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HELPS FOR TEACHERS IN AGRICULTURE

Farm Crops

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During the school year 1914-15, a study of Wheat, Oats, Legumes, Potatoes, Rotations and Corn Cultivation is to be made under the heading of "Farm Crops" in the Seventh and Eighth Grades. With the hope of giving some little aid to school teachers a brief discussion of the various topics is given with suggestions for laboratory and field work. Teachers are urged to have the pupils perform as far as possible the suggested exercises. Bulletins dealing with Farm Crops should be secured from the State Agricultural Colleges and the U. S. Department of Agriculture for reference purposes.

Wheat Seeding

The time for sowing wheat in Indiana varies considerably according to the part of the State. In the northern part of the State wheat is sown about three weeks earlier than in the southern part. The time of sowing is regulated somewhat by the time of appearance of the Hessian fly. The Hessian fly lays its eggs early in September on the young wheat plants. If there are no young wheat plants, the eggs will be deposited on grass or weeds where the young insects will about all perish. A study of the habits of the Hessian fly indicate that it is safe to sow wheat in the northern counties of the State after September 15th; in the central part of the State after September 25th; and in the southern counties about October 1st.

The best rate of seeding seems to be about six pecks to the acre. Many farmers sow only five pecks and a few sow only four pecks. If the growing season is cool and moist, the wheat plants

will stool out (produce extra shoots). In such case, one bushel of seed is likely to produce just as good a crop as six pecks, but it is safer to use the larger quantity of seed.

Many farmers now use commercial fertilizer at the time of sowing their wheat. Experience shows that the use of about 200 lbs. to the acre of a fertilizer containing from 1/2% to 2% of nitrogen, 8 to 10% phosphoric acid and 2% of potash is about right. A light top dressing of stable manure after the land is plowed is also a good fertilizer for wheat.

Exercises.—Look for Hessian fly pupae in old wheat stubble. Note and record the date that first field of wheat in the community was sown: also the last field.

How many farmers in the community used fertilizers on their wheat ground? What brands of fertilizers were used? How much was applied per acre?

Examine fertilizers by smell, taste and touch. Secure tags from sacks containing fertilizer. Of what value are these tags to buyers of fertilizers?

Visit a farm and study grain drill as to method of adjustment to sow different quantities of seed and fertilizers.

References:—Purdue Circular Number 23.

Nodules of Legumes

Such plants as clovers, cowpeas, soy beans, hairy vetch, and in fact all of the legumes, have enlargements on their roots, called nodules or tubercles. These nodules have various shapes and appearances. On the cowpea and soy bean they are nearly spherical. On the alfalfa and hairy vetch they are very much branched. On the clovers they are cylindrical in shape. In size they are as variable as in shape, those on the clovers being quite small while those on the cowpea are relatively large. The color of the nodules is usually white or flesh colored.

An examination of these nodules under a compound microscope shows the presence of a large number of small bodies, called bacteria. These bacteria are beneficial to the plants. They gather nitrogen from the air that circulates through the soil and fix it in their tissues. When the plants begin to blossom these bacteria begin to die off and give their nitrogen content to the plant. The plant changes this nitrogen to the organic compound called protein, which is a valuable feeding element. Plants that have nodules on their roots are richer in protein than plants which do not have them.

On land where a particular legume has never grown before, the bacteria which will make the nodules on its roots are usually not present and they must be introduced into the soil in order to

have nodules produced. This is called inoculation. This inoculation is accomplished by taking soil from a field in which the particular legume has grown successfully and had nodules on its roots and scattering the soil over the field to be planted. The soil should be covered at once by harrowing. Various commercial firms manufacture artificial cultures of bacteria for the inoculation of the different species of legumes. Directions for using these cultures always accompany the package.

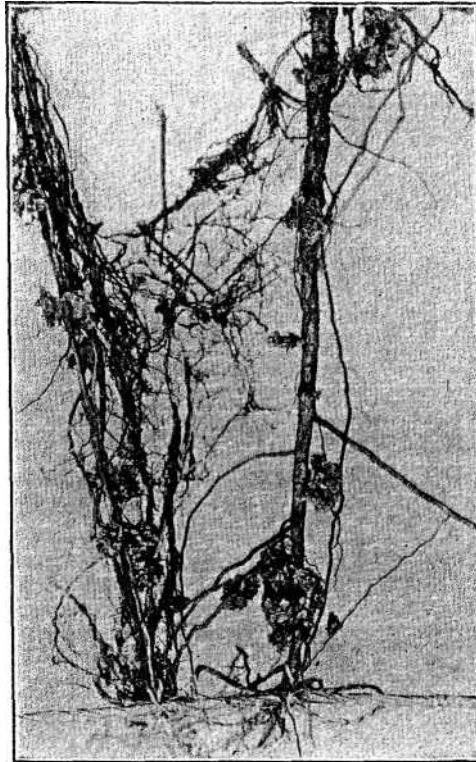


Fig. 1.—Nodules formed by nitrogen gathering: bacteria

Exercises.—Locate all kinds of legumes in the community. Dig up roots of each and examine nodules, eg., clovers, cowpeas, soy beans, vetch, alfalfa, etc. Make sketch showing attachment of nodules to roots and their comparative size. (In taking up roots, care must be exercised in removing soil so as not to strip off nodules. It is a good plan to lift a large quantity of soil with the

roots and then remove this gently with the fingers or by means of washing with water.)

Wheat Stooling and the Hessian Fly

It was stated in the lesson on wheat seeding that if the growing season was cool and moist the plants would produce extra shoots and thus make a thick stand. It has been often observed that wheat which has been somewhat winter-killed and this followed by a damp, cool spring, that the wheat crop was almost as good in yield as where a thick stand of plants lived through the



Fig. 2.—Infested wheat plant, showing; the flaxseed at the base. Note manner of growth as compared with healthy plant

Fig. 3.—Healthy wheat plant

winter. This good yield is due to the fact that such plants as remain behind produce several stems to each plant and consequently give almost as thick a stand as if only one or two stems had been produced from each seed sown. The production of extra shoots is called stooling; sometimes the term tillering is used. These extra shoots appear in other plants besides wheat. Oats, rye, and barley and in fact all the grasses produce these extra shoots. In the case of corn they are called suckers. The stooling of wheat or rye may take place in the autumn as well as in the spring. Frequently most of the stooling is done in the autumn.

Late in the autumn is the time to look for the presence of the Hessian fly. As stated in a previous lesson, the Hessian fly lays its eggs early in September on wheat plants, if they can be found. The eggs are laid on the upper surface of the leaf and soon hatch. The young insect does not have any legs and resembles a maggot in appearance. It wriggles itself down the blade to the base of the sheath. Here it absorbs the juices from the plant and causes an unthrifty condition of the plant. The plant usually produces some extra shoots to offset the harm being done to the main shoot by the insect. After living for a short time in this way the larva changes to a flat, brownish condition. This is called the pupa state. In this condition it remains through the winter. In the spring this

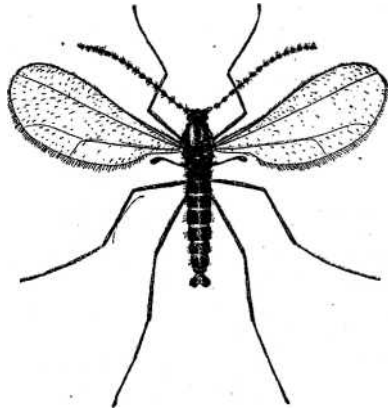


Fig. 4.—Hessian Fly (*Mayetiola destructor*).
Adult male, much enlarged

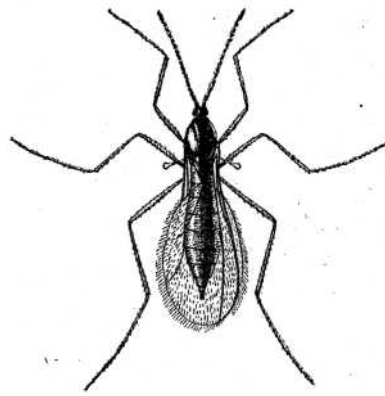


Fig. 5.—The Hessian Fly.
Adult female, much enlarged

brown pupa hatches out into a small blackish fly. This is the adult insect. This fly soon lays eggs again and we have the process repeated. It thus happens that wheat may be attacked by the fly both in the autumn and in the spring. Usually the spring attack is worse than the autumn attack because there are so many more insects.

Exercises.—Study in the field the amount of stooling of wheat or rye or both. Examine plants in several fields. Make record of the number of stalks on each plant.

Secure the name of the varieties of wheat sown by the farmers so as to determine whether the variety has anything to do with amount of stooling. Make sketch of plants examined.

Examine plants for Hessian fly. Make sketches of plants containing the fly as compared with those that are not affected.

Rotations

A rotation is the growing of crops in a systematic order. Usually three or four crops are grown in a series. A common farm rotation is corn, wheat, and clover, each crop occupying the land during a season and following each other in the order named. The kind of rotation practiced in any given section is determined by the climate, labor supply and market facilities, and to some extent the character of the soil. Crops which require long seasons for maturing cannot be grown in northern climates. Crops which require a great deal of hand labor can be grown extensively only in those sections where abundant and cheap labor can be easily had, as for example, the growing of sugar beets for sugar production. Again, unless it is possible to market the product easily and quickly, a crop suited to the soil and climate may not be a profitable one. Sometimes the farm is located at a distance from the shipping point and this shipping point is also at a considerable distance from a big market.

A good rotation should have three characteristics:

1. At least one of the crops should be a cultivated crop so that the land can be rid of weeds.
2. There should be a crop which has a tendency to improve the fertility of the soil; that is, a soil renovating crop, like clover or some other legume.
3. At least one of the crops of the rotation should be one which can be sold for cash.

This is called a money crop. The crop in moist rotations usually embody these points.

There are three rotations which have become more or less noted.

1. Norfolk rotation. This is one of the oldest systems of cropping and has been extensively used in Great Britain. It consists of four crops, turnips, barley, clover, and wheat. An examination of this rotation in relation to our climate and labor supply would indicate that it is not suited to Indiana.

2. Terry rotation.—This rotation was originated by Mr. T. B. Terry, of Ohio. It consists of potatoes, wheat, and clover. It will be noticed that in this rotation the ground needs to be plowed but once in three years, and that there is a clover sod for the potatoes.

3. Corn belt rotation.—This consists of four crops, corn, oats, wheat, and clover. Frequently either the wheat or oats is omitted and the rotation becomes a three crop one. This rotation is practiced throughout all the central states in which corn is extensively grown.

The reasons for practicing a rotation are briefly as follows:

1. The different crops draw upon the plant food in the soil in unequal amounts.
2. The root systems have different characters. Some are near the surface while others extend deeply into the soil.
3. Some of the crops in the rotation use nitrogen while others gather nitrogen and leave it in the soil for future crops.
4. The rotation helps the farmer to hold in check weeds, insects, and plant diseases.

Exercises.—Each student should draw a plan of the home farm and show different fields. In this plan should be noted the size of the fields and the crop which each has grown during the past five years. Compare these crops grown with that of a good rotation.

Have plans drawn showing ideal arrangement of the farm with proper rotation for the next three years.

Cowpeas and Soy Beans

These crops are of Asiatic origin and have been grown and used in that part of the world for a long time. They are comparatively recent crops in Indiana. Only within the last few years has interest in their growing been widespread. The two crops have quite similar characteristics. Both are legumes and good for soil improvement as well as excellent feed. They are well adapted to ordinary corn land. The cowpea will grow on sandier soil to better advantage than the soy bean. The same is also true with regard to the heavy soils like clay loams. The seed bed should be prepared the same as for corn. The planting is done in the spring after corn planting. The seed may be distributed in rows 24 inches or more apart or drilled solid like wheat. When sown in rows cultivation should be given the same as corn. If sown in rows 24 or 32 inches apart, about 30 lbs. of seed is necessary for an acre. When drilled solid like wheat, a bushel or more of seed is necessary. The seed can be distributed with an ordinary wheat drill or with a corn planter. In using the corn planter, special soy bean plates should be used. If these crops have never been grown before on the land, they should be inoculated the same as described before. When using the corn planter, inoculating soil can be mixed with the seed and distributed in that way very effectively.

If these crops are to be used for soil improvement, it is economical to pasture them down before plowing under. Hogs will derive more benefit from the pasturing than other animals.

Soy beans are ready to cut for hay when the pods are about two-thirds grown and before the leaves have begun to turn yellow. Cowpeas are ready to cut for hay when the first pods begin to show ripeness. Soy beans are ready to cut for seed when they are fully

ripe and the leaves have fallen off; cowpeas, when the maximum number of pods are ripe, and before the early ripening pods have begun to burst open. Both cowpeas and soy beans make excellent hay for all kinds of livestock.

Both cowpeas and soy beans may be sown after wheat has been removed, especially in the southern half of the state. If they can be sown by the middle of July and favorable weather conditions result, a good growth will be obtained, sufficient to pay for the cost of the seed and labor. These crops sometimes are sown in standing corn and furnish organic matter for plowing under for the next crop.

Exercises.—Secure and study dry specimens of cowpea and soy bean plants; also secure the seed of both of these crops. Note the different varieties of each. Secure as many as possible. Determine amount of each of these crops grown in the community. For what purpose are these crops grown?

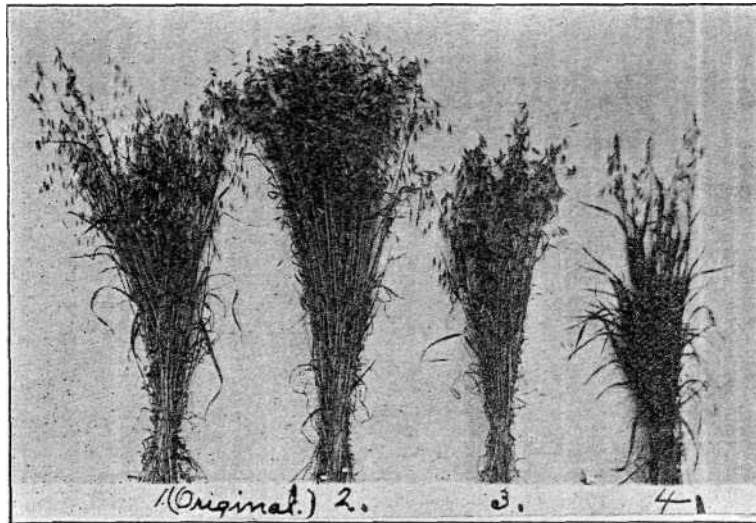


Fig. 6.—Result of selection of oats

Oats

The oat crop is quite generally grown in Indiana. It is a more certain and profitable crop in the northern half of the State than in the southern half. It is greatly influenced by the climatic conditions of the growing season. In cool, moist seasons the oat crop is a very satisfactory one but in seasons of high temperature and small amounts of rainfall, the yield is usually less than enough to pay the expenses of producing.

Most of the oats in Indiana are spring sown and are usually sown on land that was in corn last year. The seed bed is usually prepared by disking and harrowing. When so prepared the seed is distributed by drilling. In many cases the oats are sown broad cast with an end-gate seeder or other means of broadcasting. The seed is then covered by disking and harrowing the ground. The broadcasting method is adapted to cornstalk land where the stalks would be in the way of drilling.

The amount of seed sown varies greatly. Some farmers sow as little as 1 1/2 bushels to the acre, while others sow as much as 4 bushels. The majority of farmers, however, sow from 2 to 2 1/2 bushels to the acre. It is desirable that the seed be run through a fanning mill and that all the light grains and chaff be removed.

Oats are usually not fertilized. Fertilizing will show an increased yield but since the crop is a low priced one per bushel, the increased yield may not pay for the fertilizer. In some of the southern counties of the State winter varieties of oats are sown about the first of September. These live through the winter and produce good oats next spring. However, in severe winters there is likely to be large loss from winter-killing.

Occasionally a farmer sows oats in February on the frozen ground. Sowing at that time requires no seed bed preparation. If a damp spring follows, this method of sowing usually gives satisfactory yields, but in dry seasons the sowing is a failure.

There are many varieties of oats. The following varieties are quite well adapted to Indiana conditions: Silvermine, Big Four, Great Dakota, Swedish Select, Joannette. A medium early maturing variety seems to be better for Indiana than the very early maturing or late maturing ones.

Exercises.—Make germinating tests of oats. This may be done by using blotting paper and plates or some other form of germination.

Secure a number of varieties of oats in the community and study same, noting difference in size, color, thickness of hull and presence of beards and long points on the grains. How many acres of oats will be sown in the community? What is the average yield of oats per acre? Which method, broadcasting or drilling, is used?

Potatoes

Potatoes are adapted to a wide range of soils but grow best on sandy loam soil, well drained, and well supplied with decayed organic matter. The seed bed should be prepared by deep plowing, as deep as 8 or 9 inches. In Indiana potatoes are planted "early" or "late." Early planting means not later than the middle of April

while late planting means about the middle of May. It is best to put the seed pieces in furrows four or five inches deep. The seed piece should be covered with about two inches of soil and when the potatoes are up, the furrow is filled by the cultivation given the potatoes. It is desirable to have the seed pieces four or five inches below the level of the surface for the new potatoes are formed above the seed pieces. If the seed piece is planted shallow, the new potatoes will likely stick out of the ground and become green, thus spoiling them for table use.

For seed pieces, one should select medium sized potatoes and cut them in about four pieces so that each piece has at least two buds. A good seed potato is of medium size, smooth and proper shape for the variety, with a corky, netted skin, indicating good maturity. It requires about fifteen bushels of potatoes cut in quarters to plant an acre, if the rows are three feet apart and the pieces dropped 12 to 15 inches apart in the row.

Potatoes should be cultivated the same as corn and until they begin to blossom. The cultivation should be shallow and level.

There are two insects that attack the potato plants. The first to appear in the early summer is the Colorado potato beetle. Later in the season the blister beetle is very destructive to the tops. Both of these insects can be controlled by spraying with arsenate of lead or Paris green. Potatoes are also attacked by the blight. This can be controlled by spraying with Bordeaux mixture. It is probably best to mix the Bordeaux mixture and the Paris green and by one spraying save the potatoes from both the blight and the insects.

Exercises.—Have each pupil bring a half dozen potatoes from home. Secure as far as possible the name of the variety. Note varietal differences.

Study the form, size, character of the skin and texture of the potato.

Study buds (eyes) and note number and depth. What custom is followed in planting potatoes in the community. Are large whole potatoes planted, small potatoes or are potatoes cut and the cuttings planted? Which is the better plan?

Corn Cultivation

There are two objects in cultivating corn:

1. To destroy the weeds which would take up moisture and plant food.
2. To make a mulch of loose soil one or two inches deep on the surface to conserve the moisture. It is some times necessary to cultivate in order to loosen the soil but if the breaking has been well done and there has not been excessive rainfall, this should not be necessary.

Cultivation usually does not begin until after the corn is two or three inches tall. However, time can be saved and effective work done by harrowing the field with a spike-tooth harrow before the corn comes up. This harrowing will also tend to break any crust that may have formed and permit the corn to come up more uniformly. The kind of tool to use in cultivating is not as important as the way in which it is used. It is desirable that the cultivation should be shallow after the first and second times and that it should be level cultivation. Shallow cultivation is usually thought of being about 2 1/2 to 3 inches deep, while deep cultivation is more than 3 inches deep. Corn should be cultivated often enough to destroy the weeds and to preserve a mulch. This may be three or four times and it may be six or seven times. It is usually desirable to go through the corn once or twice after it is too large to go under the arch of the cultivator. For such cultivation a harrow-tooth cultivator may be used but care should be taken that the outside teeth do not cut too deeply. It is frequently better to use a drag of some kind. Many farmers use a mower or corn planter wheel or make a short plank drag. The drag breaks the crust on the surface and leaves a nice loose mulch behind.

Exercises.—Get a two-horse cultivator and study adjustment for deep or shallow work, weight of driver, width of rows, etc. Where possible take this cultivator apart and put it together again.

Locate, if possible, in the community a two-row corn cultivator. Compare this with the single row or two-horse cultivator.

How many times does the average farmer cultivate his corn? Secure as far as possible the first day and the last day of cultivation.



Plot 1, no cultivation

Plot 2, good cultivation