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OF THE
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1915

COVER CROPS

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BULLETIN

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UNIVERSITY OF TEXAS

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OCTOBER 30

COVER CROPS

The benefits of education and of useful knowledge, generally diffused through a community, are essential to the preservation of a free government.

Sam Houston.

Cultivated mind is the guardian genius of democracy. . . . It is the only dictator that freemen acknowledge and the only security that freemen desire.

Mirabeau B. Lamar.



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Mr. B. S. J. 12. 18

To the Chairman of the Schoolhouse Meeting:

The discussions of the questions given below have been prepared for the meeting to be held at the schoolhouse on Friday afternoon and are for the use of the person who conducts the meeting. Usually it will be best to have the questions written upon the blackboard before the meeting takes place, and when the time for discussion arrives, first have the question read aloud and call for discussion from the members present. Occasionally the chairman should call out someone whom he knows to be well qualified to answer the question. At times it is well to let such person know several days in advance that he or she will be called upon so that special preparation may be made by study of some of the bulletins referred to in the bibliography or of other literature. As soon as discussion has brought out whatever of interest the members present may know, then have read the discussion of the question that is given below and, if desirable, allow discussion of that. Good judgment must be used by the chairman in calling out discussion and in stopping it before it becomes unprofitable. At times it would be well to omit or pass lightly over certain questions and concentrate on others. Be sure to stop before the members are tired, and always try to have the ideas that are brought out applied to the local conditions and needs. When a meeting results in a desire to carry out some practical plan, arrange for those interested in this plan to remain after the meeting and take the necessary steps at once. Strike while the iron is hot.

Fellow Teacher and Fellow Citizens:

The topic selected for study at this meeting is of the greatest importance to Texas. There can be no doubt that our State is losing tens of millions of dollars every year from failure to grow suitable cover crops during our mild winters. While the late summer and early fall drouths, the long growing season of the summer crops, and the ravages of insects offer serious difficulties to be met by those planting cover crops in Texas, it is nevertheless true that these difficulties can be overcome if attacked with intelligence and persistence. The discussion offered at this meeting will go a long way toward solving the cover crop problem in Texas. In addition to acquiring the general information given in the discussion below, it will be necessary to make experiments in every locality in order to find what is best suited to the soil, climate, farm needs, and market facilities of that section. Each one should try out a fraction of an acre each in rape, one or more legumes, cereals, and winter root crops, in order to learn the best times and methods of planting and handling these crops and to find out which are best suited to his needs.

It is much regretted that this subject could not have been presented in August. Unfortunately, the schools were then closed. When the rural schools are open nine months in the year and schoolhouse meetings are held twice every month, such important topics will not have to be delayed two months waiting for the majority of our rural schools to open.

At the next meeting we shall discuss the farm garden, giving particular attention to what can be done in the fall garden. After this, meetings will be devoted to these topics: Poultry on the Farm; How to Prevent Disease on the Farm; Insect-borne Diseases; Feeding the Family for Health and Efficiency; Labor-saving Devices on the Farm; Labor-saving Devices in the Farm Home; Practical Methods of Increasing Crops by Plant Breeding; Tick Eradication; The Rural School-and-Community Library; What the School Can Do for the Community; What the Community Can Do for the School; Crop Diversification; the Preservation and Marketing of Diversified Crops; Farm Co-operative Enterprises. In addition, there will be printed

in a general manual several programs devoted to pleasure and social enjoyment and several to the celebration of special days, such as Thanksgiving, Christmas, Washington's Birthday, Arbor Day, Independence Day, and San Jacinto Day. Two debates, two musical programs, and a play and athletic program are also provided. This manual will be mailed out next month.

Suggestions from any source are always welcome. We hope that anyone who has a criticism to offer or can suggest a way in which the plan or programs of these meetings may be improved will write freely to the undersigned. No one is obliged to follow the programs sent by us. They are merely offered in a spirit of friendly co-operation, to be used when you think best to do so.

These schoolhouse meetings proved so successful last year in over two hundred schools in which they were tried that this year more than three thousand teachers have already personally sent in requests that the programs be sent them in order that they may carry on the meetings in their schools. We hope that many more will yet take up this valuable means of serving their communities and at the same time building up their schools. The programs, manual, and other helps will be sent free from time to time to any teacher desiring them. Let us all join hands in promoting this powerful means of building up our great State and making Texas a better place in which to live.

A. CASWELL ELLIS,

Acting Director, Department of Extension,
The University of Texas, Austin, Texas.

SCHOOLHOUSE MEETING — DISCUSSION OF COVER CROPS.

QUESTIONS.

1. In what condition must the food material in the soil be in order to be taken in and used by the plant?
2. Is all of the plant food in the soil available to plants at all times; if not, what part of the total food material present is available at one time?
3. What processes in the soil are constantly making new food material available?
4. Are these processes going on in Texas in fall and winter when the ordinary crops are not growing?
5. What happens to this available food material when a rain comes and plants are growing on the ground?
6. What happens to it in fall and winter when a rain comes and plants are not growing on the ground?
7. Give some concrete examples of the effect of washing and leaching of soil where no plants are growing.
8. How many millions of dollars' worth of fertility is washed and leached out of the bare fields in Texas each winter?
9. What is a cover crop?
10. What four great benefits do a cover crop bring to the farm?
11. What part of the year is your land idle or without a crop growing on it, and how much are you losing thereby?
12. Why is it especially desirable that cover crops be sown after dry summers?
13. What leguminous crops are best suited for winter cover crops in Texas? What non-leguminous crops?
14. Discuss the preparation of the seed-bed for these winter cover crops.
15. What is the best time for sowing, and how much seed per acre is required for each of the following: crimson clover, bur clover, vetch, rape, oats, rye, barley, wheat?
16. Discuss the relative value of each of the above named

crops as a winter cover, pasture, forage, and green manuring crop.

17. Suggest combinations of these crops that might be of value for cover crops.

18. There are about thirty million acres of land in Texas under cultivation. According to statistics, less than ten per cent of this land grows a winter cover crop. Assuming that the loss of plant food due to oxidation and leaching is \$1.00 per acre, what would be the loss to Texas farmers in one year from failure to plant cover crops? What is probably more nearly a fair estimate of the loss? Will you not begin now to prevent this great loss?

ANSWERS TO QUESTIONS

1. The plant food elements in the soil must first be dissolved in water before they can be taken up and used by the plant. Plants are like babies: they can take their food only in liquid form.

2. In the average southern soil there is never more than a small fraction of the total food material in the soil in such a condition that the plant can use it. There is no definite per cent that can be given which will represent, even approximately, the part of the total food supply which is at any one time available for the plant. The per cent varies greatly in different soils and in the same soil at different times. Some soils which have only a small amount of plant food present may have a high per cent of what they do have in such a condition that it may be used by the plant. Such soils may produce large crops for a few years, but will not last long. Other soils have a large amount of plant food in them, but only a small per cent in condition to be used by the plant. For example, we have many instances of soils which contain thirty to forty thousand pounds of potash per acre in the surface one foot of soil, and yet these soils will respond to an application of one hundred pounds per acre of an easily dissolved potash fertilizer. This shows that while there is potash enough in this soil to supply hundreds or even thousands of crops with potash, yet it is not in a condition to be used by the plants, and hence

they are starving for the want of potash in a soluble form which they can use. In other words, they are like a man would be who was standing on a pile of iron ore and coal, and all the while his body starving for want of iron and carbon because his digestive system could not take in the insoluble iron in the ore and the insoluble carbon in the coal.

3. There are chemical processes going on in the soil continually which make the plant food available for the plants. This is done by changing the substances from an insoluble to a soluble form. These chemical changes progress much more rapidly under some conditions than under others and can be controlled to a very large degree by proper management of the soil. These chemical changes move much more rapidly in a warm than in a cold soil, and therefore we have more plant food made available in the soil in the spring and summer than in the winter, but in the South the soil is warm enough to keep these changes going on to some extent all the year. Stirring the soil also greatly increases the rapidity of these processes.

4. These processes that render plant food in the soil soluble and therefore available to growing plants are continuous throughout the year in moist regions that have no freezing weather. New plant food is being made available for plants in most sections of Texas twelve months in every year.

5. We have already learned that all plant food, in order to be available to growing plants must be in solution. We know, too, that plants obtain food and drink through their roots, or root-hairs. Where the ground is covered with a growing crop the surface of the soil is full of roots and root-hairs. These growing plants require large amounts of food and water. Just as fast as the plant food is made available in the soil it is taken in great quantities into the plant through the root-hairs by a process called osmosis, and when in the plant, is changed again into insoluble forms so that it cannot be dissolved and washed away by the rain.

6. If a rain falls on the ground where no crop is growing the plant food that is in condition to be utilized by the plant is dissolved by the water. There being no plants to take it in and hold it, it is washed out of the soil and carried down too

deep for the roots of the ordinary plant to reach it, or is washed away in surface and underground streams.

7. If nitrate of soda is put into the soil at the same time the crop is planted and rains come before the young plants have their roots well distributed in the soil, the plant food in the fertilizer is largely leached out and lost. A farmer in North Texas placed \$40.00 worth of fertilizer on five acres of sandy loam soil, and planted corn. Heavy rains fell almost continually for the next three weeks, with the result that this \$8.00 per acre worth of fertilizer was leached so completely out of the soil that there was none left for the crop and one could not tell by the crop that a particle of fertilizer had ever been there. Have you ever seen black streams of water running from a straw-stack or a farm lot after a rain? This color is due to the fact that the water is loaded with humus that has been dissolved from the straw or manure. The Maryland Experiment Station exposed eighty tons of manure for one year. At the end of this time it had been reduced to twenty-seven tons. Professor Shults of Canada exposed two tons of manure containing 1938 pounds of organic matter four months. At the end of this time there were only 655 pounds of organic matter left, and the nitrogen content had been reduced from forty-eight to twenty-eight pounds. Other experiment stations have obtained just as striking results. This same loss from leaching is going on in our southern soils every fall and winter wherever a bare field is left without a growing crop to send out its roots to take in the fresh soluble food material as fast as it is set free each warm day and convert it into insoluble plant material that cannot be leached out or washed away. Every bare field may not be losing as much as the \$8.00 per acre worth of fertility lost by the North Texas farmer mentioned, but some doubtless lose even more than that, for often there are many weeks of hard winter rains.

9. A cover crop is a crop usually planted in the late summer or autumn, that will provide a green, growing cover for the land during the late autumn and winter months.

10. The cover crop is of value to the farm and farmer in four ways, as follows:

(a) It takes in the plant food that becomes available during

the fall and winter months, thus conserving it on the farm when it otherwise would be largely leached and washed out.

(b) It furnishes excellent winter pasture for live stock.

(c) It prevents washing and gullyng.

(d) It provides vegetable matter to turn under in spring and produce humus, which is so valuable to the soil in improving its texture, increasing its water-holding capacity, and supporting the bacteria that help to make the food materials in the soil more soluble. "The Progressive Farmer" says in its issue of September 14, 1914, that "it is becoming a well-recognized fact that in the future the really good farmer will be the man who regards washed-away fields as little short of a crime, and whose only commercial fertilizer bill is for phosphoric acid and possibly potash." This is true. To allow soil to wash when washing may be avoided is criminal, and to continue to buy nitrogen or do without it when it may be had by growing leguminous crops either as winter covers or otherwise is poor economy, to say the least.

11. Cultivated lands in Texas are usually idle from three to five months every year, depending upon the crop grown and section of the state in which the land is located. By leaving the land idle we not only lose fertility from the soil by leaching, oxidation and washing, but we fail to reap the profits of a good winter crop. Land that is worth \$100.00 an acre when producing but one crop a year is easily worth \$150.00 when made to produce two crops. It is easier to make \$150.00 an acre land profitable by sowing all cultivated land to winter cover crops than it is to make interest on the same land at \$100.00 per acre, if no cover crops are grown.

12. When land is heavily fertilized and the season following the period of fertilization is dry, the plants cannot use the fertilizer applied because there is not enough moisture to dissolve the plant food and make it available to the plants. The fertilizer, therefore, lies in the soil in about the same condition as it was when applied. The same is true of fresh fertility set free by chemical action during a hot summer. When the fall and winter rains come, this food material goes into solution and becomes available very rapidly. If there is no cover crop on the soil to take it in and hold it, it is leached out and lost.

If there is a cover crop growing on the land, the fertilizer intended for the summer crop will be taken in by the winter cover crop and saved.

13. The leguminous crops best suited for winter covers in Texas are crimson clover, bur clover, and winter vetch. The best non-leguminous crops for this purpose are oats, rye, barley, wheat and rape. (Let those who have had experience with these or other cover crops in this section discuss such of their experience as would be of help to all.)

14. All cover crops should have a well-prepared seed-bed. The depth of plowing will depend upon the time of preparation, the amount of rainfall, and the temperature. Unless the seed-bed can be prepared four or five weeks before time to sow, deep breaking is not to be recommended. If the probabilities of plenty of moisture (taking weather reports of previous years as a basis) are not good, do not plow the land deep. If one is practically assured of an abundance of moisture and a mild winter, the land may safely be plowed deep. Otherwise, it is better to disk up a good seed-bed or plow shallow and pulverize thoroughly with disk or smoothing-harrow. All seed-beds for winter cover crops should be firm, moist and well settled, so that the seeds may germinate at once. At times the cover crop is best planted with the one-horse drill in the middles of the still growing summer crop. (Let those with successful experience in planting cover crops in this section tell of their methods of sowing.)

15.

Crop.	Time of sowing.	Amount of seed per acre.
1. Crimson clover	Sept. 1 to Oct. 15	12 to 20 lbs., usually 15
2. Bur clover...	Sept. 1 to Nov. 15	12 to 18 lbs., usually 15
3. Winter vetch..	Sept. 1 to Nov. 15	} 20 to 30 lbs. vetch with } 1½ bu. oats
4. Rape	Aug. 20 to Oct. 15	
5. Oats	Sept. 1 to Oct. 20	2 to 2½ bu.
6. Rye	Sept. 15 to Oct. 15	4 to 6 pecks
7. Barley	Sept. 15 to Nov. 1	7 to 9 pecks
8. Wheat	Oct. 15 to Nov. 15	5 to 7 pecks

It may be necessary to inoculate for crimson clover, bur clover, and vetch. The simplest method of inoculating for bur

clover is to sow the clover in the burs. Soil from fields where crimson clover and vetch have been grown may be used to inoculate for each of these crops respectively. If the inoculated soil cannot be secured, artificial cultures can be obtained from the Bureau of Plant Industry, Washington, D. C. In ordering these cultures, be sure to state the kind of legume to be grown and the acreage to be inoculated. Direction for using the cultures will be furnished by the above Bureau.

16. The leguminous crops are practically always to be preferred if they can be grown satisfactorily, because of their ability to gather nitrogen. Crimson clover, bur clover, and



Figure 1. Bur clover on Bermuda sod. Note the fine pasture before the trees have even begun to put out. Courtesy of the Alabama Agricultural Experiment Station.

vetch take large quantities of nitrogen from the air and transfer it to the soil. Since nitrogen is the most needed food element in most soils, and since it is the most expensive fertilizing element, it is highly important that leguminous crops be grown to supply nitrogen. One of these legumes is adapted to one section, while another is better adapted to another. Grow the ones that grow best in your section.

Too much cannot be said regarding the merits of rape as a winter pasture. The Dwarf Essex is the best variety for Texas. It affords an excellent hog pasture and the seed costs but little. In feeding experiments at the Alabama Station, it was found that hogs being fed on a ration of two parts corn and one part of wheat, and allowed the use of rape for pasture, produced pork on an average of 34.4 per cent less cost per pound, counting the cost of the rape pasture, than did the lot fattened on the same ration and confined to dry lots. It must be remembered, however, that a few acres of rape is all that is profitable on any farm. One acre will afford ten to twelve one-hundred-pound hogs grazing for six to eight weeks, provided a moderate grain ration is also fed.



Figure 2. Swine foraging on rape. Courtesy of the Agricultural Experiment Station of the University of Wisconsin.

Oats may be considered as one of the best and most profitable non-leguminous crops in the South. It is practically a sure crop, is easily sown, costs little to produce, affords an excellent winter pasture, produces a good grain or green manure crop,

and prevents washing and leaching. The South should sow many times its present acreage to oats.

Rye, barley, and wheat are more or less important in certain areas of the South. Wheat is important in North or West Texas. The barley acreage in the State is very small. The rye acreage is altogether too small. It is the one non-leguminous crop that grows fairly well on thin and sandy soils. It should be used as a winter cover on large areas of soils that grow no cover crop at the present time.

17. There are various combinations of leguminous and non-leguminous crops that often prove very valuable. Winter vetch is nearly always sown with oats. Rye, rape, and crimson clover are frequently sown together. Oats and rape make a good mixture. Bur clover is frequently sown on Bermuda or Johnson grass sod. Crimson clover and oats are mixed for a winter cover oftentimes. Discussions of these mixtures and the amount of seed to sow may be found in the bulletins mentioned in the references for further study.

18. To assume that but one dollar's worth of plant food is leached from each acre of land that is left without a growing crop during the winter months is placing the loss at too small a figure. The loss is many times this great. But even at so small a figure, the loss to Texas would be \$27,000,000 annually, which is not a figure to be scoffed at. One hundred million would probably be a much closer estimate of this loss of fertility from lack of cover crops in Texas. To the millions of dollars' worth of fertility that would be saved by cover crops, add the value of several months' grazing for work stock on 27,000,000 acres each year at a time when feed is scarce, the value of the additional cattle and hogs that could be raised, the value of the extra crops made while land would otherwise be idle, and the value of the vegetable matter turned under in spring, and it is plain that cover crops can be made to add easily a hundred million dollars or more each year to the wealth of Texas.

List of References for Further Reading.

Winter Crops: Wheat, Oats, Rye, Barley, Speltz, Vetch, Bur Clover, Crimson Clover; Bulletin No. 117, 1915. Georgia Experiment Station, Athens, Ga.

Oats: Distribution and Uses. Farmer's Bulletin No. 420, U. S. Department of Agriculture, Washington, D. C. [All Farmer's Bulletins are sent free by the Department upon request.]

Oats: Growing the Crop. Farmer's Bulletin No. 424.

Winter Oats for the South. Farmers' Bulletin No. 436.

Winter Oats in the Cotton Belt. Special, Nov. 21, 1914, U. S. Department of Agriculture.

How to Avoid Failure with Oats.- Progressive Farmer, Sept. 5, 1914.

Barley Culture in the Southern States. Farmer's Bulletin No. 427.

Barley: Growing the Crop. Farmer's Bulletin No. 443.

Winter Barley: Farmer's Bulletin No. 518.

Rye in the Cotton Belt. Special, December 2, 1914, U. S. Department of Agriculture.

Winter Wheat in the Cotton Belt. Special, November 21, 1914, U. S. Department of Agriculture.

Wheat. Bulletin No. 83, Agricultural Experiment Station, Lexington, Kentucky.

Wheat Production in Georgia. Circular 6, Agricultural Experiment Station, Athens, Ga.

Rape for Hog Pastures. The Progressive Farmer, September 26, 1914.

Rape as a Forage Crop in the Cotton Belt. Special Circular, December 15, 1915, U. S. Department of Agriculture.

Winter Bur Clover. Bulletin No. 108, A. and M. College, College Station, Texas.

Southern Bur Clover. Bulletin No. 165, Alabama Experiment Station, Auburn, Alabama.

Crimson Clover: Seed Production. Farmer's Bulletin No. 646.

Selection for Disease Resistant Clover. Bulletin, Whole No. 75, University of Tennessee, Knoxville, Tenn.

Crimson Clover. Bulletin No. 147, Alabama Experiment Station, Auburn, Alabama.

Crimson Clover. Bulletin No. 165, Alabama Experiment Station, Auburn, Alabama.

Crimson Clover: Growing the Crop. Farmer's Bulletin No. 550.

Crimson Clover. Farmer's Bulletin No. 579.

Hairy Vetch Alone and in Mixtures. Leaflet No. 29, Agricultural Experiment Station, La Fayette, Indiana.

Hairy Vetch for the Cotton Belt. Special, December 15, 1914, U. S. Department of Agriculture.

Vetch Growing in the South Atlantic States. Farmer's Bulletin No. 529.

Vetches. Farmer's Bulletin No. 515.

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