 inches apart. The rows were four feet apart. The corn was thinned to one stalk per hill.

QUESTIONS: 1. How much difference was there in the yields of corn when grown with beans turned under and beans cut for hay ?

2. Do soybeans cut for hay improve the land ?

3. What was the increase where beans were cut for hay as against the plats where no beans were grown?

11. Effect On Yield Of Corn Where Beans Were Picked For Seed vs. Cut For Hay.

Soybeans	Av. yield of Corn per Acre in bushels					
Year	1927	1929	1931	1933	1935	Av. of five tests
Picked for seed	37.9	43.3	42.2	36.8	44.3	44.8
Cut for hay	33.5	28.6	29.0	23.8	26.9	28.8

SOURCE: Unpublished data of the Agr. Exp. Sta. at Rocky Mount, N. C. Adopted from: "Suggestive Helps to Teachers, " No. 6.

EXPLANATION: Seventeen plots were used in this experiment and the results reported are the averages. Duplicate fertilizer applications were made on all plots. The area is Coostal Plain and the soil of a "Denbar fine sandy loam " " type.

QUESTION: 1. Which method seemed to leave the soil in a less productive state ?

2. Since the stalks remained on the land when the beane were picked, what do you conclude about the importance of returning to the soil that which is taken away as nearly as possible ?

12. Corn Yield Test With Soybeans And Velvet Beans Grown In Combination.

Treatment	Pounds air-day cut corn and legumes	Bus. shelled corn per acre
Corn alone (no legumes)	7104	55.8
Corn and velvet-beans (planted when corn was)	7092	30.3
Corn and velvet-beans (beans 3 weeks later)	7178	42.2
Av. all corn and velvet bean plots	7137	36.3
Soybeans planted when corn was planted	8511	43.7
Soybeans planted 3 wks. after corn	7877	48.2
Av. all soybeans plots	8194	46.0

SOURCE: Forty-Seventh Ann. Rpt. Ga. Agr. Exp. Sta., 1935.

EXPLANATION: The summer legumes used were Otootan soybeans and Early Speckled velvet beans.

QUESTIONS: 1. Did the summer legumes increase the yield of corn ?

2. Which legume reduced the corn yield most ?

3. Compare the total forage yield of these various trials.

4. What deduction could you make concerning this experiment ?

13. Plant-Food Elements Added Or Removed By Various Crops.

Crop	Acre yield	Nutrient elements per acre					
		Added	Removed				
		N	N	P	K	Ca.	Mg.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Corn	40 bus.		40	7	8	.4	2.8
Oats	40 bus.		26	4.5	6.5	.8	1.6
Wheat	25 bus.		36	6	7.5	.5	2.0
Soybeans[a]	20 bus.	16		8	25	2.8	3.0
Soybeans[b]	$2\frac{1}{4}$ bus.		30	13	40	72.0	31.0
Alfalfa[b]	3 Tons.			13	96	120.0	24.0
Red Clover	2 Tons.			10	60	64.0	18.0

SOURCE: Ill. Agr. Exp. Sta. Bul 456, 1939.

EXPLANATION: a- Soybeans sold, straw returned.

b- Hay sold, no manure returned.

These data were compiled from various sources,

QUESTION: 1. How did a crop of soybeans compare with corn and wheat in the removal of nitrogen ? Removal of phosphorus ? Potassium ? Calcium ? Magnesium ?

2. Why is it important to restore to the soil plant-food that had been removed ?

3. How can plant-food be restored economically ?

14. Grain vs. Livestock Farming.

(1910-1936)

		First 10-yr. period	Second 10-yr period	Twenty-yr Average	Seven-yr.Av. 1930-1936
Ear Corn, bus.	Livestock farming	67.3	86.3	76.8	70.0
	Grain farming	59.2	79.8	69.5	69.2
	Difference	8.1	6.5	7.3	0.8
Soybeans, bus.	Livestock farming	21.7	25.1	23.4	27.7
	Grain farming	19.1	22.0	20.5	26.8
	Difference	2.6	3.1	2.9	0.9
Wheat, bus.	Livestock farming	32.5	33.8	33.1	36.1
	Grain farming	29.4	29.7	29.6	29.3
	Difference	3.1	4.1	3.5	6.8

SOURCE: Ohio Agr. Exp. Sta. Bul. 592, 1939.

EXPLANATION: This experiment was started in 1910 with the rotation of corn, soybeans, wheat, and clover. Clover is omitted from the chart due to lack of comparison, With the livestock system of farming all the crops except the wheat grain is feed and goes back to the land as manure. In the grain system the corn, soybean seed and wheat are sold. The residue is put back in the ground. The corn in the rotations got two tons of limestone per acre until 1931 when it was discoutinued. The corn land also received 320 lbs. of 20 % superphosphate. In addition the corn in the livestock system had an average of 15.42 tons of manure per acre since the experiment started. The wheat got 240 lbs. of 20 % superphosphate per A. under each system. The soybeans got no extra fertilizer.

QUESTIONS:

1. Is it possible to keep up the fertility of the soil with out manure from livestock ?

2. Discuss other fac

14.Cont'd.

2. Discuss other factors such as balance, and increased income from grain sold on the hoof, that should be considered.

3. Did the difference in yield warrant livestock farming over grain farming in this experiment ? On the average farm in Virginia ?

c. Fertilizing

1. Fertilizer and Lime Test.

Treatment	Corn yield in bus.		Wheat yield bus.		Hay yield in lbs.	
	Lime	No lime	Lime	No lime	Lime	No lime
Superphosphate, 200 lbs. on wheat.	30.2	18.3	13.2	6.7	2455	975
Superphosphate, 200 lbs on wheat and corn.	28.4	21.7	13.7	8.0	2839	1398
Superphosphate, 400 lbs. on wheat	30.4	22.9	13.4	8.4	2839	1536
Superphosphate, 400 lbs. on wheat and corn.	30.7	24.3	13.0	8.7	2857	1690
Superphosphate, 200 lbs. and Muriate of potash 25 lbs.	33.6	24.3	13.1	8.7	2945	1444
Superposphate, 200 lbs. Muriate of potash, 25 lbs. Nitrate of soda, 90 lbs.	35.8	25.1	15.3	10.6	3113	1518

SOURCE: Unpublished data of Va. Agr. Exp. Sta. at Chatam, 1939.

EXPLANATION: The last two fertilizer treatments in the table were applied to both wheat and corn in the rotation. This test is being conducted on Cecil Sandy loam as a three-year rotation. It has been in progress for fifteen years and the above figures are averages up to and including 1938. During this period the average increase of limed plots over unlimed plots has been corn 38.2 per cent, wheat 58.8 per cent and hay 99.1 per cent. This had been conducted as a four-year rotation for 12 years but the hay was changed from two years to one year. This station is in the Piedmont area.

QUESTIONS: 1. How did the limed plots compare with the unlimed ones ?

2. Did corn benefit from the use of lime ? Which crop benifited the most ?

3. Did the addition of potash and nitrogen increase the yields materially ?

2. Effect Of Annual Fertilizer Applications On Crop Yields.

Treatment per acre	Corn, bus.	Wheat bus.	Clover hay, tons	Mixed hay, tons	Ann. gross returns	Av. Annual increase from fertilizer use.
Dried blood, 308 lbs.	26.42	5.66	.95	1.15	$ 19.34	$ 0.09
Superphosphate, 438 lbs.	45.09	19.35	1.66	1.91	36.12	16.87
Muriate of Potash, 200 lbs.	39.59	10.65	1.41	1.26	27.23	7.98
Check, no fertilizer	30.89	6.52	.84	.97	19.25	
Dried blood, 308 lbs. Superphosphate, 438 lbs.	38.66	14.94	1.45	1.51	29.86	10.61
Dried blood, 308 lbs. Muriate of potash, 200 lbs.	41.42	11.04	1.21	1.38	27.41	8.16
Superphosphate, 438 lbs. Muriate of potash, 200 lbs.	52.13	19.09	1.91	1.85	36.54	16.29
Dried blood, 308 lbs. Superphosphate, 438 lbs. Muriate of potash, 200 lbs.	55.55	23.43	2.03	2.43	39.97	20.72

SOURCE: Hutcheson, Wolfe and Kipps, Production of Field Crops, McGraw-Hill, 1936.

EXPLANATION: The figures are averages in terms of acre units for twenty years of testing (1914 to 1934) with the above crops in a four-year rotation. The data are tabulated from tests on Frederick silt loam by the Virginia Experiment Station.

QUESTIONS: 1. What did this experiment show concerning commercial fertilizers ?

2 . What three methods of fertilization gave the largest gross returns ?

3. Which gave the lowest increase from fertilizer use ? Which appeared to be the most profitable ?

3. Phosphorus Source Test On Limed And Unlimed Plots.

	Corn, bus.		Wheat, bus.		Red clover, lbs.	
	Limed	Umlimed	Limed	Unlimed	Limed	Unlimed
No phosphate	35.3	30.0	14.8	10.9	3260	1140
Gypsum	38.2	30.5	14.7	11.5	3200	1000
Superphosphate	39.1	33.6	21.3	13.9	4300	1700
Basic slag	38.3	35.1	18.6	14.1	4120	1860
Bone meal	38.0	34.3	16.7	12.4	3740	1520
Rock phosphate	37.6	29.7	16.1	11.8	3660	1560

SOURCE: Va. Agr. Exp. Sta. Bul. 292, 1933.

EXPLANATION: The above yields are for acre units. The averages are for eight years of testing. The experiment was conducted on Berks silt loam in Augusta County. Phosporus was applied annually at rates which gave 32 pounds of P_2O_5. Nitrogen and potash were also applied annually to each plot in equal amounts.

QUESTIONS: 1. Which material gave the highest yields on the limed plots ? Unlimed ?

2. How did rock phosphate compare with superphosphate ?

3. Which treatment gave the lowest yield of corn ? Wheat ? Hay ?

4. Time To Apply Phosphorus.

Crop	Applied every year		Applied every third year		Applied every sixth year	
	Super-phosphate	Rock phosphate	Super-phosphate	Rock phosphate	Super-phosphate	Rock phosphate
Corn (bus.)	39.1	37.6	44.5	42.3	42.2	37.8
Wheat (bus.)	21.31	16.8	22.34	18.18	20.17	16.09
Red Clover (lbs.)	4,300	3,660	4,120	3,500	3,660	3,160

SOURCE: Va. Agr. Exp. Sta. Bul. 292, 1933.

EXPLANATION: This is a comparison of the effect of superphosphate and rock phosphate on the yields of corn, wheat, and clover in rotation, when applied each year, every third year and every sixth year. The test was conducted on Berks silt loam at the Augusta Substation for a period of eight years. Material was applied at the rate of 200 pounds of superphosphate per year. Nitrogen and potash were also added annually.

QUESTIONS: 1. How did the rock phosphate compare with superphosphate ?

2. What difference was there in yields in comparing the different times of application ?

3. Does phosphorus leach very quickly ?

5. High vs. Low Analysis Superphosphate.

Treatment	Increase in yield			Value of increase	Cost of fertilizer	Bal.
	Corn bus.	Wheat bus.	Clover lbs.			
16% superphosphate	1.3	10.5	280	$ 11.22	$ 7.91	$3.31
44% superphosphate	1.0	9.5	200	9.85	7.00	2.85
44% superphosphate Gypsum	2.0	11.0	280	12.02		
Av. yield of unfertilized plots	39.7	23.9	4070			

SOURCE: Ohio Agr. Exp. Sta. Cir. 53, 1938.

EXPLANATION: This experiment on the above three-year rotation was conducted from 1923 to 1932 inclusive. The 16 per cent superphosphate was applied at the rate of 375 pounds per acre on both corn and wheat. The 44 per cent superphosphate was applied in amounts to equal the phosphoric acid in the 16 per cent treatment. The gypsum was applied so as to equal the amount of phosphoric acid in the 16 per cent treatment.

QUESTIONS: 1. Does the evidence indicate a slight superiority of 16 per cent over the 44 per cent ?

2. On the whole are the differences large enough between the two phosphates to be significant ?

6. Effect Of Potash In Addition To Nitrogen And Phosphorus.

Treatment	Average yields of crops grown in rotation (1914-1936)				Percentage of marketable corn.	Ratio in pounds		Pulling resistance of corn plants	Per cent leaning and broken stalks.	
	corn bus.	wheat bus.	clover hay. tons	grass hay. tons		corn to stover	wheat to straw	1927-32	1928 1931	1929 1930 1932
0	32.34	6.40	.82	.96	76.33	.94: 1	.48: 1	111	43.0	7.6
K	39.52	10.17	1.01	1.11	81.49	1.00: 1	.58: 1	154	43.7	1.1
KN	41.74	10.66	1.19	1.37	76.61	.97; 1	.48: 1	174	43.0	1.1
P	46.34	19.28	1.67	1.87	84.53	1.03: 1	.58: 1	145	65.1	3.1
KP	53.03	19.63	2.03	1.88	88.24	1.00: 1	.58: 1	208	25.1	1.6
NP	39.78	14.93	1.42	1.51	79.51	1.05: 1	.52: 1	131	48.2	18.1
N	27.91	5.48	1.01	1.13	71.10	.85: 1	.41: 1	103	73.9	17.4
KNP	55.97	23.94	2.14	2.43	88.86	.96: 1	.57: 1	215	32.3	2.1

SOURCE: Va. Agr. Exp. Sta. Reprint, M-7.

EXPLANATION: This experiment had been in progress at Blacksburg for tweny-three years. A four-year rotation of corn, wheat, clover and grass. The formula of treatments is as follows:

O, no fertilizer.

N, 308 pounds of dried blood annually.

P, 438 pounds of superphosphate annually.

K, 200 pounds of muriate of potash annually.

6. Cont'd.

QUESTIONS: 1. Has the addition of potash increased yields ?

2. What effect has potash shown on pulling resistance ?

3. What has this experiment shown concerining the importance of phosphorous in the fertilizer ?

4. Next to the complete fertilizer what combination gave the best yield of corn ?

Highest pulling resistance ?

7. Concentrated vs. Ordinary Analysis In Hill.

Treatment in hill		Average increase in yield, bus.		Value of increase	Cost of fertilizer	Balance
Analysis	Amount, lbs.	Corn (4-yr)	Oats (4-yr)			
4-12-4	200	8.4	4.0	$ 5.40	$ 3.19	2.21
8-24-8	100	6.9	1.3	3.84	2.90	.94
12-36-12	67	8.2	2.7	4.91	2.82	2.09
15-30-15	50	5.8	1.8	3.44		
Av. unfertilized yields.		30.0	25.0	22.50		

SOURCE: Ohio Agr. Exp. Sta. Spec. Cir. 53, 1938.

EXPLANATION: This experiment was conducted at Wooster on silt loam soil. Valuations for estimating returns were as follows:

Corn----------$ 0.50 per bushel

Oats---------- .30 per bushel

Fertilizer, 4-12-4,------$ 31.92 per ton.

Fertilizer, 8-24-8,------ 58.05 per ton.

Fertilizer,12-36-12,----- 84.20 per ton.

Fertilizer,15-30-15,----- "Nitrophoska"

QUESTIONS: 1. Compare the differences in the yields of the various analyses ?

2. Which analysis is the most practical to use from the standpoint of yield, convenience, labor required and money return ?

8. Distributing Fertilizer In A Four-Year Rotation.

Pounds of 4-12-4 per acre in rotations,				Av. yield for 3 years, per acre			
Corn	Wheat	Wheat	Hay	Corn, bus.	Wheat, bus.	Wheat, bus.	Hay, lbs.
333	333	333	0	38.08	28.22	22.99	2407
500	0	500	0	43.68	25.67	25.83	2787
500	500	0	0	40.79	29.11	22.61	2760
0	500	500	0	29.79	27.22	25.78	2873
250	250	250	250	34.46	27.89	23.61	2980
125	125	125	125	32.17	26.74	22.30	2933

SOURCE: Unpublished data of the Va. Agr. Exp. Sta. at Staunton, 1939.

EXPLANATION: This experiment was started in 1936 and has been conducted three years. The purpose is to determine how to distribute the fertilizer in a four-year rotation so as to get the most benefit from it. The left side of the table gives the amount of fertilizer and the crop it was applied to in six different tests or rotation methods. The soil is Berks silt loam in Augusta County.

QUESTIONS: 1. Which method of fertilizer distribution in the rotation gave the highest yield of corn ?

2. How did the yields of the other crops rank in the method where corn was highest ?

D. Manuring Practices

1. Effect of Manure Applied to Corn.
Increase in pounds per acre.

Corn----------745

Oats----------342

Hay----------980

Wheat----------328

SOURCE: Ill. Agr. Exp. Sta. Rpt., Urbana, 1935.

EXPLANATION: This is an average of 23 different soil experiments at the Illinois Station. Barnyard and stable manure were applied to the corn in the rotation at the rate of one pound of manure for each pound of product removed. The hay was mostly clover. The increase in corn yield amounted to 745 pounds or 13 bushels.

QUESTIONS: 1. What crop in the rotation did the manure help most ?

2. Were there any advantages in applying the manure in the rotation to the corn crop ?

3. Did the manure affect all crops in the rotation favorably ?

2. Place To Apply Manure.

Treatment (6 tons of manure per A. per rotation)	Average yields per acre			Financial statement per rotation	
	Corn, bus. 1919-1938	Wheat, bus. 1919-1938	Hay, bus. 1919-1938	Total value of grain and hay	Value of increase due to manure
No treatment, check	41.3	25.4	3768	$ 55.29	
Plowed under for corn	58.5	30.4	4331	71.39	$ 15.41
Top-dressed for corn after planting.	53.5	31.7	4498	70.10	13.44
No treatment, check	43.9	24.5	3949	57.35	
4 T-plowed under for corn. 2 T-on wheat in winter.	58.2	31.3	4808	73.37	16.56
Top-dressed wheat in winter	51.4	29.8	4742	68.51	12.25
No treatment, check	42.9	24.1	3748	55.72	
Top-dressed on young clover after wheat harvest	54.7	29.2	4811	69.95	14.22
Top-dressed on 2 nd growth clover after hay harvest	58.0	30.2	4304	70.38	14.65
No treatment, check	43.8	24.2	3619	55.74	
Av. of check plots	43.0	24.6	3771	56.03	

SOURCE: Ind. Agr. Exp. Sta. Cir. 242, 1939.

EXPLANATION: This experiment was conducted at the experiment farm at Lafayette. The purpose was to determine the best place in the rotation to apply the manure. All crops were removed and six tons per acre were applied in each three-year rotation as designated.

The test covers nineteen years or six complete rotations and four check plots.

QUESTIONS: 1. What method gave the largest total crop increase ?

2. Did this experiment illustrate the importance of manure on the farm ?

3. At what point in the rotation in applying the manure did it effect the largest yield ?

3. Supplementing Manure With Fertilizers.

Treatment		Increase in yield		Value of increase	Cost of fertilizer	Balance
		Corn, bus.	Oats, bus.			
(Manure	8 T. broadcast					
(0-16-0	225 lbs. broadcast	25.1	10.4	$ 15.67	$ 6.37	$ 9.30
Same + 3-12-4	100 lbs, in hill	30.5	11.9	18.82	5.45	13.37
Same + 3-12-4	200 lbs. in hill	31.6	10.8	19.04	7.92	11.22
Av. unfertilized yields		26.3	43.7	26.26		
Manure	8 T. broadcast	11.9	6.3	7.84	4.00	3.84
Same + 4-12-4	200 lbs. in hill	20.0	8.4	12.52	7.19	5.33
(4-124	200 lbs. in hill					
Same + (0-20-0	200 lbs. broadcast	21.5	9.2	13.51	9.29	4.22
Av. unfertilized yield		30.0	25.0	22.50		

SOURCE: Ohio Agr. Exp. Sta. Cir. 53, 1938.

EXPLANATION: These data represent two experiments being divided by the horizontal double line in the middle of the table. For the upper on the corn yield is averaged for six years and oats five years. In the lower experiment the corn yield is a five year average and the oats four years. Manure in the experiment was charged at fifty cents per ton, the estimated cost of hauling. The experiment was conducted at the Wooster station. The hill applications of fertilizer were in circular one-inch bands, five inches from plant.

QUESTIONS: 1. Did the evidence point to the desirability of supplementing manure with moderate amounts of fertilizer to the hill.

3 Cont'd.

2. When manure was supplemented with fertilizer around the hill was there any advantage in also adding a broadcast of superphosphate ?

3. What practice gave the best results.?

4. Effect Of Commercial Fertilizers And Manure.
On Yields Of Corn And Other Crops.

Treatment	Corn, bus.	Wheat, bus.	Clover hay, lbs.	Grass hay, lbs.
Superphosphate, 438 lbs.	48.15	19.98	3482	3827
Ammonium nitrate, 114 lbs. Superphosphate, 438 lbs. Muriate of potash, 200 lbs	57.70	25.10	4682	5126
Sulphate of ammonia, 200 lbs. Raw rock phosphate, 219 lbs.	42.43	12.00	3493	3794
Superphosphate, 438 lbs. Muriate of potash, 200 lbs.	54.61	20.54	4026	3938
Muriate of potash, 200 lbs.	39.37	10.75	1992	2291
Ammonium nitrate, 114 lbs. Muriate of potash, 200 lbs.	41.54	11.12	2522	2830
Ammonium nitrate, 114 lbs. Superphosphate, 438 lbs.	40.53	15.15	3104	3109
Ammonium nitrate, 114 lbs.	27.84	5.89	2118	2378
Manure, 16 tons once in 4 yrs.	59.97	23.65	4435	4222
Manure, 16 tons once in 4 yrs. Raw rock phosphate, 219 lbs.	58.00	21.66	3765	3549
Manure, 4 tons annually	62.79	24.57	5183	5390
Manure, 16 tons each 4 yrs. Superphosphate, 438 lbs.	57.36	25.47	4815	4541
Raw rock phosphate, 219 lbs.	38.54	10.45	2541	2326
No treatment (av. 2 plots)	32.66	6.84	1682	1945

SOURCE: Unpublished data of Va. Agr. Exp. Sta. at Blacksburg, 1939.

EXPLANATION: This experiment has been continuous since 1914, thus represents a 25-year average. The results of this experiment should be adaptable on practically all limestone soils in the state and the heavy clay soils of the Piedmont area. The superphosphate was 16 per cent analysis. The yields are for per acre unit. The manure was applied to the corn unles otherwise noted.

4. Cont'd.

QUESTIONS: 1. How did the value of manure compare to other treatments ? 2. Compare the treatment with manure each four years plus superphosphate annually, with that of other treatments as to cost and total yield of all three crops. How affective was nitrogen alone ?

5. Applying Manure At Different Seasons.

Season	Fresh manure		Rotted manure	
	Corn	Wheat	Corn	Wheat
	Bushels per acre			
Summer - July	82.8	20.0	71.6	22.0
Fall - November	69.1	18.4	68.0	17.3
Winter - January	58.2	17.9		
Spring - March	57.5	17.8	61.4	18.0

SOURCE: Md. Agr. Expl Sta. Bul. 122, 1907.

EXPLANATION: Manure was applied on sod land before plowing for corn. Corn yields were for four years, wheat for two years. The yields were averaged. This experiment was conducted at the Maryland Station.

QUESTIONS: 1. At what season did corn give the highest yield ?

2. Which was best, fresh manure or well rotted manure ?

3. Are there any other factors to be considered in the time to apply manure ?

E. Liming Problems.

1. Increased Value of Crops by Using Lime.

Crop in rotation	Corn	Wheat	Sweet clover
p H value for check plots	5.58	5.58	5.58
Best p H for rotation	6.84	6.84	6.84
Lime, optimum amount	2400 lbs.	2400 lbs.	2400 lbs.
Cost of lime	$ 6.00	$ 6.00	$ 6.00
Annual cost of lime per acre	$ 0.60	$ 0.60	$ 0.60
Amount of crop increase for period	63.20 bus.	23.40 bus.	9 tons
Crop increase value minue cost of lime	$ 41.40	$ 17.40	$ 129.00
Crop increase value for period	$ 47.40	$ 23.40	$ 135.00
Net return for each dollar invested in lime	$ 6.90	$ 2.90	$ 21.50

SOURCE: Va. Agr. Exp. Sta. Bul. 292, 1933.

EXPLANATION: This experiment was conducted in Augusta County on Berks silt loam and covers a period of ten years, 1923 to 1932, inclusive. Lime was applied once in six years. Valuations used were limestone $ 3.00 per ton, corn $ .75 per bushel, wheat $ 1.00 per bushel and hay $ 15.00 per ton. Each plot got an annual application of 300 pounds of 3-8-3 fertilizer.

QUESTIONS: 1. Which crop gave the greatest net return for each dollar invested in lime ? Second best ?

2. In applying lime what factors should determine the amount to use ?

3. Did it pay to use lime in this rotation ? Would the same general principle be true in any rotation involving corn, small grain, and a legume hay crop ?

2. Does It Pay To Use Lime ?

Crop and values	Unlimed	Limed
Corn in bushels	23.6	45.8
Oats in bushels	36.0	49.0
Wheat in bushels	17.7	27.9
Clover in pounds	1288.0	3405.0
Timothy in pounds	1496.0	3684.0
Total value of crops per rotation	$ 49.86	$ 91.79
Gain for liming per rotation		41.92
Cost of liming per rotation		7.50
Balance per rotation		34.42

SOURCE: Ohio Ext. Bul. 177.

EXPLANATION: This illustrated the effects of lime on yields of crops in a five-year rotation conducted at the Wooster station from 1917 to 1931. Fertilizer was applied on the limed and unlimed plots. Forty plots for three complete rotations were averaged.

QUESTIONS: 1. What did this experiment prove as to the value of lime on crops ?

2 . What was the percentage value of the crops grown without lime as compared to the total values grown with lime ?

3. Effect Of Lime And Acid Phosphate On Yields.

Crop and values	Crop increase and value per rotation		
	Limestone	Acid phosphate	Limestone and acid phosphate
Corn in bus. per A. (av. of 68 crops)	7.2	6.6	16.0
Soybean hay in lbs. per A. (av. of 62 crops)	622.0	658.0	1430.0
Wheat in bus. per A. (av. 46 crops)	2.0	2.9	8.8
Clover hay in lbs. per A. (av. of 49 crops)	849.0	569.0	2110.0
Value of increase in dollars	22.61	20.84	58.40
Cost of treatment in dollars	5.00	10.00	15.00
Net gain per acre in dollars	17.61	10.84	43.40

SOURCE: Ky. Agr. Exp. Sta. Cir. 32.

EXPLANATION: This study dealt with a four-year rotation of the above crops and is the collected data from six Kentucky experiment stations outside of the Blue Grass Region. For the first two rounds of the rotations, applications of lime were made at the rate of two tons per acre and acid phosphate at the rate of 800 pounds per acre per rotation. After two rotations the lime was discontinued and the phosphate cut in half. Corn was priced at 75 cents per bushel, wheat $ 1.25 per bushel and hay $ 20.00 per ton for computing values.

QUESTIONS: 1. Was it a paying proposition to lime for this rotation ? To fertilize with acid phosphate ?

2. Compare the increases of the different crops under the two treatments.

4. Lime Tests With Corn When Grown With Red Clover And Sweet Clover In Rotation.

Lime treatment per acre in pounds	Three-year av. yield of grain in bus. per acre	
	Red clover rotation	Sweet clover rotation
600	50.2	42.4
1200	51.5	42.6
No lime	42.6	31.0
1800	53.0	46.8
2400	53.2	45.6
3000	48.8	50.1

SOURCE: Unpublished data of Va. Agr. Exp. Sta. at Williamsburg, 1939.

EXPLANATION: This was conducted with the purpose of determining the rate of liming when corn was grown in rotation with the above clovers. The experiment was c conducted from 1936 to 1938 and represents a three-year average. These data were not intended for a contrast of the two clovers when grown in rotation with corn. The tests were conducted in the Coastal Plain area. Red clover stands were good with all lime treatments but sweet clover did well only with the heavier applications. The soil plots were Norfolk sandy loam.

QUESTIONS: 1. Was the value of lime to corn apparent in this test ?

2. Might the value of lime to corn be derived largely from the indiredt source accruing from more luxuriant clover stands ?

3. What seemed to be the optimum lime rate for corn when red clover was in the rotation ? Sweet clover ?

5. Comparative Values Of Raw, Burnt, And Hydrated Time.

	Corn, bus.	Wheat, bus.	Oats, bus.	Hay, lbs.	Straw and Stover, lbs.	Av. wt. of air-dry matter, lbs.
Limestone	49.2	22.5	37.5	4,092	2,416	4,332
Hydrated lime	49.9	24.2	42.4	3,798	2,476	4,380
Ground burnt lime	49.5	23.1	37.3	3,793	2,425	4,281

SOURCE: Pa. Agr. Exp. Sta. Bul. 211, 1927.

EXPLANATION: This test showed the comparative values of heavy applications of three forms of lime on Volusia and Westmoreland soils, as measured in crop yields. The amount of lime of each kind applied was based on a total equal amount of calcium oxide.

QUESTIONS: 1. Is it true that, "the kind of lime to use should be determined almost entirely by the kind which gives the greatest sweetening power for a dollar invested ?"

2. Did this experiment show that there was little difference in the kind of lime used as long as the total portion of calcuim oxide was the same ?

6. How Much Lime To Apply ?

Pounds of lime-stone per acre	pH reading in 1932	Av. yield per acre		
		Corn, bus.	Wheat, bus.	Sweet clover, lbs.
600	6.05	31.53	14.81	1522
1200	6.40	37.96	15.93	2484
1800	6.63	39.28	16.85	3026
2400	6.84	40.33	17.78	3516
3000	7.05	40.74	18.42	3798
3600	7.25	41.23	18.62	4038
None	5.74	29.54	14.05	886
4200	7.40	38.12	17.87	3770
4800	7.45	37.07	17.76	3718

SOURCE: Unpublished data of Va. Agr. Exp. Sta. at Staunton, 1939.

EXPLANATION: These data represented an average of 14 years for corn, 15 for wheat and 13 for sweet clover. The first eight years of this experiment was covered in the Virginia bulletin 292 and it was from that source that the p H reading is taken. The soil was Berks silt loam. Lime was applied each six years. A fertilizer treatment of 300 pounds of 3-8-3 was applied per acre annually to all plots.

QUESTIONS: 1. At what p H range did the corn yield best ?

2. How did the other crops respond at the same range ?

3. Was there danger of applying too much lime ?

4. How did the limed plots compare with the check plots where no lime was applied ?

F. Miscellaneous

1. Corn and Some Associated Crop Yields and Prices in United States.

Crop 1926	Acreage	Av. yield per acre	Production	Farm Price per bus.
Corn	99,492,000	26.6 bus.	2,645,031,000 bus.	$ 0.64
Wheat	56,526,000	14.7 bus.	832,305,000 bus.	1.20
Oats	44,394,000	28.2 bus.	1,253,739,000 bus.	0.40
Barley	8,200,000	23.3 bus.	191,182,000 bus.	0.57
Rye	3,513,000	11.4 bus.	40,024,000 bus.	0.83
Buckwheat	707,000	18.3 bus.	12,922,000 bus.	0.88
Alfalfa hay	11,057,000	2.49 tons	27,496,000 tons	
Annual legume hay	3,490,000	1.09 tons	3,797,000 tons	
Clover hay	7,402,000	1.38 tons	10,185,000 tons	
Timothy hay	8,884,000	1.16 tons	10,273,000 tons	

SOURCE: Overton and Roberts, Farm management and Marketing, Lippincott, 1936.

EXPLANATION: These figures were for 1926 as this seemed to be a very good representative year for average yields, acreages and prices. The average price for all tame hay was $ 14.09 per ton. Wild hay sold for $ 10.07. These were average prices received by farmers.

QUESTION: 1. How did corn rank as to other crops in acreage, yield and value ?

2. Standards Of Purity And Germination Of Corn And Other Rotation Crops.

	Longevity, av. yrs.	U.S.D.A. Standards Purity	Germination	Wt. per bushel	No. of seed per bushel
Corn	4	99	90-95	56	1,440
Barley	3	99	90-95	48	15,786
Oats	3	99	90-95	32	12,700
Rye	2	99	90-95	54-56	29,250
Wheat	2-7	99	90-95	60	14,000
Alfalfa	6-8	98	85-90	60	219,500
Alsike clover	2	95	75-80	60	698,500
Crimson clover	2	98	85-90	60	149,600
Red clover	5-6	98	85-90	60	313,900
Sweet clover	5	99	85-90	60	259,400

SOURCE: N.Y. Agr. Exp. Sta. Cir. 73, 1924.

EXPLANATION: This table indicates the standards for purity and germination generally recognized as satisfactory, the average number of seed per pound, and the number of years that the different seeds may be expected under average conditions, to retain their vitality to such an extent as to have value for planting. The weights per bushel are either standard for New York or those in common usage.

QUESTIONS: 1. What is the longevity of corn ? Standard germination ?

2.. Which legume has the longest longevity of seed ?

3. Disease Losses Of Corn And Other Cereal Rotation Crops.

Crop	Highest loss	Lowest loss	Principal disease in 1925 in order of most damage
Corn	10.7	6.0	Ear rots, root rots, smut, leaf rust
Wheat	16.9	8.9	Bunt, stem rust, loose smut, scab
Oats	8.6	4.8	Smuts, stem rust, crown rust
Barley	11.2	3.9	Covered smut, stripe, loose smut, stem rust
Rye	2.3	1.4	Ergot, smut, stem rust

SOURCE: Bur. of Plant Industry, U.S.D.A. "The Plant Disease Reporter Supplement 49," 1926.

EXPLANATION: The losses of various crops due to all diseases has been estimated each year from 1919 to 1925, inclusive. The extremes for each crop are given as well as a specific analysis for 1925 of principal diseases. The figures were for the nation.

QUESTIONS: 1. How did corn losses compare with other cereal crops ?

2. Do the above principal causes of corn losses exist on your farm ?

XXIII PRODUCING SILAGE

A. Selecting Silage Crop

1. Yield of Corn as Compared to Other Silage Crops.

Name of crop	Variety	Yield in T. per acre
Corn	Cocke's Prolific	16.04
Corn	Boone County White	13.66
Sorghum	Early Amber	12.12
Soybeans	Mammouth yellow	10.15
Cow peas	Whipporwill	8.36
Millet	Golden (German)	5.63

SOURCE: Va. Agr. Exp. Sta. Bul. 227, 1922.

EXPLANATION: This experiment was conducted at the Blacksburg Station for four years. The figures in the table are the average for that period. About 95 per cent of the silage made in Virginia is made from corn. The above silage crops are listed in order of importance as grown in Virginia for that purpose.

QUESTIONS: 1. Which crop gave the highest yield ?

2. What are the requirements of a good silage crop ?

2. What Variety Shall I Grow ?

A Comparison of Green Weight Per Acre of Different Varieties of Corn..

Name of Variety	Yield in T. of green forage per A.
Virginia Ensilage	11.63
Pamunkey Ensilage	11.39
Cocke's Prolific	11.23
Eureka Ensilage	11.13
Virginia White Dent	10.20
Bigg's Seven Ear	9.06
Hickory King	9.78
Blount's Prolific	8.74
Casey's Pure Bred	8.62
Boone County White	8.30
Gold Standard	7.86
Leaming	6.95

SOURCE: Va. Agr. Exp. Sta. Bul. 227, 1922.

EXPLANATION: These are the silage varieties most commonly grown in the state. The experiment was conducted at the Blacksburg station over a period of five years; the average for that period is tabulated in the above table. It should be noted that the station suggests Cocke's Prolific as probably the best to grow because of its small leafy stalks.

QUESTIONS: 1. Which type of corn produced the highest, regular ensilage corn or the grain varieties?

2. What are some desirable features of a good ensilage corn ?

3. Feeding Value Of Corn Compared To Other Field Crops.

Crop	Av. yields per acre	Pounds digestible nutrients per acre	
		Protien	Total
Corn silage	11.5 tons	300	4,300
Alfalfa hay	2.25 tons	477	2,266
Clover hay	2.0 tons	280	2,076
Grass hay	1.5 tons	105	1,551
Oats hay	2.0 tons	180	1,852
Corn grain	41.0 bus.	170	1,930
Oats grain	30.0 bus.	90	686

SOURCE: Mass. Agr. Exp. Sta. Bul. 356, 1939.

EXPLANATION: The digestible nutrients were based on tables from Morrison's "Feeds and Feeding." The average yields were for the state of Massachusetts in 1937.

QUESTIONS: 1. How did corn for silage compare in total digestible nutrients ?

2. Which crop yielded the most protien ?

3. How did the grain yield of corn compare with the grain yield of oats in protien and total food value ?

4. Analyses Of Corn And Other Forages In Green State And As Silage.

Roughage	Digestible nutrients in 100 pounds			
	Dry matter in 100 lbs.	Crude protien	Carbohydrates	Fat
Green corn fodder	23.1	1.0	13.7	0.4
Corn silage	21.1	1.0	11.4	0.4
Green sorghum fodder	24.9	0.7	14.8	0.7
Sorghum silage	22.8	0.6	11.6	0.5
Fresh red clover	26.2	2.7	13.0	0.6
Clover silage	24.4	2.0	9.6	0.8
Green soybeans	23.6	3.2	10.2	0.5
Soybean silage	27.2	2.8	10.8	0.9
Green cowpeas	16.3	2.3	8.0	0.3
Cowpea silage	21.2	1.8	9.7	0.5
Kentucky bluegrass	31.6	2.3	14.8	0.6
Green oats and peas	22.6	2.4	10.6	0.6

SOURCE: Henry and Morrison, Feeds and Feeding, Henry-Morrison Co.

EXPLANATION: This table gives the amount of digestible nutrients in one hundred pounds of various crops when ensiled and when fed in the fresh stage.

QUESTIONS: 1. Does ensiling change the analysis of green feeds ?

2. How does corn compare to other silage crops ?

3. Is there any factor to be considered other than the analysis in determining what silage to put up ?

5. Food Value Of Corn Versus Other Silage.

A Comparison of the Food Constituents of Corn and Other Silage Crops.

	Name of crop	Protien	Fats	Crude Fiber	Carbohydrates	Dry matter
Percentage of various constituents on the moisturefree basis.		%	%	%	%	
	Cocke's Prolific Corn	9.30	1.61	27.28	56.91	
	Boone County White Corn	9.21	1.87	23.61	61.50	
	Sorghum	4.87	2.25	31.19	57.35	
	Soybeans	18.47	3.83	30.75	38.93	
	Cowpeas	16.94	2.43	30.39	40.49	
	Millet	7.15	1.91	34.33	49.19	
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Amount of the various constituents produced to the acre.	Cocke's Prolific Corn	646.70	122.15	1,856.40	4,016.35	6,962.59
	Boone Co. White Corn	617.09	130.90	1,570.35	4,256.16	6,830.00
	Sorghum	322.59	154.26	2,104.13	3,876.93	5,398.48
	Soybeans	965.91	207.34	1,638.98	2,006.95	5,239.03
	Cowpeas	522.22	74.15	963.30	1,265.39	3,123.07
	Millet	278.45	75.30	1,378.94	1,958.85	3,982.59

SOURCE: Va. Agr. Exp. Sta. Bul. 227,1922.

EXPLANATION: The above table was computed by the station chemists on the basis of yields of the various crops indicated. It is based on a four-year average at the Virginia station.

Question

5. Cont'd.

QUESTIONS: 1. What crop gave the highest protien yield ?

2. What are some objections to soy beans for silage as compared to corn ?

3. What food constituent is most expensive when bought on the market ?

4. What deductions can be made from this chart ?

6. Digestible Nutrients Of Corn, Soybeans And Combination Of The Two.

Crop	Dry matter per unit area		Lbs. digestible nutrients				Nutritive ratio
	Corn	Soybeans	Crude protien	Carbohydrates	Fat	Total	
Corn alone	100		5.17	61.3	2.79	72.7	1:13.
Soybeans alone		74.6	10.12	32.2	1.58	45.9	1: 3.
Two rows of corn and 2 rows of soybeans	53.6	36.1	7.67	48.5	2.26	61.3	1: 7.
Two rows of corn and one row of soybeans	72.4	22.5	6.80	54.1	2.50	66.5	1: 8.
Corn and soybeans in the same row	80.3	28.9	8.08	61.8	2.85	76.3	1: 8.

SOURCE: N.Y. Agr. Exp. Sta. Bul. 634, 1935.

EXPLANATION: A unit area of corn producing 100 pounds of harvested material was used as a standard of comparison for the various crops and combination of crops listed. The study covered a period between 1922 and 1928 and an average of two varieties each of corn and soybeans was used. The yield and the digestible nutrients are given in terms of pounds.

QUESTIONS: 1. How did corn compare with soybeans alone in amount of crude protien ? Total digestible nutrients ?

2. Compare the answers to question one with the total dry matter per unit area of corn and soybeans.

3. What method produced the greatest amount of dry matter and digestible nutrients ?

7. Relative Amount Of Shelled Corn To A Ton Of Silage For Various Varieties.

Variety	Number of crops	Pounds of shelled corn		
		Maximium	Minimum	Average
Johnson County White	12	431	218	302
Reid Yellow Dent	10	442	252	330
Funk Yellow Dent	8	557	224	342
Thomas	12	459	258	336
Cocke Prolific	12	454	212	291
Eureka	9	380	151	274

SOURCE: Md. Agr. Exp. Sta. Bul. 329, 1931.

EXPLANATION: This experiment was conducted at the College Park Station. The figures are given in pounds of shelled corn per ton of silage. It was suggested that Funk Yellow Dent is better adapted to the mountain region of the state while Cocke Prolific and Eureka give better tonnage of green feed in the eastern section of Maryland. The latter two are regular silage varieties.

QUESTIONS: 1. Which varieties gave the most grain for a ton of silage ? Which the lowest ?

B. How Much To Grow.

1. Capacity Of Cylindrical Silos for Well-Matured Corn in Tons.

Depth of silo, feet	Inside diameter of silo, feet					
	12	14	15	16	18	20
20	38	51	59	67	85	105
22	43	59	67	77	97	120
24	49	66	76	87	110	135
26	55	74	85	97	123	152
28	61	83	95	108	137	169
30	68	93	105	119	151	187
32	73	101	115	131	166	205
36	105	130	140	155	190	235
40	121	150	165	180	228	279

SOURCE: Field Crop Enterprises, Lippincott, 1937.

EXPLANATION: This is merely a table giving the approximate capacity of round silos at various sizes.

QUESTIONS: 1. What size silo should one build to hold 100 tons of silage for winter feeding ? Summer feeding ?

2 . Size Of Silo Needed For Herds Of Different Sizes.

Number of cattle that can be kept 6 mo. on 30 lbs. per head daily.	No. of tons needed	Size of silo		No. of acres required to fill silo at 8 tons per acre
		Diameter	Height	
8	22	10	24	2.7
10	27	10	27	3.4
12 2	32	10	29	4.0
14	38	10	33	4.7
16	43	10	35	5.4
20	54	12	33	6.7
25	67	12	38	8.4
30	81	12	43	10.0
35	95	12	48	11.9
40	108	14	43	13.5
45	121	14	46	15.1
50	135	14	50	16.9
60	162	16	46	20.3
70	189	16	51	23.6
80	216	18	48	27.0

SOURCE: Overton and Robertson, Farm Management and Marketing, Lippincott, 1936.

EXPLANATION: Where more than fifty cattle are kept it is desirable to have more than one silo in most cases. This compilation allows for twenty per cent settling of silage.

QUESTIONS: 1. What size silo is desirable for a herd of thirty cows ? How many acres of silage corn at eight tons per acre would a farmer have to grow ?

C. Planting.

1. Rate Of Drilling Corn for Silage.

Kernels Dropped Every	5-yr av. yield. tons per acre	Total nutrients, lbs. per acre
4 inches	15.74	7694
6 inches	14.27	5736
10 inches	13.53	5879
12 inches	12.87	5528

SOURCE: Ohio Agr. Exp. Sta. Bul. 269, 1914.

EXPLANATION: This gives the average yields of corn silage for five years when sown at different rates. There was a tendency for corn to lodge when planted four inches apart.

QUESTION: 1. From all the evidence which rate of planting would you recommend ?

2. Which rate gave the best yield in this experiment ?

3. What factors enter in to determining the rate of corn planting ?

2. Yield Comparisons From Planting Different Numbers Of Kernels Per Hill.

	Number of kernels per hill				
	1 ker.	2 ker.	3 ker.	4 ker.	5 ker.
Stover per acre, lbs.	2114	3005	3643	4030	4481
Ear corn per acre, lbs.	2260	3642	4483	4766	4708
Therms energy in ears	1654	2659	3254	3446	3398
Therms energy in stover	668	950	1152	1275	1417
Total therms energy in plant	2322	3609	4406	4720	4815
Lbs. ear corn per 100 lbs. stover	107	121	123	118	107

SOURCE: H.A. Wallace, "What Thick Planting Does to Corn" Wallaces Farmer, May 1, 1935.

EXPLANATION: This table covers a 21-year average at the Ohio station. It gives the acre production in pounds of tonnage and therms of energy from planting different numbers of kernels to the hill for silage.

QUESTIONS: 1. What rate of planting gave the best results ?

2. What factors should be considered in determining the rate of planting on your farm ?

D. Harvesting Silage.

1. Composition Of An Acre Of Corn At Different Stages Of Maturity (Pounds Per Acre

Stage of maturity	Green weight	Dry weight	Protien	Fat	Nitrogen-free extract
Tassel	26,702	4,307	388	47	2288
Milk	29,636	6,000	461	73	3283
Dough	25,209	6,669	501	142	4002
Glazed	21,138	6,910	533	161	4213
Ripe	16,106	6,612	495	145	4030

SOURCE: Mass. Agr. Exp. Sta. Bul. 356, 1939

EXPLANATION: This test was conducted to determine the weight and food value of the entire corn stalk at various stages of growth.

QUESTIONS: 1. While the maximum green weight was reached in the milk stage, did this same result exist for the dry weight ?

2. Why should corn reach the ripe stage before cutting for husking ?

2. Comparison Of Cost Of Filling Silos By Different Methods.

Item	When hired stationary cutter was used.	If owned stationary cutter had been used.	If owned field harvester had been used.
Cash costs	$ 135.28	$ 78.21	$ 63.02
Unpaid costs	53.85	57.20	36.60
Depreciation	10.21	29.49	49.96
Interest	5.67	23.34	34.89
Total	205.01	188.24	184.47

SOURCE: U.S.D.A. F. Bul. 1725, 1934.

EXPLANATION: The above table gives the cost of filling an 175-ton silo with a custom machine on one farm in 1929, and estimated costs if a stationary cutter and field harvester had been owned. The field harvester chops the corn for silo length in the field and puts it in the wagon box. At the silo it is unloaded to the blower which sends it on into the silo. It is used considerably in the West.

QUESTIONS: 1. Under the above circumstances would it be cheaper for a farmer to own his own cutter if he already owns belt power ?

2. How much would it cost per ton to fill the silo when the hired stationary cutter was used ?

3. Relation Between Size Of Crew And Effeciency Of Labor And Power In Making Silage.

	Less than 10 men in crew	10 to 14 men in crew	15 to 19 men in crew
Number of farms	32.00	36.00	18.00
Acres cut per farm	20.90	14.80	10.60
Yield of silage per acre, tons	7.20	7.50	8.40
Tons cut per cutting hour	5.40	8.20	10.00
Labor and power used per hour: man labor, hours	9.21	11.25	14.19
Horse labor, hours	12.20	11.99	12.76
Tractor use, hours	1.33	.94	.84
Labor and power used per ton: man labor, hours	1.28	1.50	1.69
Horse labor, hours	1.69	1.60	1.52
Tractor use, hours	.18	.13	.10

SOURCE: Ill. Agr. Exp. Sta. Bul. 373.

EXPLANATION: This study was conducted on 86 farms in Illinois in 1929 using stationary cutters. It did not include men cutting corn.

QUESTIONS: 1. Was labor more effecient with smaller crews or larger crews ? How about tractor power ?

4. Harvesting By Hand vs. Corn Binder Method.

Year	Yield per acre, tons	Binder with elevator		By hand	
		Per acre	Per ton	Per acre	Per ton
1927	15.80	$ 15.74	$ .99		
1928	11.90			17.45	1.47
1929	9.75			15.51	1.59
1930	6.25	12.75	2.04		
1931	17.54			18.19	1.04
1932	10.00	12.62	1.26		
1933	11.88			21.56	1.82
Average	11.87	13.57	1.28	18.18	1.42

SOURCE: Md. Agr. Exp. Sta. Bul. 362, 1934.

EXPLANATION: The data in the table represent the actual costs of producing corn silage on the Experiment Station farm during the last seven years. These figures include every cost item incurred in handling silage from the time the corn was cut until it was stored in the silo. Depreciation rate on machinery was based on twenty years service. Full interest charges on the silage equipment were included in the several cost items. The investigator states that the corn binder with elevator is a good investment on farms where 100 to 125 tons of corn silage are harvested annually.

QUESTIONS: 1. When the yield per acre was high what effect did it have on the cost of harvesting silage per ton ?

2. Aside from cost, how does topography, speed of operation, clearing the ground of weeds, erectness of plants, size and shape of the field, condition of the soil at harvest time, abundance of labor, etc. enter as factors in determing whether to get a binder ?

5. Horsepower Required To Run Silo Filler.

Width of cutter throat, in.	Horsepower required to elevate silage						Approximate capacity tons per hour.
	24 ft.	28 ft.	32 ft.	36 ft.	40 ft.	50 ft.	
10	10.5	10.8	11.2	11.4	11.8	12.7	4
12	13.1	13.6	14.0	14.4	14.8	15.9	5
14	15.8	16.5	17.1	17.7	18.4	20.2	7
16	18.5	19.4	20.5	21.5	22.5	25.0	9
18	21.6	22.8	23.9	25.1	26.4	29.3	11
20	25.6	26.5	27.6	28.4	29.4	31.8	13
22	28.6	30.6	31.4	32.4	33.4	35.8	15
24	33.1	34.2	35.4	36.0	37.5	40.3	17
26	36.6	38.3	39.7	41.6	43.2	47.3	19

SOURCE: U.S.D.A., F. Bul. 578, 1935.

EXPLANATION: This table was computed on the basis of tractor power being used and it gives the horsepower required to operate a silage cutter and blower with cutter throats of varying widths and silos of varying heights. If steam power were used the horsepower ratings may be 25 per cent less; for electric it may be reduced 15 per cent from the table figures.

QUESTIONS: 1. How much horsepower for a gas tractor would be required to fill a 40-foot silo with an eighteen-inch cutter throat ? If an electric motor was used ?

E. Miscellaneous.

1. Cost of Producing Corn Silage.

Factor involved.	Average cost per acre.
Manure, lime, fertilizer	$ 11.72
Land preparation	3.93
Seed and planting	0.98
Cultivation	3.22
Harvesting and storing	14.04
Total cost	33.87
Yield, tons	12.87
Cost per ton	$ 2.92

SOURCE: Md. Agr. Exp. Sta. Bul. 329, 1931.

EXPLANATION: These figures represent an average tabulation of six years of corn silage production at the College Park Station from actual cost accounts. The fields were eight to nine acres in size and rectangular in shape with the length about double the width. Manure was applied at the rate of ten tons per acre before plowing for corn. Two hundred pounds of 2-12-4 fertilizer was broadcast prior to the last harrowing before planting. A three-year rotation of corn, wheat, and mixed hay was practiced.

QUESTIONS: 1. What was the greatest item in cost of producing silage ?

2. Is silage a comparatively economical feed at $ 2.92 per ton cost ?
How does it compare with cost of hay ?

3. How many head of cattle would one have to have to justify the cost of a silo ?

2. Yield Of Corn Silage Following Various Cover Crops.

Year	Yield of corn silage following: (tons)					
	Check	Rye	Rye and vetch	Vetch	Crimson clover	Sweet clover
Av. 1922-1934	9.51	10.08	9.75	9.71	9.28	9.24
Av. 1922-1928	9.87	10.19	9.28	10.12	9.57	9.68
Av. 1929-1934	9.09	9.97	10.29	9.26	8.96	8.78

SOURCE: W. Va. Agr. Exp. Sta. Bul. 275, 1936.

EXPLANATION: These tests were run on De Kalb silt loam at Morgantown, A two-year rotation of soybeans for hay and corn for silage was followed. No fertilizer was used for the first nine years but from 1929 on, 300 pounds per acre of superphosphate was applied each year. In 1931 two tons of lime per acre were applie to correct an acid situation. No other manure or fertilizer was added. Four replications were run for each plot each year.

QUESTIONS: 1. What was the effect of the various cover crops on yield ?

2. Are there other advantages besides increased fertility for growing cover crops ?

3. Might the acid condition of the soil up to 1931 suggest the lower yields after the clovers especially sweet clover which demands a neutral soil ?