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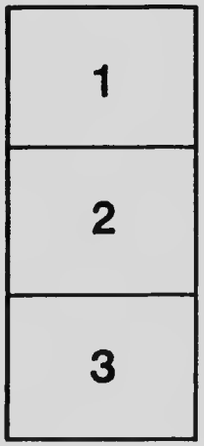

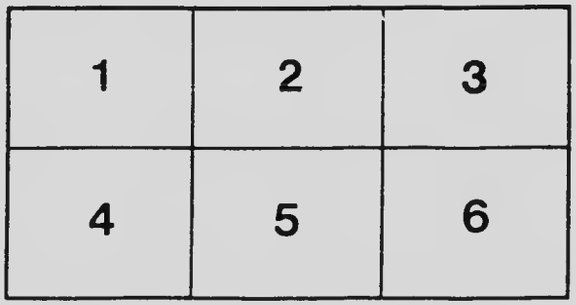

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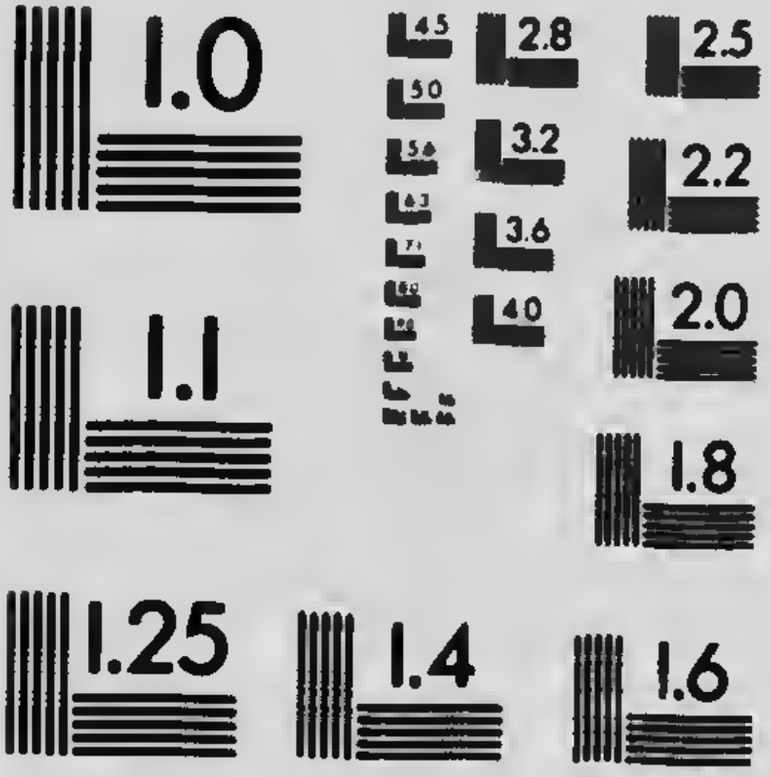

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DOMINION DEPARTMENT OF AGRICULTURE
OTTAWA, CANADA

TOBACCO DIVISION

REPORT ON THE TOBACCO INDUSTRY IN ONTARIO

By

W. A. BARNET

Bulletin on Tobacco No. A—4

Published by direction of the Hon. SYDNEY A. FISHER, Minister of Agriculture, Ottawa, Ont.
January, 1909

10525—1

To the Honourable
Minister of Agriculture.

SIR,—I have the honour to present herewith Bulletin No. A4, one of the series of bulletins of the Tobacco Division, entitled 'Report on the Tobacco Industry in Ontario,' prepared by W. A. Barnet, assistant of the Tobacco Division.

This bulletin, although not containing any technical information, will be of assistance to the tobacco growers in Ontario, by placing at their disposal a knowledge of the methods of culture in the different sections of the counties of Essex and Kent. They will find also some valuable suggestions which will be carried out on our experiment station, and I therefore recommend that this report be printed for distribution.

I have the honour to be, sir,
Your obedient servant,

F. CHARLAN,
Chief of the Tobacco Division.

OTTAWA, January 4, 1909..

10525—1½

REPORT ON THE TOBACCO INDUSTRY IN ONTARIO.

The object of the investigation here reported upon was to find out, so far as mere inquiry can discover, the present situation of the tobacco industry in Essex county. Particular attention was paid to the practices generally adopted in the preparation of the soil, the manuring and fertilizing of the same, the manner of establishing seed beds to obtain plants, and to note any special practices or problems relating to the production of tobacco.

In addition experimental work was begun in the selection of seed plants; the object being to breed a particular strain of tobacco suited to the soil and climatic conditions of that section of Ontario and furnishing the desired characteristics of leaf.

Preparation of the soil.—Having a suitable type of soil, well drained, with a fair amount of vegetable matter present, the next important consideration is its preparation. Clover sod has given the best results in all parts. A few advocate stubble land or corn ground, but by far the greatest weight of evidence is in favour of the clover sod; and my own observation of the growing crop has gone to confirm this opinion.

As to the time of ploughing there is a great variety of opinion, all of which seems to be tolerably correct for the district in which each particular method is advocated. On the clay loam, and more especially on the typical clay soil, fall ploughing, unquestionably, has given the best results. To give the proper treatment it should be ploughed early and disced in the fall; but few farmers seem to follow this method.

Outside of the beneficial physical effects to the soil, one of the greatest benefits of fall ploughing is the exposure of the chrysalids of the tobacco worm to the action of the frost and other adverse conditions. If more of the growers, whose crops have been badly damaged by this insatiable feeder, would practise fall ploughing and the use of cover crops, even on the sandy types of soil, there would be a much smaller percentage of damaged leaves in many crops and a much more valuable product would result.

Notwithstanding, on the sandy soils all along the ridge of land bordering the lake, spring ploughing is practised. The growers claimed equally good or better results than from the fall ploughing. Where there is any gravel in the soil it is liable to wash with the spring rains, and become very hard if ploughed in the fall whereas, the sandy soil seems to run together too much or drifts badly in winter if fall ploughed. But if the land is not tilled in the fall, it should be ploughed as early as possible in the spring. This conserves more moisture and gives the land time to become firm before planting. By becoming solid below capillarity is increased, and more moisture will be brought to the surface to nourish the plants during the dry weather. With late ploughing the land invariably is loose, open and lumpy, and is very apt to dry out. Many instances of the latter case have been brought to my notice this season.

One field in which I happened to be served as a very convincing example to show the importance of early spring ploughing. A narrow strip in the field was ploughed three to four weeks before planting, and an area comprising a few rows alongside was left till just before planting. All the field received the same cultivation and was planted the same day with the same type of plants. On July 31, when I visited the plantation, it could be seen very plainly where the line of demarcation was between the late and the early spring ploughing. There appeared to be about two weeks difference in the growth of the plants. Several crops that were backward, indicating

a much reduced yield, were planted on ground prepared too late in the spring; and the decreased return could be accounted for in no other way. When the land is lumpy, open and dry, there is not enough moisture to push the tender young plants along; insects, especially the different species of cutworms, are apt to attack the growing crop, and whole fields suffer often in this way.

The only tobacco district where I found fall ploughing followed was that of Pelee Island. The practice is adopted generally by most of the better growers. One reason why it is more prevalent there is the fact that a great deal of the soil is of a clay nature. In a few instances I found that late spring ploughing was practised; and, as a result, the weeds were greatly in advance of the tobacco crop. When ploughing is left till too late in the spring there is not the same chance to kill the weeds before planting time, which is a very important consideration, since they draw heavily on the moisture of the soil. Generally speaking, unless there is an abundance of moisture in the soil, late ploughing should not be practised.

A number of farmers along the lake front sow a crop of peas in the early spring, or rye in the fall, and plough down this cover crop in the spring. This is a very valuable practice, since it increases the organic matter and prevents the sand from drifting. If the crop of rye is turned under before its maturity is too far advanced it is generally accompanied by good results.

In many instances where late ploughing was practised a great deal of trouble was experienced in getting a good stand of plants; some farmers were obliged to reset several times. This indicates a great deal of extra expense, besides such late settings will never develop into any more than half a crop, considering one season with another.

Thus, no direct conclusion may be drawn as to the exact time of ploughing. The date varies a good deal with the season. Some plough early in April, as soon as the frost is out of the ground. Many who did not begin early this season were waiting for rain to soften the ground. The spring of 1908 was exceptionally dry for a long period just when the growers were ready to make preparations for planting.

As a general statement, I would say that among farmers who have a clay soil the better class practised fall ploughing so far as time allowed them, whereas that class who had a light or gravelly sand invariably followed spring ploughing. Some have tried fall ploughing on this light soil, but found it was of no advantage since the land became so solid that it required ploughing in the spring again.

As to the number of ploughings, invariably the soil is turned over but once, for the simple reason that farmers have not time to repeat the operation. I found but one grower who had ploughed his tobacco ground more than once during the spring. His reason was that he retained more moisture in the ground. It is a question in my mind if the increased return would warrant the extra labour and outlay incurred in this, the most expensive operation of tillage. Early spring ploughing followed by frequent and thorough cultivation is the more economical practice in the light soil. However, it is not the most effective method, and should be supplanted in most cases by fall ploughing.

As regards the depth of ploughing, there is a wide difference of opinion. Some growers plough clay soil from 4 inches to 5 inches deep, others as deep as from 6 inches to 8 inches, both believing their particular method to be the best. On sand and sandy loam soils there is just as much diversity of opinion. Many good growers plough as deep as 8 inches, while others go to a depth of from 4 inches to 6 inches and claim to get good results. As a matter of fact, the depth is not so important a point as the thoroughness and efficiency of the operation.

The after preparation of the soil is even more important than the ploughing. The majority of growers realize the circumstance, that unless the ground is well worked up into a fine state of tilth, the plants cannot make the uniform continuation of growth which is desired. The soil should be thoroughly pulverized with the disc harrow, and put into a fine condition of tilth with the smoothing harrow. If it is lumpy,

the roller should be used, but on the sandy types of soil there is little occasion to use this implement. Very few growers use the spring tooth cultivator; the disc and smoothing harrows are the implements used. The number of times the average farmer cultivates his tobacco ground depends a good deal on the type of soil. A few disc five or six times after ploughing, and aim to repeat the operation once a week till the time of planting. But where late ploughing is practised, and the land is allowed to dry out and become lumpy, no amount of tillage will bring that field into a suitable condition for planting. Many crops have suffered from just such a practice in 1908. As a result, the tobacco, which is a very exacting crop, never recovered from such a severe setback and was only half a yield.

Manures and fertilizers in growing tobacco.—Regarding the manuring and fertilizing methods adopted we have found much less difference of opinion. In any case, nearly all the farmyard manure available is put on the tobacco ground in fall, winter or spring. The only exception to this statement was found in the Pelee Island district. Many farmers on this island who produced but very little manure grew tobacco on the marshy land, which comprised quite a large area. In this vicinity the soil, which is pure black muck or perhaps clay, containing a large percentage of decaying organic matter, retains a large available supply of nitrogen. Consequently, the tobacco grows coarse and heavy without an application of manure. However, where tobacco, corn and cereals have been grown too frequently without rotation, the soil was becoming depleted in its natural supply of nitrogen and potash; and the better class of growers realized that they must grow clover where the soil was dry enough and, in addition, produce as much manure as possible.

There was some difference of opinion in regard to the amount of manure used, the time of application and the method of incorporating it with the soil. For instance, some growers bordering on the lake pastured hogs on a clover sod during the fall, and in the following spring ploughed under a heavy application of hog manure about four to eight weeks before planting.

Regarding the amount of manure applied, it varied from ten to twenty loads per acre; the latter amount would be a fairly heavy application, since twelve loads is equivalent to twenty tons. In very many cases all the manure on the farm was put on the tobacco ground; however, the fertilizing value of the manure varies a great deal, depending on the amount of grain used, the number and class of stock fed, the litter supplied and the care in handling. As a general statement, the most successful farmers who kept a number of hogs and cattle—feeding all the grain and fodder produced on the farm—applied twelve to fifteen wagon loads to the acre. Those who used the manure spreader applied about eight to twelve loads, the latter allowance being the largest quantity that can be put on at a single application.

The majority of the tobacco growers who apply the manure in the spring and incorporate it with the soil at the time of spring ploughing seem to obtain fairly constant results. A few practise top dressing in the winter and discing in the manure in the early spring; and their efforts are attended frequently with very good results. The efficiency of this practice will vary a good deal with the season; if the manure was applied to a sandy soil late in the spring and a long dry period followed, such as Essex county experienced this season the benefits of the manure would not be appreciably noticed that season, since the constituents are slowly soluble. Hence, this practice needs to be tried more extensively before reliable conclusions may be drawn. As a general conclusion, we would say that at the present time practically all the manure is incorporated with the soil at the time the spring ploughing is done.

The commercial fertilizer problem is still in the experimental stage, and the success attending its use is very variable. The one most widely tried is what is known as high grade special guano. A large number of growers in the important tobacco producing sections have applied a few tons of this fertilizer to small acreages in previous years. Some have tried it but one year on one particular type of soil. A

few farmers could detect the benefits in the increased yield of the crop, which evidently shows that their particular soil was lacking in some of the ingredients which the fertilizer contained. But the great majority of growers have used this prepared mixture to no advantage. Although many people did not realize any return from this high grade guano, however, in many cases the following crop of oats or wheat showed the effects of the chemical manure. Since there are so many problems wrapped up in the judicious use of fertilizers, it is impossible to draw any conclusions as to the merits or demerits of the mixture. At all events, there was very little fertilizer applied this season. The use of chemical manures has been confined to the Essex county district; no growers on Pelee Island have tried fertilizers during any previous years.

The quantities of manure applied vary with the method of application. Quite a number have used the guano at the rate of 200 to 300 pounds to the acre, putting about a tablespoonful in each tobacco hill at planting time. In following this method I found that in most cases the fertilizer was too much concentrated in one spot, and the plants were 'burnt.' Other have taken precautions to mix the soil and fertilizer in the hill, and have noted but little benefits from the application. The greater number have applied the mixture broadcast at the rate of 600 to 800 pounds per acre, harrowing in before planting.

A very limited number who have had considerable experience with fertilizers have applied a home mixed, complete fertilizer, buying the single ingredients, sulphate of potash, nitrate of soda, and acid phosphate from a fertilizer company, and applying broadcast. Others again have bought prepared mixtures from different fertilizer companies, and applied in the above manner at the rate of 500 to 800 pounds per acre. By way of summary we would say that the greatest measure of success was found where the ingredients were bought singly and mixed at home.

One of the chief difficulties is that growers, as a whole, have not studied the needs of the tobacco crop, the particular elements lacking in their soil, the action and composition of these commercial manures, and their relative cost. In nearly all cases the fertilizer has been applied solely with a view of increasing the quantity of the crop, regardless of quality or any other consideration. In a number of cases the fertilizer has been purchased simply because certain tobacco dealers handled it, and the grower in return expected the dealer to buy his crop. In such cases the fertilizer has been used as a sort of connecting link between the dealer and farmer, no calculation being made by the latter as to whether the increased yield, if such was the case, was sufficient compensation for the initial outlay in the fertilizer.

Regarding this problem there is a broad field for experimental research. Many growers know that manures, rich in potash, are demanded for tobacco. Nevertheless, the exact form of fertilizer as suited to the soil requirements of the Essex and Kent farmer, requires much careful investigation, since on many farms the soil has become depleted of some fundamental elements necessary to the growing of a Burley-type of tobacco; such soils are termed 'Burley sick.' Some crops of Burley of this season will not give half a yield, while other farms actually will not grow Burley at the present time. Heavy applications of farm-yard manure, however beneficial they may be, or the frequent use of leguminous crops, however large an amount of nitrogen or inert potash they may restore to the soil, are not sufficient in themselves to meet all the demands of the tobacco crop. Such manures need to be supplemented with commercial fertilizers; and there is a vast need for data regarding when, how much, and how to profitably employ these chemical manures.

However, a little inquiry into the history of these 'Burley sick' farms has revealed the fact that rotation of crops has not been followed to any extent, the different crops being placed without any regard to the effect on the land or on each other. For example, Burley tobacco has been grown in each of three or four successive years on the same section of the farm within the short period of six years, a crop of grain and clover having intervened before another term of tobacco cropping. Thus the

soil has become depleted in the special demands of the Burley variety. Too many growers do not realize the importance of a short rotation of crops.

Nature of seed beds and methods of establishment.—There are more methods in vogue in regard to the establishment of seed beds than in any other branch of tobacco culture, and coupled with this we have a very varying degree of success. I might say that each grower has his particular method, scarcely two adjoining neighbours adopting the same.

The failures attending the rearing of plants are numerous, to say the least. A grower may prepare his beds in a particular way one year, and the following year take the same precaution and have no plants. Some particular seed, soil or manure used, the quantities of each used, or the too frequent establishment of the bed in the same place, may cause the grower a great deal of trouble.

The strongest and healthiest pla. s I found were grown in the bush, and are known as bush plants. The above were later in maturing than those reared in the hot-bed, but withstand unfavourable conditions of transplanting better, and adapt themselves to their new environment more easily.

The method commonly adopted in getting these plants is very simple. Late in summer or early in fall the area of ground which is generally on the south side of the wood lot, is cleaned up by burning brush or old logs on the selected ground. This practice kills all the weed seeds and insect pupæ, besides giving a nice ash bed, which is rich in potash. In the spring, as soon as the ground is warm enough to favour the growth, it is ploughed or thoroughly spaded up, a nice fine seed bed made and the seed sown. Some growers protect the bed with cotton by having stakes at intervals to support the cover, but the majority grow the plants in the open without any cover tops. Fewer failures attend this method than any other brought to my notice.

The common practice in establishing seed beds is to choose a convenient location in a well sheltered spot, then to remove the soil to a depth of from 4 to 8 inches, to put in a few inches of hog manure or a mixture of hog and hen manure and to replace the soil removed, to make a fine surface layer and to sow the seed. In many cases the latter is mixed with dry sand or ashes in order to get a more even distribution in sowing. In following this method, probably the first year there will be a good stand of plants, and it may be that the beds prepared in a like manner will give fairly good results the second year. But, as far as I could learn, in nine cases out of ten, the grower could not get strong plants if the system was followed during a third season, particularly if he were trying to rear White Burley plants. Numerous failures, where the leaves turned yellow, developed dark roots and finally died, were due to the rigid following of this method. This system would be more satisfactory in growing the cigar-type plants, but the White Burley plants should not be grown longer than one year in the same bed without change of soil. It seems to me that a large number of the failures in rearing plants are due to this simple practical error.

In a few cases the warm bed was used rather than the half warm bed mentioned above. In establishing this bed pure horse manure was made use of rather than hog or hen manure. This system, where judiciously practised, seemed to give fair results, the plants being obtained quite early.

However, I found that when well rotted manure was applied in the fall that the best results, at all events, the least varying results, were obtained. By covering the already prepared soil with a thick layer of well rotted hog manure, or a mixture of hog and cattle manure, and allowing it to leach down through the soil, the ingredients of the manure become incorporated in this medium. Very often finely cut tobacco stalks were added to the above preparation. In the spring the manure was thoroughly mixed with the soil, or, if there was too much coarse material, it was raked off, then the soil was spaded up and the seed sown. In rare instances the growers have added to the surface of the common clay loam a thin layer of bush virgin soil. In watering,

many have used the dilute liquid from hen manure without injury to the plants, thereby forcing the growth.

On the occasion of a visit to the Walker Company's plantation in October, I found their beds already prepared for next spring. The method of establishment consisted in adding about four inches of pure black mould, consisting of thoroughly decomposed cattle manure and old pasture land soil, to the clay subsoil. This type of soil was of a very loose, friable texture. In watering the plants a solution of nitrate of soda, used at the rate of 800 pounds to the acre of seed bed, together with the liquid from tobacco stems, has been utilized to good advantage.

In conclusion, I believe that few growers realize that the nourishment in the small tobacco seed is extremely limited, and the young seedling is early called upon to rely on food from the soil of the seed bed. Consequently, they fail to realize the importance of having all conditions agreeable to the exacting needs of this delicate plant.

As regards the kind of cover tops, the great majority of growers use the cotton covering. Only one case was brought to my notice where oiled cotton had been adopted. In using the cotton I believe many fail to take full advantage of its purpose, in that it is not stretched tightly and closely over the frame; consequently, there is a draft created below the covering, which is very injurious, especially during the cold, windy days of early spring. If we are to gain full benefit of the cotton by the retention of the sun's heat of the day during the cool evening hours, we must have it tightly stretched. These minor details deserve attention.

A small number used the glass frames, by which method the plants may be grown more quickly; but in cases where the glass tops were in vogue, I found that the particular object in view had been the growing of early tomato and cabbage plants. However, not a few spoke in favour of the introduction of glass frames to ensure early plants. I found that the Erie Tobacco Company and the Walker Company were using the glass hot house to good advantage.

However, I believe that the great majority of growers do not pay enough attention to one of the fundamental questions, namely, the source of their seed supply. Too frequently the farmer relies on the old seed supply of his neighbour, or of a seed firm which is not too careful in its methods, or probably his own seed supply, which was gathered from plants regardless of their individuality. A full treatise of this subject will be dealt with later.

As regards the species of insects attacking the tobacco in this section of the province, we might state that they are few in number, but very destructive to the tobacco crop. The most injurious species found were the wire-worms, the cut-worms and the horn-worms.

The first mentioned were found in rare cases, where the grower had in the previous year ploughed down an old timothy sod which had been seeded for a number of years. In a few cases the wire-worm had destroyed completely the first setting, thus necessitating a great deal of extra expense in resetting. Such a difficulty may be overcome easily when a rotation of three or four years' duration is practised.

Tobacco is no less subject to the attacks of cut-worms than other crops. Set out in newly ploughed fields in the early summer, the plants are quickly attacked by those hungry worms, which have existed in the soil, for a few days at least, without any kind of food. In some sections they have done considerable damage; often the first and even the second plantings have been destroyed. From all reports the cut-worm seems to do more damage on Pelee Island than in any other district. The best way to prevent the damage is to have strong healthy plants, to have the ground in the best possible condition and endeavour to plant at a time when there will be showers and a subsequent rapid growth. There is no practical way of fighting the cut-worm on a large scale. Poisoning with bran and Paris green is recommended where they are very bad, but if preventive measures are observed such treatment will not be necessary.

Invariably the insect which causes the most damage is the tobacco-worm or horn-worm. There is but one generation of this insect in Essex county. The eggs, which

may be found on the under side of the leaf, are laid singly in the months of July and August. In a few days the young caterpillars are hatched and are soon ready to begin their ravages.

The actual damage resulting from horn-worms varied in the same locality during the different seasons. It was not an uncommon occurrence to find a crop badly damaged, despite every effort put forth to combat the insect, and the crop in an adjoining field practically exempt from the horn-worm. For some reason, the former field seemed to be a favourable ground during that season, whereas in the preceding year the grower might not have experienced any damage from the horn-worm.

The general method of combatting this insect is hand-picking at the time the suckering and topping is being done. A limited number have resorted to the use of arsenical poisons—Paris green. Two problems experienced in its effective use are: 1st. The difficulty in obtaining a solution of proper strength—not too concentrated to burn the leaf, nor too weak to be effective; 2nd. The undue reliance on its insecticidal effects, ultimating in an increased damage to the crop. A few growers have used the sweetened cobalt, squirting it into the jimson flower in order to kill the adult sphinx moths of the tobacco worm. If every farmer would set out a few jimson plants in early spring in his tobacco field and use their flowers as a means by which to apply the sweetened cobalt, scores of adults would be killed. Every adult moth exterminated means about 150 to 200 fewer eggs being laid. Another very useful agent in getting rid of horn-worms is the duck; and a very surprising fact is the limited number who even think of trying this useful animal. I found that on the 230 acre plantation of the Walker Company about 600 ducks did all the 'worming.'

A valuable preventive measure in combating this insect is fall ploughing, followed by discing. By ploughing about four to five inches deep we expose the chrysalids to the action of the weather, thereby destroying scores of worms that are hibernating. By subsequent cultivation many will be broken up by coming in contact with the revolving disc of the harrow. It seems to me that were no other object aimed at than the destruction of these pupæ, we would be justified in fall ploughing.

Dates and distances of planting and dates of harvesting.—As intimated elsewhere in my report, there is a wide difference in practice between the earliest and latest planting, even as much as six weeks lapses in some cases. It is very doubtful if even a month's delay can be afforded in producing a tobacco plant, for I believe the season is not too long for best results.

The distances of planting vary with nearly every grower. The majority plant the Burley-type tobacco at practical distances for cultivation, and with a view to obtaining maximum yields. However, scores of farmers set the cigar type tobacco at the same distances; consequently, the yield is greatly diminished and the quality is poor. There is a striking need for demonstration plots to correct this error.

Then, in regard to dates of harvesting, too many fail to take advantage of cutting at the proper stage of maturity. In nine cases out of ten the mistake lies in allowing the tobacco, especially cigar types, to become too ripe. To determine the exact dates and distances for planting, and the best dates for harvesting with a view to obtaining correct conditions for growing and curing, would be an exacting line for investigation.

Special work in seed selection.—A watchful study of any tobacco field in Ontario will reveal a great lack of uniformity as regards nearly all characters. This variability is noticeable particularly with regard to the difference in number, size, shape and manner of growth of leaves on individual plants, the time of ripening of the leaves on the same and on different plants. This lack of uniformity results in a decreased yield, and greatly augments the cost of grading the different types, the expense of which must be borne indirectly by the farmer. One of the leading tobacco growers of Essex made the statement recently that unless we had large, heavy

seed, obtained from a known reliable source, we cannot hope to have uniform, disease resistant plants; and the only reliable method to get such seed is individual seed selection among the growers.

A fertile cause of the above defects in the tobacco crop is the use of immature seed. Certainly, there is reason for believing that small immature seeds produce variable plants which are more subject to certain diseases, particularly the mosaic disease, than are plants grown from heavy, well matured seed. The increased yields in all classes of crops resulting from the use of large, plump, well matured seed has been demonstrated by experiment time and time again. Why should not the conclusions apply with equal force in the usage of tobacco seed?

Another productive source of variation rests in the common practice among some Ontario growers of obtaining seed from one of the states to the south of us, which differs in soil and climatic conditions. This system may be advantageous if the seed plants grown from this seed have been naturalized and rigid selection practised previous to using their seed for the general crop. Nevertheless, the method is rather hazardous for the average Ontario grower.

However, the important cause of this variability in the tobacco crop of Ontario is cross fertilization. According to the laws of plant breeding, seed originated from cross fertilization produces plants which do not resemble either parent. Where the seed plants have been grown without protection from cross fertilization, a number of flowers will be hybridized by such agencies as bumble bees, honey bees and other small insects. Thus, desirable plants may be crossed with undesirable plants in the same field or possibly from an adjoining field. Even the intermixing of pollen of desirable plants will break up the original type, resulting in undesirable variations, which are probably reversions to unimproved strains of tobacco.

Perhaps the most important field for investigation is that of breeding a strain of tobacco suited to the soil and climatic conditions of Essex county and furnishing the desired characters in the leaf. This line of investigation requires expert attention and cannot be conducted successfully on volunteer experiment stations. Nevertheless, with the hope of developing a particular type suited to the above conditions, a large number of plants were selected on each of the experimental plots in the different sections of the county.

The method of selecting seed plants adopted by the writer was to examine, several days before topping, nearly every plant in a small area of the field and to mark with a tag those plants which approached the ideal, so that they might be easily recognized when the final selections were made. The object of this preliminary choice rested in the certainty that such characters as early maturity and vigour of growth could be recognized more easily in the young plant than later. At a later date, just before the first flowers opened, the final selections were made, when all characters were considered.

The [illegible] of the leaves on each plant was measured with the ordinary tape line, one near the bottom, one near the middle and the other near the top of the plant. The uniformity, shape, colour, texture, size of veins and other minor characters were examined. The number of leaves on the plant was counted and the number and size of suckers were noted. In addition, observations were made regarding the uniformity of the leaves on different parts of the plant, the presence of rust, white spots, and especially the mosaic disease, together with the height of the plant and the distance between the leaves. In no case was a plant suffering from mosaic disease selected for seed purposes.

In all, the special characters of some forty plants comprising the different varieties were recorded in the record book; the purpose is to plant the seed in small sections of the seed bed, to follow the transmission of the characters of the parent plant to the progeny and to develop a special well adapted type of tobacco. The plants finally selected were given a number for identification, this number was written on a paper tag attached to the seed head.

The method for saving seed was as follows: To protect the flowers from cross pollination, a 12-lb. paper bag was placed over the flower head just when the first flowers were beginning to open. This kept out all agents whereby the pollen might be carried from flower to flower, and at the same time did not retard the development of the flowers and the seed. This method impressed growers as being unpractical; their claim was that the flowers would not have sufficient light and air and could not mature their seed. However, the practice was found by actual experience to be thoroughly practical and quite efficient.

The time when the first flowers begin to open is the most suitable stage for saving seed of the best plants under bag. At that time the flower stem is strong enough to support the weight of the bag. A few plants were 'bagged' earlier than the above stage, and the tender stem became badly bent and in some cases was broken off. When the desired development was reached, all small leaves and branches with the exception of the main stem were removed, and the bag tied loosely over the flower head. The rapid development of the flowers made it necessary to visit the plantations in a few days, to remove all unnecessary growth and replace the bag. This practice was repeated two or three times during the summer. When sufficient pods had developed seed, all immature capsules and late flowers were destroyed and the bag removed. Thus nothing but large fertilized capsules were left to ripen. The seed heads were harvested in the ordinary way and hung in a dry place.

In saving the seed plants all the leaves were allowed to remain on the plants till the seed was harvested. This practice was contrary to the general method adopted in Ontario, whereby all the leaves were removed from the seed plants early in summer. The argument advanced was that unless the plants were stripped the seed would not mature properly. However, in all cases the selected plants matured their seed perfectly before there was any danger of frost. This much disputed point would be worthy of consideration in experimental research.

CONCLUSION AND RECOMMENDATION.

1st. *Preparation of the land.*—A practical test of fall versus spring ploughing on at least two different types of soil—sandy loam and clay—with a view to establish the comparative merits of both of these practices would be required. The date and depths of ploughing are also disputed too generally, especially the date of spring tillage.

2nd. *Methods of manuring and fertilizing.*—Farm-yard manure and clover supply the nitrogen, but many soils termed 'Burley sick' are lacking seriously in other required elements. The exact form of fertilizer as suited to the conditions of the Ontario farm requires careful investigation. The quantities, methods and time of application of chemical fertilizers, together with a comparative test of specially prepared mixtures versus single chemical manures are fields demanding consideration. The quantities to apply and the best methods of application of farm-yard manure require close attention. A feasible aid in the solution of the whole problem is the adoption of a suitable rotation of crops. Many farmers are too haphazard regarding this important point.

3rd. *The method of growing plants.*—A large number of growers either through neglect or inacquaintance with the proper methods do not raise their own plants and consequently are obliged to purchase them wherever they can be procured. A series of experiments to determine the surest and best methods of raising young plants, especially the Burley type, is needed.

4th. *Variety tests.*—Certain varieties should be thoroughly tested in south-western Ontario for recommending to growers, since the tobacco plant is so susceptible to small local differences of soil and climate.

5th. *Dates of planting and harvesting, according to each variety.*—A study of different distances of setting is demanded. In southwestern Ontario there is a difference of over a month between the earliest and the latest planting. Undoubtedly this delay cannot be afforded. In addition, a large amount of the tobacco, especially the cigar type, is allowed to become too ripe before harvesting. What is needed in this direction is to determine the most favourable time for planting and also for harvesting, with a view to establishing the weight in pounds, and a demonstration relative to the quality of the tissue. The best method and most favourable time for curing are features requiring investigation.

6th. *Fighting insect pests.*—Short rotation of crops for the struggle against the wire-worm, and especially the cut-worm, should be adopted. Fall ploughing and subsequent cultivation, followed by the use of a suitable cover crop, together with the establishment of a small seed bed of jimson weed, with a view to early distribution of the plants among the growers would be an important field for investigation.

7th. *Selection of seed and propagation of types selected.*—Perhaps one of the most important lines of investigation is that of breeding a variety of tobacco suited to the soil and climatic conditions of Ontario, and furnished with the desired characteristics of leaf. This line of investigation demands expert attention. By selecting in the field plants that show the desired quality of leaf, or probably by cross breeding one variety with another, undoubtedly a type of tobacco especially adapted to Ontario conditions, and of high quality, can be originated in a reasonably short time. Through the aid of such demonstration work the grower will be in a position to practise individual seed selection, to adopt the method of saving seed of the best plants under bag and to propagate this seed.

OTTAWA, December 29, 1908.