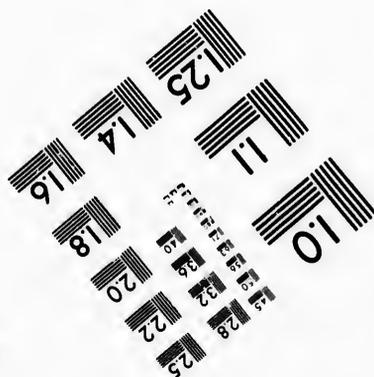
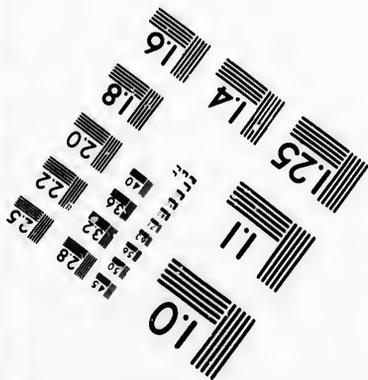
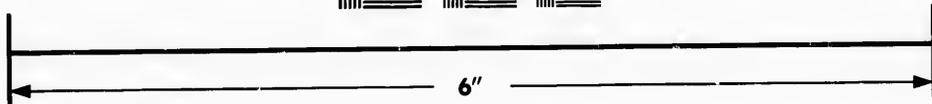
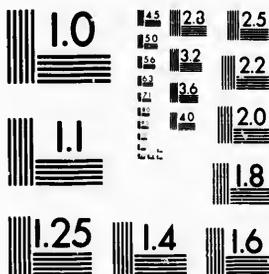


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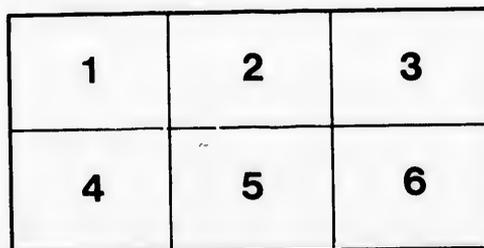
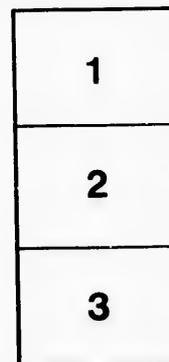
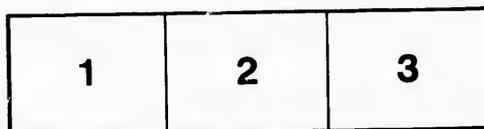
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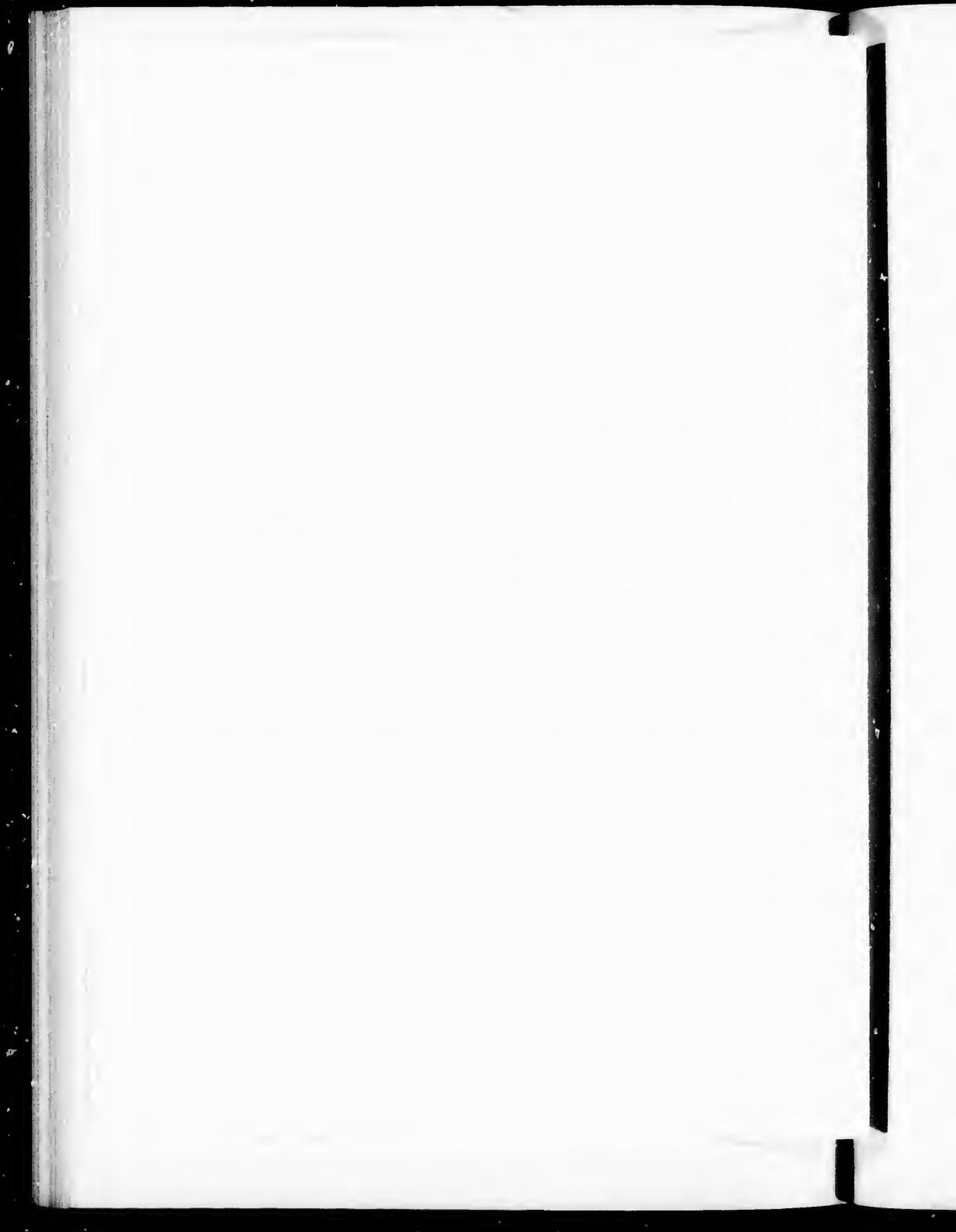
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DEPARTMENT OF AGRICULTURE
CENTRAL EXPERIMENTAL FARM
OTTAWA, CANADA

BULLETIN No. 30

TOBACCO CULTURE

APRIL, 1898

PUBLISHED BY DIRECTION OF THE HON. SYDNEY A. FISHER, MINISTER OF AGRICULTURE

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To the Honourable
The Minister of Agriculture.

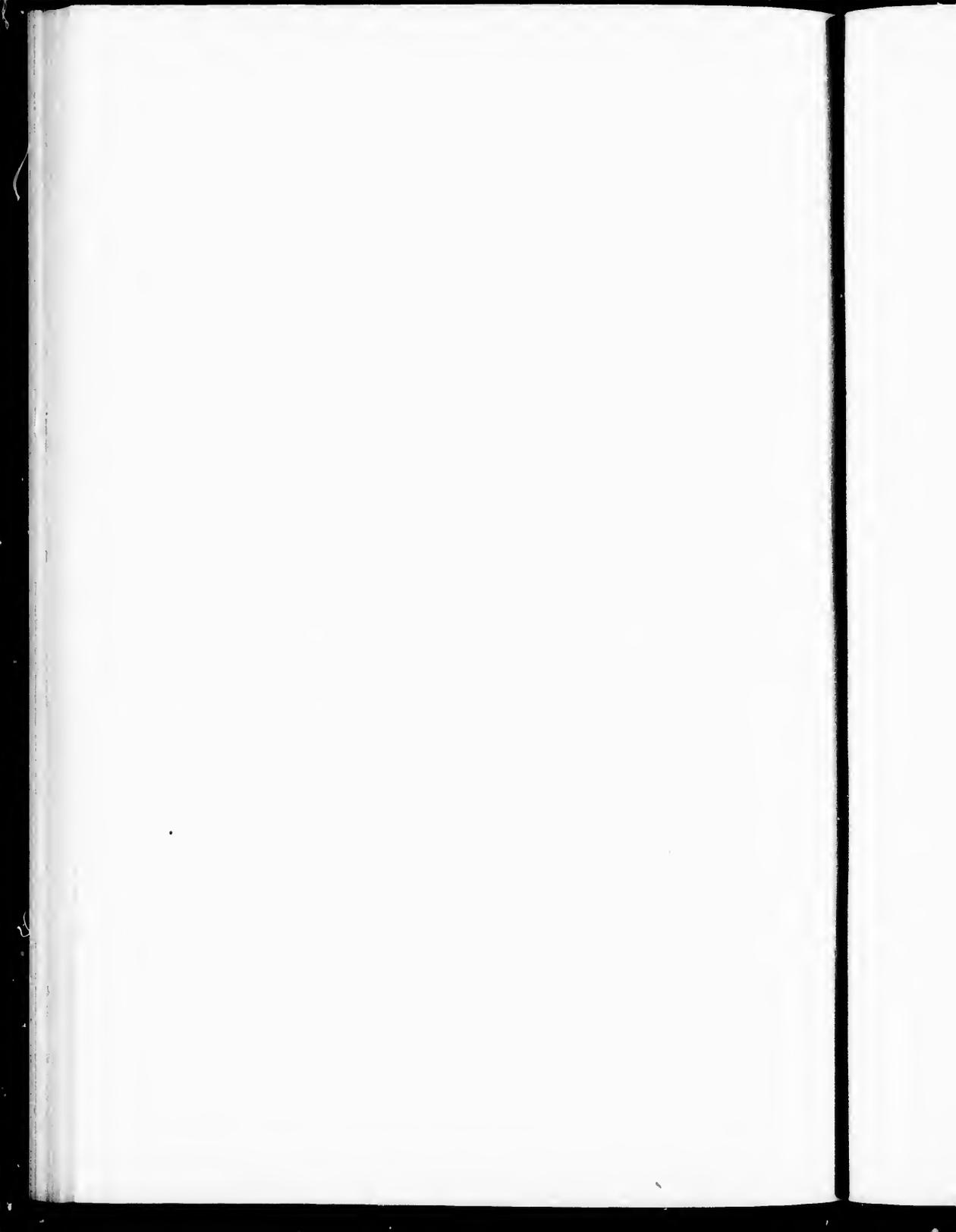
Sir,—I beg to submit for your approval Bulletin No. 30 of the Experimental Farm series prepared by myself.

The rapid increase during the past few years in the area of land devoted to the growing of tobacco in Canada has resulted in a great demand for information on this subject, and many inquiries have been made by correspondents at the Central Farm for particulars relating to this industry. Under your instructions and with the view of meeting this demand, the Bulletin now submitted has been prepared, giving the results of the experience of practical men who have been engaged in tobacco growing for many years.

I trust the facts presented will be found of value to those seeking information on this subject.

I have the honour to be
Your obedient servant,
WM. SAUNDERS,
Director Experimental Farms.

Ottawa, April 5th, 1898.



TOBACCO CULTURE.

BY

William Saunders, LL.D., F.R.S.C., F.L.S., &c.,

DIRECTOR EXPERIMENTAL FARMS.

The substance known as tobacco consists of the leaves of a narcotic plant, a native of South America, belonging to the order *Solanaceæ* and known to botanists as *Nicotiana Tabacum*. Its use is more general and widely spread than that of any other narcotic or stimulant; it is largely manufactured for smoking, is also prepared for chewing, and is used to a more limited extent as snuff. Specimens of this plant were first brought to Europe in 1558 by Francisco Fernandes, a physician who had been sent by Philip II. of Spain to investigate the products of Mexico. While tobacco first came to Europe through Spain, the habit of smoking was initiated and spread by English example, and Sir Walter Raleigh was one of the devotees to the use of this weed who helped to bring it into prominence. During the seventeenth century its use spread with great rapidity among all the nations notwithstanding the resolute opposition of statesmen and priests, and penal enactments of the most severe description.

There are other species of tobacco grown to a limited extent in other parts of the world, but the tobacco produced on the American continent and in Cuba, is all made from the species referred to. The tobacco plant is a coarse, rank-growing annual, which attains a height of from four to six feet, crowned with a panicle of pink flowers and having alternate leaves which are very large, often attaining a length of three feet or more and a proportionate width. Although this plant is a native of South America, it flourishes over a very wide area and adapts itself to many different climates. It is grown in most of the southern and middle States in the neighbouring republic, and its cultivation is rapidly increasing in Canada. The tobacco plant is very susceptible to variations in climate and soil; not only are the size and texture of the leaves so influenced, but the quality, strength and flavour are thus affected in a remarkable degree. During the long period this plant has been under cultivation, many different varieties have been produced, but the finer qualities of high flavour are grown chiefly in tropical countries with a comparatively dry climate. The seeds of the high-flavoured sorts, such as are grown in Cuba, when sown in the cooler climates of the eastern States or Canada produce plants of much less flavour and of a different texture. Nevertheless, many useful commercial varieties can be grown in the cooler climates of this country.

The census of Canada in 1891 shows a total product in all the provinces of 4,277,936 pounds, of which about 90 per cent was grown in the province of Quebec. Most of this crop was cultivated in small areas, rarely exceeding a few acres on any one farm. Recently the cultivation of tobacco has increased very rapidly in western Ontario, especially in the county of Essex. Walker Sons, of Walkerville, were among the pioneers in this industry, and have for some years past had the largest tobacco farm in the Dominion. In 1897 they had 130 acres under this crop. A considerable number of farmers in the neighbourhood of Leamington, Ont., have of late entered on the cultivation of this plant, growing from 5 to 20 acres each. It is estimated that about 1,000 acres of land were devoted to the growing of tobacco in that part of Essex in 1897, and that about 40 car loads of cured leaf were shipped from that district. It is believed that a much larger area will be planted during the coming season.

SOIL AND ITS PREPARATION.

The soil most suitable for a tobacco crop is a deep rich friable loam, dry and warm, which can be easily worked up into a fine and mellow condition. While a rich sandy soil is usually preferred, the crop often does equally well on a loamy clay, provided it is of such a porous and open character as will admit of its being brought into a fine condition of tilth; tobacco does not usually succeed well on a heavy clay. When grown on the heavier classes of soil the plants produce a thick leaf more suitable for the manufacture of chewing tobacco, and when grown on lighter sandy soils a thin or light leaf more suitable for the making of cigars. The tobacco plant grows very rapidly and is a gross feeder and needs an abundant supply of plant food, hence, in the preparation of the soil for this crop barn-yard manure is used very liberally. About thirty two horse loads, or more, per acre are applied during the winter or early in the spring and ploughed under. Subsequently the land is harrowed—usually with a disc harrow—from time to time until the soil is thoroughly and finely pulverized to a depth of about three inches. Wood ashes may also be freely used with much benefit to this crop.

SOWING THE SEED.

Tobacco seed is sometimes sown in hot-beds, sometimes in cold frames and occasionally in open ground. The first method has been practised at the Central Experimental Farm at Ottawa and is the plan usually followed in the province of Quebec, but in western Ontario, where the season is longer, although hot-beds are frequently used, the sowing of the seed in cold frames and open beds is not uncommon.

In preparing a hot-bed select a southern or south-eastern exposure sheltered on the north, and dig out a space 5 feet by 12, or any required length, to the depth of 18 inches. Place 3 or 4 inches of straw in the bottom and cover with fresh manure from the horse stable to the depth of 8 or 10 inches treading it down well.

Cover with good rich loamy soil to a depth of 4 or 5 inches, and pack it firm. Allow this to stand for a few days to heat up and then rake the bed smooth, when it will be ready to receive the seed. Where a hot-bed is used, the seed may be sown in rows from 4 to 6 inches apart, or broadcast, having previously been mixed with ashes or corn-meal so as to ensure more evenness in sowing. If sown broadcast the surface should afterwards be pressed firmly by placing a board about one foot wide and nearly the length of the bed, on the surface of the newly-sown ground, and walking over it, then move the board so as to press another foot, and so on, until the whole bed is evenly pressed. Then cover with frames either glazed or covered with cotton to protect from cold and frost and sprinkle the surface often enough with water or weak liquid manure to keep it moist. Germination takes place in about ten days, and in from twenty to thirty days after the plants appear, they should be large enough to transplant.

Where the seed is sown in cold frames or open beds, a sheltered position is desirable, with a southern exposure. Upon the plot selected, brush is usually burnt until the soil is made hot enough to kill the seeds of grass and weeds near the surface. When the soil has thus been baked to the depth of about half an inch and the bed has cooled, the surface is stirred with hoe or spade to the depth of 2 or 3 inches. Well-rotted manure is then spread over the ground and raked and worked until it has become thoroughly mixed, and the whole made mellow and fine. Mix carefully one tablespoonful of seed with about a quart of ashes and sow broadcast. This quantity is sufficient for a bed ten feet square, and should furnish plants enough for an acre of land. Brush or rake the seed in very lightly and use a light roller to make the surface compact, smooth and even, or press the surface smooth with a board in the manner recommended for the sowing in hot-beds. Use cotton covered frames or cover with light brush thick enough to afford some shade to the young plants and to protect them from drying winds, and water from time to time as needed to keep the ground moist. Keep the plants free from weeds and thin them out where necessary to avoid crowding. Sometimes the seed is sprouted before sowing. This may be done by mixing it with some fine mould and placing it near a stove or in some other warm place and keeping it moist for four or five days. Sow it as soon as it can be seen to have sprouted. By adopting this plan some time may be saved, but it is not generally recommended. The time of sowing will vary in different localities, ranging in Canada from the 1st to the 15th of April, and the young plants will be ready to put out from the 25th of May to the 10th of June. The seed bed should be large enough to permit of a sufficient number of plants of the same size being taken from it to complete the planting of the desired area at one operation, so that the subsequent growth may be even and regular. There should also be a surplus left sufficient to fill the vacancies caused by failure.

PLANTING.

The plants are usually put out in rows about 4 feet apart and from $2\frac{1}{2}$ to $3\frac{1}{2}$ feet apart in the rows. Where practicable, the rows

should run north and south so that each plant may get the largest amount of sunshine. The places for the plants in the rows are usually indicated by running over the ground with a corn marker. Some prefer to ridge the ground before planting, and claim that subsequent cultivation can be carried on with less injury to the plants where this method is practised. If the ground be flat or heavy this plan is preferred, but on lighter soils with good drainage the plants may be successfully grown either with or without ridging.

When the plants in the seed bed are 4 to 5 inches high and the largest leaves from 2 to 2½ inches wide they are ready for the field. Before any are lifted the bed should be thoroughly sprinkled with water so that the earth may adhere to the roots. A cloudy day after a shower of rain is preferred for transplanting, but if the plants are carefully removed with a ball of earth attached to the roots of each they may be set out with fair success, provided the ground is reasonably moist, without waiting for such specially favourable conditions. Small plants should not be used, it is better to wait a few days until they are of the proper size. When planting, a basket of plants is carried by a boy up between the rows when one is dropped at each side where indicated by the marker; the men follow and put them in the ground, using a planting peg or the finger for this purpose, pressing the earth carefully about the roots. Where the plantation is very large, a planting machine is sometimes used. Messrs. Walker Sons use the Bemis' planter by which with one pair of horses, driver and two men to tend the machine, about twenty thousand plants may be set per day.

Some experiments have been tried at the Central Experimental Farm as to the effects of twice transplanting. The plants were pricked out from the hot-bed to cold frames, where they were set in rows 8 inches apart, and about 3 inches apart in the rows, and after they had grown strong and stocky they were transplanted to the field. It was observed that when treated in this way the plants grew more rapidly and there were fewer failures in planting than when they were transplanted directly from the hot-bed to the field. The yield of leaf was also larger. When transplanting from the beds the thinning should be so carried out as to give the remaining plants more room and thus permit of a spreading stocky growth.

CULTIVATION.

After planting, the ground should be stirred with a one-horse cultivator about once in ten or twelve days, so as to keep the land thoroughly clean from weeds, and in a porous and mellow condition. Frequent cultivation will also induce more favourable conditions of moisture. This should be continued as long as the cultivator can be passed through the rows without injuring the plants. After this, as the roots of the plants will then almost fill the space between the rows, the ground should be kept clean by shallow hoeing.

PRIMING AND TOPPING.

By the word "priming" is meant the removal of the lower or primary leaves which come out too near the ground, and often touch the surface and become torn and sandy. It is an advantage to do this work early, so that the plants may not unnecessarily lose strength by their growth. The distance from the ground this priming should be done depends somewhat on the variety, but the bottom of the stalk is usually stripped to a height of from 4 to 6 inches from the ground.

Topping is the removal of the flower stalk with one or more of the upper and smaller leaves. This is done to throw the strength of the plant which would otherwise go to the production of seed, into the more perfect development of the leaves. The plant is ready to top when the "button," as the blossom is called, has grown long enough to be taken hold of without injuring the upper leaves of the plant. As the plants do not all blossom at the same time, it is usual to let those stalks which bloom first run a little beyond the usual time of topping, so that all may be topped at the one operation. The tops when broken off should be thrown between the rows and allowed to decay. The number of leaves left on the stem at the time of topping varies from ten to sixteen or eighteen, depending on the variety grown; if topped too high the upper leaves are apt to be too small to be of much value. As the leaves of the tobacco plant are arranged on the stem in eight perpendicular ranks, the ninth leaf stands directly over the first. This fact will assist the operator in determining the number of leaves on a stalk without counting them.

SUCKERING.

After topping, "suckers" soon begin to grow, shooting out from the stalk on the upper side of each leaf at the base, those at the top starting first. As soon as they are large enough to be pulled they should be promptly removed, otherwise much of the strength of the plant will be lost and the maturing of the crop delayed. Should they start a second or third time, they should be again removed.

SAVING OF SEED.

To obtain seed for sowing the following year, a few of the earliest, most thrifty and large-leaved stalks should be left without topping. These will bloom and seed freely, and when the crop is cut these stalks should be allowed to stand. As soon as the seed pods turn to a blackish colour the seed will be nearly matured; then cut off the heads and hang them up in a dry place to cure. Later in the season strip the seed pods from the stalks, rub them in the hand and clean the seed by sifting through a fine sieve. Tobacco seed is said to retain its germinating power for several years.

INSECT ENEMIES.

Cutworms are sometimes very active in destroying the newly set plants. Where these are troublesome they may be reduced in

number by placing at many different points in the field small bunches of poisoned weeds, grass or clover. These bunches are tied and rendered poisonous by dipping them in a mixture of Paris green and water in the proportion of two ounces of the poison to a pailful of water. The cutworms take shelter under the bundles of weeds and eat of the poisoned material and die. In hot weather these bundles should be put out after sundown and a shingle may be laid on each to keep it fresh. Cutworms are the caterpillars of dull-coloured active moths or "millers," which fly at night, mostly during the month of July. The caterpillars lie hidden during the day and come out to feed at dusk. They are smooth and naked, and are usually of some dull shade of greenish grey, or brown, with dusky markings. When these caterpillars are fully grown, which is usually in the latter part of June, they enter the ground and change to chrysalids, from which the moths emerge later in the season. These deposit their eggs on grass or other plants or weeds; the young larvæ hatch in about a fortnight and feed usually unobserved amid the abundant growth of summer, and when they reach a length of one-half to three-quarters of an inch they bury themselves in the ground in autumn, where they remain until the following spring. On emerging from their long period of torpor they become very active and feed greedily on almost any green plant which comes in their way.

Cutworms usually attack the plants about the base, and having eaten the stem through leave the greater part of the young plant to wilt and perish. Where a plant suddenly withers and dies, the author of the mischief can generally be found within a few inches of the plant, buried just below the surface of the ground. In such cases they should be searched for and destroyed. Where cutworms are plentiful it is necessary to look over the plants every day or two, and to promptly reset any which may have been killed.

After the cutworms have disappeared the caterpillar of a large sphinx moth, *Sphinx quinquemaculatus*, becomes a most troublesome foe to the tobacco grower. This insect spends the winter in the chrysalis state buried in the ground. Early in June the chrysalis wriggles its way up to the surface, when the moth escapes. It flies at dusk and in its flight much resembles a humming-bird, and soon begins to deposit eggs. These are laid singly on the under side of the leaf, where they hatch in the course of a few days when the young larva or "worm" begins to feed on the leaf, making small holes here and there in it. About the time when the leaves are as large as a man's hand these caterpillars appear. The plantation should then be gone over carefully, looking at every plant. A sharp eye will detect the small holes they make in the leaf very promptly, and on turning it up a small green caterpillar will be seen on the under side with a projecting horn on the hinder end of its body. These should be at once destroyed, which may be done by crushing them between the finger and thumb. As the eggs of these caterpillars continue to be laid during a considerable part of the season, constant watchfulness and frequent inspection is needed to prevent injury to the crop. Where the fields are neglected these caterpillars grow rapidly and

eat voraciously, and a single specimen will soon destroy the greater part of the leaves of the plant on which it has been placed and on several others near by. When full grown this larva is 3 inches long, or more, and about the thickness of the fore-finger, green, with paler stripes along the sides of the body. When disturbed it raises its head in a threatening manner and looks quite ferocious, but is incapable of inflicting any injury.

HARVESTING.

When the leaves approach maturity they gradually lose their deep green colour and assume a yellowish hue, which, in some varieties, is mottled with deeper markings of the same colour. The veins of the leaves become swollen and the substance of the leaf feels thick and gummy. At this stage the tip of the leaf becomes somewhat brittle and the midrib will usually break with a clean fracture if the tip is sharply doubled back; the leaves are then ready for harvesting. When the leaf is sufficiently matured, the sooner it is cut the better, as it is liable to injury from frost or other unfavourable weather. The usual method is to cut the plant down nearly to the ground and suspend the stalk with its leaves attached in a suitable drying-house where, when dried, the leaves are stripped and packed. The other method which is sometimes followed by those who cultivate tobacco on a small scale, or where labour is plentiful and cheap, is to strip the leaves from the plants in the field, gathering them as they mature and stringing them on twine or wires attached to laths or strips in such a manner as to allow each strip with its load of leaves to be handled separately. These are then placed in the drying-house to cure. By this process a better quality of leaf is obtained but at a larger cost for labour.

Some growers split the upright stem of the plant before cutting, with a sharp knife down the middle to within 4 or 5 inches of the base, then withdraw the knife and cut the stalk off close to the ground. This plan is said to be convenient for hanging, as the stalks can be placed astride the strips on which they are suspended and the leaves on stalks thus treated dry more rapidly; they are, however, more apt to slip off the sticks when moving them.

Another method is to pierce through the stalks with a V-shaped spear made of iron or steel, with a socket large enough to admit the end of a stick on which the tobacco is to be hung. The stick is set upright on the ground, fitted with the spear at the end, when the tobacco is lifted, one stalk at a time, and thrust on the spear, which passes through the stalk, about six inches from the base. The sticks are usually made $4\frac{1}{2}$ feet long, and afford space enough to suspend eight plants. When one stick is filled, the spear is taken off and attached to another, and this process is continued until the plants are all hung. Other growers prefer to suspend the plants by tying them to suitable sticks with twine.

Cutting should begin as soon as the dew is off the plants in the morning. Cut with a hatchet or suitable knife, grasp the stalk with the left hand and bend it well to the left, so as

to expose the lower part of the stalk, and sever with the knife near the surface of the ground, letting the stalk drop over without doubling the leaves under. Lay the plants on the ground to wilt for an hour or two, or until the leaves lose their brittleness and can be handled without breaking. Then load the tobacco on a wagon, keeping the butts out on both sides in loading, and draw to the drying-house. No more plants should be cut than can be taken in and hung up the same day. Never cut tobacco on a rainy day, as the leaves are then sure to get sandy, which will lessen their value, and do not allow the plants to lie long on the wagon or in a pile, as they soon sweat and heat, which quickly injures them.

DRYING.

A house 30 by 24 feet so arranged as to hang the tobacco in four tiers is said to be large enough to give drying accommodation to an acre of tobacco. Most growers prefer to build their drying-houses tight, so that they may be closed up in unfavourable weather. Such buildings are supplied at the base with a number of doors, affording openings large enough to admit air freely, and ventilators are provided above. Drying-houses are most commonly built from 16 to 20 feet wide, 16 feet high and 40 to 50 feet long, or longer if required. Occasionally buildings are met with which have their sides covered with boards so placed as to leave an inch or more of space between each to provide for free access of air. This, however, does not afford sufficient protection in case of unfavourable weather. Whatever method may be used for hanging the stalks, they are placed on the sticks about 5 inches apart, leaving eight or nine stalks on a stick, and the sticks are so arranged as to leave a space of 8 or 9 inches between them.

When the plants are sufficiently dried, which is known by the stems becoming of a brown colour and breaking when bent, the tobacco is ready for stripping. Damp weather is chosen for this operation, when the damp air is freely admitted and the leaves absorb moisture so that they can be handled without breaking. The operator pulls the leaves from the stalks one by one, until he gets what is technically called a "hand," which consists of from twelve to sixteen leaves, when these are fastened together by a good leaf folded to two or three inches in width, and wound around the base and secured by tucking the end under. During the stripping the leaves are separated into two grades according to size and soundness—all the torn and injured leaves, as well as the small and less matured specimens, forming the second grade.

BULKING.

After the tobacco is stripped it is packed down each day where it will be secure from drying winds or wet. The "hands" are placed with butts out and the leaves overlapping at the tips for about one-third of their length, laying one row of butts one way, then another on the opposite, keeping them straight and

even to prevent the air from drying the material. The "hands" are pressed together by kneeling on them while packing, and when the piles have reached a convenient height, say 3 to 4 feet, they are weighted with heavy planks on top so as to press the material down as compact as possible. The pile is then covered with some fabric or material such as blankets or sacking to prevent the drying of the exposed parts, and in this condition it is allowed to remain about a month during which time the curing or "sweating" process goes on by which when properly attended to the leaves acquire a uniform colour. The bulking is followed by an increase of temperature in the pile, which should be watched, and when a thermometer placed in the centre of the heap indicates a temperature of 100 to 110 Fahr., or when the heat is uncomfortable to the hand when introduced, the "bulk" should be opened and rearranged so that the outer and upper tiers may be brought to the centre. In this way the heat is lessened and the curing process proceeds evenly and uniformly throughout the pile. When the tobacco is thoroughly cured the "bulk" is opened and the material arranged more loosely and gradually cooled when the tobacco will be ready for market. When disposed of, it is usually packed in bales of about 100 lbs. each, firmly pressed together and enclosed in sacking.

VARIETIES.

Among the earliest and best yielding varieties tested at the Experimental Farm are: White Burley, Connecticut Seed Leaf, Pennsylvania Seed Leaf, Pryor Yellow, Climax, Yellow Mammoth, Oronoko Yellow, Safrano, Brazilian and Canadian. In 1896 the White Burley grown at the Experimental Farm was matured and partly harvested, when a sharp frost occurred in September, which greatly injured the later sorts. The White Burley is much grown in the Province of Quebec, and is also the variety most extensively cultivated in western Ontario. The Connecticut Seed Leaf stands probably next in public favour, and is well spoken of generally. Messrs. Walker Sons have found the White Burley and Connecticut Seed Leaf the most profitable varieties to grow, and think that a fair average of the yield of these varieties, taking one season with another, would be about 1,800 lbs. of cured tobacco per acre. Dr. G. LaRoque, late M.P. for Chambly County, Quebec, in his excellent little book on "Culture et Préparation du Tabac" gives the crop of the different varieties grown in Quebec as ranging from 900 to 1,500 lbs. per acre, while Mr. M. G. Bruner of Olinda, Ontario, estimates the crop about Leamington at from 1,000 to 1,100 lbs. per acre. Where the same varieties are grown the yield in every case will depend much on the quality of the land and the quantity of manure which has been used. In the small experimental plots at the Central Experimental Farm, the weight of crop has been estimated in different seasons from about 1,500 to 2,500 lbs. or more per acre.

TOBACCO AN EXHAUSTING CROP.

From the reports which have been published of chemical analyses of the leaves and stalks of the tobacco plant, it is evident that this crop draws heavily on the potash in the soil. It is also a considerable consumer of nitrogen and of lime. On such land as is frequently used for this crop, the ploughing under of clover to enrich the soil, large applications of barn-yard manure, liberal dressings of wood ashes or of salts of potash, and an occasional application of lime, will all be found beneficial. As the stalks take from the soil about the same proportion of the fertilizing constituents as the leaves, the exhausting effect of this crop on the land may be lessened by allowing the stalks to remain on the ground to decay and then ploughing them under.

In the preparation of this bulletin the writer has been aided by valued information from Walker Sons, of Walkerville, Ont., from John McNutt, Ruthven, Ont., and other practical tobacco growers both in Quebec and Ontario. Free use has also been made of the information gained by the comparative test of varieties carried on for several years by the Horticulturist at the Central Experimental Farm.

