DOMINION DEPARTMENT OF AGRICULTURE
OTTAWA, CANADA

TOBACCO DIVISION

RESEARCH WORK AT HARROW EXPERIMENTAL STATION IN 1911

BY

W. A. BARNET, B.S.A.

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JULY, 1912

26278—1

To the Honourable
The Minister of Agriculture.

Sir,—

I have the honour to submit herewith Bulletin No. A-14, of the series of the Tobacco Division, entitled 'Research work at Harrow Experimental Station in 1911.'

This bulletin contains the report of Mr. W. A. Barnet, in charge of the station, on the work carried out under his supervision during the year 1911-1912.

A perusal of this bulletin will inform the tobacco growers of Ontario regarding the work which has been done at the Harrow Experimental Station.

I beg to recommend that this bulletin be printed for distribution.

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

F. CHARLAN,
Chief of the Tobacco Division.

Ottawa, July, 1912.

26278—1½

RESEARCH WORK AT HARROW EXPERIMENTAL STATION IN 1911.

BY

W. A. Barnet, B.S.A.

The season of 1911 opened early and the majority of farmers who were making large plantations of tobacco began earlier than usual. Many growers increased their bed space, and the seedlings having made rapid growth, there were more plants than in the three former years, consequently a larger area was planted in the weed.

Since the area of the farm was increased to 38½ acres including about 2 acres rough waste land, the acreage in tobacco and corn was added to. Fifteen acres of tobacco, including nine of improved Burley and six of Warne, were experimented with. Fifteen acres of Improved Leaming Corn and 4½ of wheat were also grown. The balance of the farm included an orchard of about an acre and rough land used for buildings and pasture.

The orchard. The orchard which was badly in need of pruning, comprised 26 trees. Several of the trees were badly infested with the San José scale and three had almost succumbed. In the early spring all the above trees were pruned, fully 25 per cent of the wood growth being cut out. On April 29, I sprayed all the trees for the San José scale drenching them thoroughly with the commercial lime sulphur, diluting it to ½. The second spraying with the weaker solution of lime sulphur and lead arsenate, 2 pounds to 40 gallons of the solution, was made just after the blossoms fell, From these few trees, which were not in a thriving condition, a gross return of $80 was realized. This is a fair showing when we consider that but eighteen barrels were disposed of for domestic use, the balance being sold to the canning factory. The fruit, especially the Greening variety, was badly infested with the San José scale. Next spring we expect to plow up the orchard, scrape the trees and give them three thorough sprayings. By so doing the moisture will be conserved in the soil and the fruit of better quality.

Starting a peach orchard. On April 30 eighty peach trees were set out 20 feet by 20 feet. These trees were headed back to 18 inches, or two feet from the ground. They did well till a severe drought, extending over a period of six weeks in June and July, killed about twenty-five per cent of the trees. The ground was stirred around the trees but, being in clover, the moisture was not conserved in the soil and the above result was the consequence. Next spring this area will be ploughed, manured, and fertilized, and tobacco planted between the rows. By manuring and fertilizing and growing a cultivated crop in the space between the rows for two or more years, it is expected that the trees will make a fair growth.

Corn and Wheat Experiments.

Part of the area in corn was manured at the rate of 12 spreader loads per acre. About 3 acres of the fifteen was clover sod. The corn on this area yielded 140 bushel

baskets per acre, while that on similar soil stubble ground yielded barely 100 bushels per acre. (No manure applied in either case). This demonstrated that if maximum returns are aimed at on this sandy loam soil it is almost necessary to plough under a clover sod. A successful yield is assured when this practice is followed. At all events the best position in a rotation for corn is following a sod either pastured or from which a crop of hay has been taken.

The seed used was carefully selected and nothing but large uniform ears used. A large number of ears were tested for germinability before planting. The crop grown partly on the same soil as in 1910, yielded on the average 110 bushel baskets per acre. The 1911 crop was better than that grown in any previous year yielding well matured hard corn containing a smaller percentage of nubbins than usual. It pays to select the seed, have the soil in a high state of fertility, and follow this with thorough cultivation. A seed plot 20 hills square was conducted according to the rules of the Canadian Seed Growers' Association. A portion of the crop will be sold for seed purposes but the feed corn is being fed to hogs. Accurate account is being kept of the feed consumed and the difference between the selling and buying price of the pigs will represent the prices obtained for the wheat and corn. At all events, some manure will be made on the farm, thus doing away with a lot of heavy teaming.

The area in corn was seeded with clover, just before the last cultivation, at the rate of 7 pounds per acre, but the seed was so long in germinating that it made very little growth in the fall. In the light of two years experience with this method, the writer would say that this practice has not been a success.

The wheat, Dawsons Golden Chaff variety, yielded 30 bushels per acre. Despite the very dry season there was a fairly good catch of clover in this crop. Owing to some smut being found the wheat was treated before sowing with a formalin solution of 1 pound of the former to 40 gallons of water. The 8 acres of wheat together with 4 acres of oats to be sown in the spring, will be seeded with clover at the rate of 15 pounds per acre.

Plant Bed Experiments.

Scarcity of plants. As in former years there was a scarcity of seedlings in some sections just at setting time, and plants were sold as high as $1.75 per thousand. Owing to the extension of the tobacco crop into sections of Ontario where it had not previously been grown, and owing to the large increase in the acreage in Essex and Kent counties, seedlings were in strong demand despite the fact that the favorable spring pushed the plants along. Most of the growers provided larger areas for their plant beds and scores of beds were established on new soil that had never grown a plant before. In some sections there was quite a marked tendency to adopt the use of glass sash as a cover top and as a means of obtaining earlier plants. Some beds under glass were not as even as those grown under cotton but the plants being thinner on the ground, were stronger and more healthy.

Different Kinds of Beds Established on the Farm.

Seventeen hundred square feet of beds were established according to the following methods:

1. Hot bed with cotton covering.
2. Cold bed with cotton covering.
3. Hot bed with glass covering.
4. Cold bed with glass covering.
5. Hot bed with different proportions of special plant bed fertilizer, applied to the ordinary soil.
6. Cold bed with the same treatment given.
7. Cold bed with nitrate of soda applied to the ordinary soil.
8. Cold bed with glass covering with a thin layer of black soil applied to the ordinary soil.

Bright Tobacco Beds—Warne Variety.

The Warne beds under glass were sown April 10 with seed which had been swollen for three days. A plant bed fertilizer—Gold Dust—applied at $\frac{1}{10}$ pound per square foot was raked in well and a thin layer of black virgin soil (about $\frac{1}{2}$"-1") was spread over the ordinary soil. On one or two beds the seed was sown on the ordinary soil, but the plants came up very uneven and never were as good as where the virgin soil was applied. The dark coloured, friable soil, seemed to suit the requirements of this variety, the seed came up very evenly and the seedlings made rapid growth from the start, being ready for setting May 18.

The seed was sown at the rate of a heaping teaspoonful per 70 square feet. The beds were about the right density, the plants were strong and had a rich green cast. In the light of three years experience with different methods of establishing plant beds for this variety, it would appear that the one above outlined is preferable.

Owing to the intense heat developed under the glass sash particularly where the dark soil was used, it was found advantageous to give a very thin coat of lime on the under side of the glass. By so doing the temperature was sufficiently high and the soil was kept moist more easily.

The Management of Cold Beds under Glass.

On account of the volume of air in the cold bed with glass covering being limited great care is necessary not to allow the temperature to run too high. The other precaution not to have too much cold air on the tender plants to chill them is necessary. Give as much ventilation as possible in order to develop thrifty, stocky plants. A close muggy atmosphere produces leggy plants and invites disease.

Watering should be done in the forepart of the afternoon in order to let the surface of the soil and the plants have a chance to dry off before closing the frames. If very warm sunshiny weather prevails, it will be necessary to water the beds twice each day to keep the soil moist. During last spring's management of the beds, this practice was found almost compulsory if the beds were to be kept moist. The soil should be kept damp throughout but never wet.

Methods of Establishing Burley Beds.

Experiment 1. Cold bed, glass covering, fertilized at $\frac{1}{10}$ pound per square foot. Gold Dust fertilizer, $\frac{1}{2}$" black soil on ordinary soil sown dry seed April 15.

Experiment 2. Cold bed, cotton covering, fertilized 1/10 pound per square foot, Gold Dust fertilizer, also a light application of hen manure worked into the soil. Sowed swollen seed 1/8 oz. per 100 square feet. April 15, thick seeding.

Experiment 3. (a) Cold bed, cotton covering, fine stable manure worked into the soil fertilized at 1/10 pound per square foot nitrate of soda sown April 24, sprouted seed.

(b) Same as above; glass covering.

Experiment 4. Cold bed, glass covering, fertilized at 1/8 pound per square foot; at 1/12 pound per square foot; at 1/16 pound per square foot, raked in well on surface of ordinary soil. Sown April 24, sprouted seed.

Experiment 5. Hot bed, cotton covering, a light application of hen manure worked into the soil fertilized at 1/10 pound per square foot; Gold Dust fertilizer. Sown April 15, dry seed.

Experiment 6. Hot bed, glass covering, fertilized at 1/8 pound per square foot; at 1/12 pound per square foot; at 1/16 pound per square foot on surface of ordinary soil. Sown April 24, sprouted seed.

Notes on Beds.

The earliest and strongest plants were obtained from beds under experiment 1. As in the case of Warne variety beds, the dark soil with the glass covering gave excellent results. The hot beds under cotton gave plants about 2 weeks earlier than those grown in the cold bed. The latter beds did not do well, the soil not containing enough humus to bring the plants along quickly at the start. Where the sprouted seed was sown April 24 the plants made good progress, this being one of the best beds. The heavier application of fertilizer at 1/8 pound per square foot gave larger healthier plants than where the lighter application was given where the nitrate of soda was applied under glass the seedlings did well, but under the cotton the growth was uneven, due partially to the shaded position of the beds. The sprouted seed sown under cotton made more rapid progress than where dry seed was sown. It was an advantage to sow swollen seed under cotton as it germinated quicker allowing the plants to get a start before the weeds came along. It was found that nitrate of soda at say 1/4 pound to 2 to 3 gallons of water, using the solution every other day, gave the best results as in former years. A stronger solution might be used, if one takes the precaution to water again after applying the solution, in order to wash off the excess of soda and prevent any burning of the leaf. Where the farmer has plenty of hen manure it is just as effective and not so complicated in its use.

Conclusions from Work in Bed Establishments.

(1) Prepare the beds in the fall, plough and manure well.

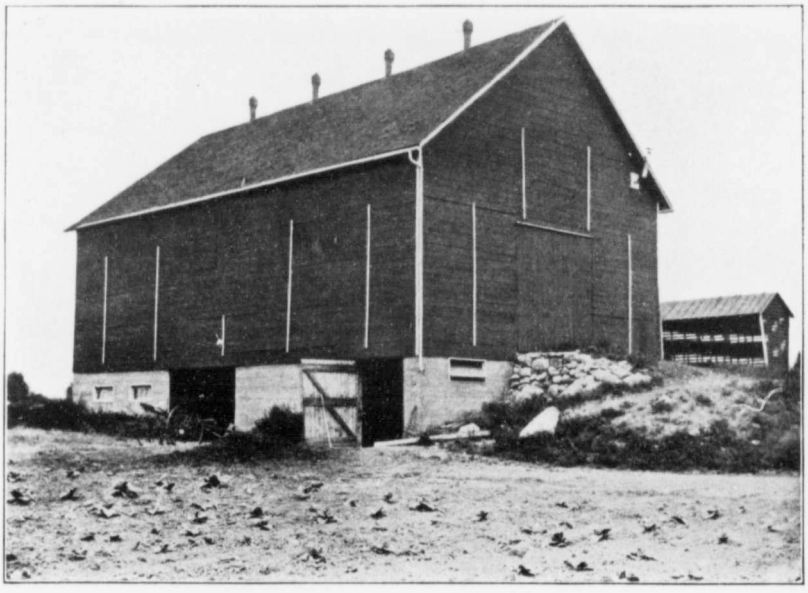
(2) To obtain early plants cover a portion of your bed area with glass sash or make a small hot bed.

(3) Obtain rich light loamy soil and apply about 1/2 inch of dark bush soil or rich black loam to the surface of the ordinary soil.

Plate I.

Harrow Experimental Station. Foreman's House.

Plate II.



Harrow Experimental Station. Tobacco barn, 36 x 60.

(4) If possible make up the beds 10 days before sowing to allow the weed seeds to germinate.

(5) Apply a plant bed fertilizer at 1/10 pound per square foot.

(6) Do not sow too thickly, a teaspoonful (1/4 oz.) to 70 square feet is a safe quantity to sow.

(7) To hasten the growth of the seedlings, use a solution of nitrate of soda 1/4 pound to 2 gallons of water, or a solution of hen manure one part of the stock solution to 10 parts of water.

(8) Give light frequent waterings in warm weather every day, especially if glass is being used as a covering.

(9) Obtain early plants if a well matured and paying crop is expected.

Experiments with Virginia Type Tobacco.

The soil. The importance of selection of the soil was again very conclusively shown this season. Where the soil was a light coloured friable sand or sandy loam the leaf made a more uniform growth and matured more evenly, giving a lighter coloured product of good texture. The best adapted parts of the field were easily picked out. A small portion of the 6 acre plot tended to have a close clayey nature and the tobacco on this area never ripened up properly, always retaining the green cast.

While the area in Essex and Kent counties adapted for this variety is quite limited, still there are a few types of light coloured sandy soil and gravelly spots well suited for the production of Warne. A light porous sandy soil of average fertility will give the best coloured leaf. Plant this tobacco on ground that has previously grown a crop or two of Burley.

The influence of the season. However, the distribution of the rainfall, a cold backward spring or a windy rough period in early fall have a very direct influence on your final product. To illustrate, this season the crop made a uniform growth from date of planting and appeared to ripen up fairly well, but had not yet "yellowed up" when the rainy period broke in and started up a secondary growth, just when harvesting was about to commence. Again in the latter part of September very heavy southwest winds prevailed, which bruised the leaves badly. This misfortune happened to the third and last curing, the first two curings escaped this accident. However, if one took the precaution to plant early and handle not more than 2 acres in one kiln in a season, this latter trouble would be alleviated. Up to the present we have handled 3 acres in each kiln in a season, but the last curing has nearly always been rough tobacco.

Date of setting. Planting was begun June 1, and the six acres were finished inside of 4 days.

The plants were ready about 10 days sooner, but owing to pressure of spring work, the ground was not prepared. However, had the crop been planted earlier, the general product would have been better. Speaking from 3 years, experience, the writer would emphasize the importance of early setting on a suitable soil, since the season

is none too long for this type of leaf. Further, two acres seemed to be sufficient to handle in one kiln during one season, if the best product was looked for.

Cultural methods. Practically the same methods were followed as in former years. The crop was "primed," that is the lower leaves were removed and the plants topped before the flowers opened. This year's topping was made at 10 to 14 leaves. The higher topping was tried with the idea of having a larger number of smaller leaves, which generally have a brighter colour when cured. One of the difficulties experienced with the Warne has been the fact that the leaf grows too large. The higher topping while giving a slightly larger yield, also gave a brighter coloured leaf.

A portion of the crop was harvested according to the Virginia method of splitting the stalk, inverting the plant, placing it over the lath, and hauling directly to the curing barn. However, the bulk of the crop was cut with the sickle, allowed to wilt, piled into ordinary sized piles, and then strung on the lath in the usual manner. This latter method was more expedient, and since the tobacco was left in the field two days before hauling, it wilted thoroughly and commenced to yellow up. It was thought that the crop was handled more expeditiously, very few leaves being broken off, and that the first changes in the curing process were hastened by handling it in the ordinary manner.

The Curing.

The first two kilns were filled September 2 and 4, and firing was begun immediately. The process lasted for 4½ days. The following notes were taken during the process.

CURING THE SMALL KILN.

Setting and fixing the colour:

80° to 90° F. from 9 a.m. Tuesday till 6 p.m.
105° to 115° F. from 6 p.m. Tuesday till 10 p.m. Wednesday.
115° to 120° F. from 10 p.m. Wednesday till 6 a.m. Thursday.

Drying the leaf:

120° to 140° Fah. 6 a.m. Thursday till 9 a.m.
140° to 155° Fah. 9 a.m. Thursday till 9 p.m.
NOTE.—Ventilators open all day Thursday.

Drying the stem:

155° to 170° Fah. 9 a.m. Thursday till 6 a.m. Friday.

Drying the stalk:

170° to 200° Fah. 6 a.m. Friday till 8 p.m.

NOTES ON LARGE KILN.

Yellowing the leaf:

80° to 95° F. 1 p.m. Tuesday till 6 a.m. Thursday.
95° to 110° F. 6 a.m. Thursday till 3 p.m. Thursday.

Note—At 3 p.m. the barn was given more air and the temperature increased as the humidity was too great—the leaf was sweating too freely.

110°to 125° F. 3 p.m. Thursday till 6 a.m. Friday.
125° to 140° F. 6 a.m. Friday till 10 p.m. Friday.

Drying the leaf:

140° to 155° F. 10 p.m. Friday till 6 a.m. Saturday.
155° to 175° F. 6 a.m. Saturday till 11 a.m. Saturday.
175° to 185° F. 11 a.m. Saturday till 12 a.m. Saturday.
185° to 210° F. 12 a.m. Saturday till 12 p.m. Saturday.

Note—The ventilators were closed at 11 p.m.

From the results of these two kilns, it was very evident that it was preferable to have the tobacco yellow well in the fore part of the curing stage if the best colour was expected. Close observation was made of leaves in different stages of the yellowing process, and it was noticed that unless the leaf was fully yellowed up, down to the mid-rib before the drying was commenced it did not cure a uniform colour. It was thought that when the stalk was not split, the curing process was lengthened a few hours, but the colour of the leaf was apparently as good as where the stalk was split.

Bulking. The bulking down was done as usual. Although the greater portion of the crop was left in the bulk for several weeks, there was no heating in the pile or molding of the stalk; the leaf kept in perfect condition.

Grading. The following classes and grades were made: First—'Wrappers'—subdivided into 3 grades—bright lemon, bright red, and dark red. Second—Lugs—It was considered that there was a larger percentage of the best grades, particularly the bright red, than in former years.

Fertilizer Tests with Bright Tobacco.

Four acres were planted 3½ feet x 2 feet June 1 and 2. Six hundred pounds per acre of the 3-8-3 combination of home mixed fertilizer was applied broadcast and harrowed in twice and rolled just before planting.

An acre, not including the above area, was divided into six plots, planted the same day at 3½ feet x 21 inches and fertilized as follows:

No. 1. Superphosphate, 350 lbs. per acre.
Nitrate of soda, 300 lbs. per acre.

No. 2. Superphosphate, 350 lbs. per acre.
Nitrate of soda, 300 lbs. per acre.
Sulphate of potash 200 lbs. per acre.

No. 3. Nitrate of soda, 300 lbs. per acre.
Sulphate of potash 200 lbs. per acre.

No. 4. Superphosphate, 350 lbs. per acre.
Sulphate of potash 200 lbs. per acre.

No. 5. 3-8-3 combination, 800 lbs. per acre.

No. 6. Check plot.

Plots 4, 5 and 6 contained the ripest tobacco and at the same time the yellowest leaf on the hill. This was conclusive evidence (that was borne out in previous years) that this soil did not require a fertilizer containing a large percentage of nitrogen to get the best coloured leaf in bright tobacco. To confirm this statement, it was noted that plots 2 and 3 were quite growthy and had a greenish cast for 10 days after the other plots were harvested. The tobacco on these latter mentioned plots was also larger in the leaf. A conclusory statement is that this soil required potash and phosphoric acid to get the best quality of leaf.

Soil treatment. The soil for the above tests was a uniform textured sandy loam. The previous cropping in 1909 was wheat, in 1910 Burley tobacco manured in winter and early spring. Rye was sown in the fall of 1910 before the tenure of the land was agreed upon. This crop was ploughed under in 1911 just as it was heading out. Owing to the summer of 1911 being very dry, the rye was not thoroughly decomposed. At all events the sowing of rye for a cover crop, with the idea of adding fertility to the soil, is a false one. It is preferable to plough under a leguminous crop like peas, red clover or hairy vetch. If rye is to be turned under, do not wait till it is heading out or has headed out, since the tough, wiry straw, of this cereal will not decompose readily and will form a dividing layer in the bottom of the furrow between the upper surface soil and subsoil, shutting off capillary action of the soil water. This experience on a sandy soil was met with last summer. Had the crop been pastured or ploughed under when say 8 inches high, the results might have been better.

The Returns from Bright Tobacco and its Comparative Value with Burley.

During the past three seasons, the average price secured for this tobacco has been 25 cents per pound or an average gross return of $250 per acre.

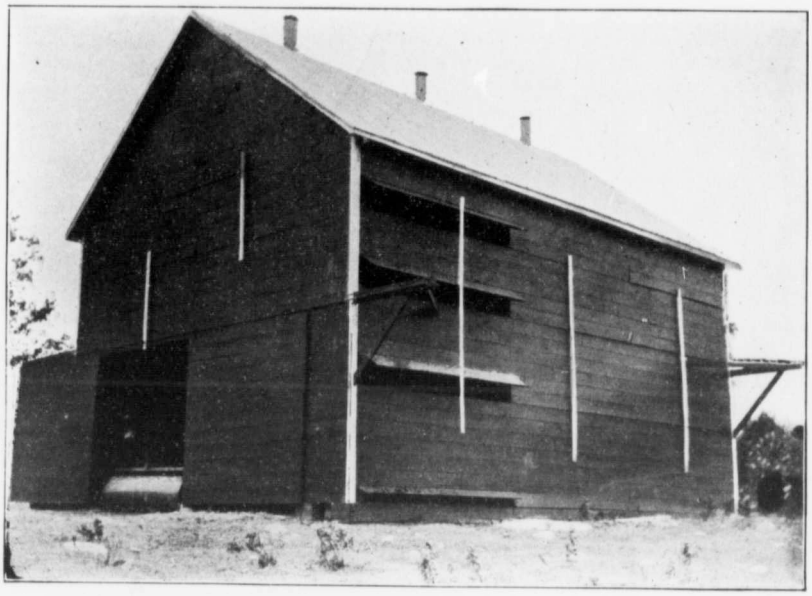
Some of the difficulties connected with its culture are: the variability of the colour; the extra labour incurred in the suckering and grading; the expenditure for wood for curing, and the skill required to handle the curing process. On the other hand some of the advantages of this type are: No manure expenditure necessary; a very small expense for commercial fertilizers; an impoverished light sand will produce this leaf whereas Burley would be a failure; and the very limited time required for curing, thus giving the use of the barns for other purposes if required.

Counterbalancing all the merits and demirits of the two crops the writer would say that the white Burley is preferable for the average farmer to grow. But the writer would suggest this, that for the tobacco grower who has a piece of light sandy soil, that will not produce Burley successfully, and who is anxious to learn the little differences in the handling of this crop, his land might be made to produce a paying return in bright tobacco.

Our Present Outlook.

While perfection in its culture has not been reached, still it is believed that by growing the Warne on the same soil for two to three seasons in succession, and by

Plate III.



Harrow Experimental Station. Combination barn (the upper part being used for curing, the lower for storing implements).

Plate IV.

Harrow Experimental Station. A good crop of corn.

closer planting, thereby getting a smaller leaf and not reducing the yield, that a larger percentage of light red wrapper grade, also the bright leaf will be produced. Next season we purpose handling four acres instead of six in the two kilns. The last curing has always been prolonged into the first week of October when the larger acreage was produced.

Burley Experiments.

Preliminary Note. Four acres of rye were ploughed under from May 10-12 just when the bulk of the crop had nicely headed out. In a few days time the land was rolled with a weighted roller, double disced, rolled and disced again. While it worked up nicely still the soil was very dry on the surface and the top 3"-4" lacked moisture even at planting time. Just previous to planting, the land was harrowed and rolled. The object of the different rollings was to firm the soil and get the moisture nearer the surface. In every case a mulch was restored after the rolling. The above area was manured at 12 loads per acre early in the spring. The balance of the Burley ground was manured and ploughed early in the spring

Damage from cutworms. Owing to the cutworms being very bad at the time of the first setting, over an acre of Burley had to be replanted, while the bulk of the crop was reset by hand three times. The use of calcium carbide in the barrel at planting time was recommended by an American paper and it was given a trial. The odor given off by this material was supposed to keep the cutworms away from the plants. However these insects did just as much damage where the carbide was used in the water barrel as where it was not used.

The only direct and effective method of combating the cutworms that the writer knows of, is the use of poisoned bran, applying a small handful here and there in the row. Last season I saw a 3 acre field where this method was adopted with marked success. The cutworms seemed to prefer the sweetened bran to the young plants. Where the bran was sprinkled in the row, a perfect stand was obtained and in a few rows where none was used the stand was very uneven. Fifty pounds moistened bran was mixed with ½ pound Paris green, and to each gallon of water used in moistening the bran, ½ pound of sugar was added.

Where the grower is forced to plant and the cutworms are known to be numerous, the above method is recommended for trial. While it would not apply in the case of a large acreage, still from observations in one field where the insects were very troublesome, the writer would advise its use on a small scale in preference to any other method.

Combating the Tobacco Worm. No spraying with lead arsenate for the horn-worm was resorted to this season as was the custom in former years. About July 10 thirty-six ducks were put in the patch. With the aid of hand worming at topping and suckering time, the ducks kept the plantation practically free of worms. No grain was fed simply plenty of water kept in the field. In the fall they were fattened and disposed of to advantage. In the light of two years' experience with ducks, and judging from observations in other large plantations where they were used, I would

strongly recommend their trial. They will save the grower much expense just at the time of year when labour is scarce and high priced.

Fertilizer Tests with Burley.

A series of experiments that were begun in 1909 were continued this season. I might say that these single fertilizers were tested not merely in an experimental way but they were used primarily as a paying investment. If by any practical means it is possible to increase the net returns per acre from the crop, we should aim to do it. Hence our extensive use of commercial fertilizers on the tobacco crop.

Method of applying fertilizers. The whole 9 acres were fertilized broadcast with a special spreader. The machine did fairly efficient work, the fertilizer was broadcasted by being forced out of the bottom of the drill box by a revolving drum. The quantity to apply was regulated by opening or closing the oval shaped holes in the bottom of the box.

While a quicker start might be obtained by hill fertilizing, still a better season's growth should be produced by broadcasting, since the plant food is spread out in the soil where the roots are. Then if the crop passes through a drought, the placing of concentrated, quick acting, soluble fertilizers too close to the roots of the young plant, might injure them.

EXPERIMENT No. 1.

One acre was divided into six plots of equal size. The soil being of like texture, was prepared in the ordinary manner, planted June 15 with the same type of plants. The distance of planting was 3½ feet by 32 inches.

The plots were treated as follows:

Plot No. 1—

300 lbs. superphosphate per acre.
300 lbs. sulphate of potash per acre.
400 lbs. nitrate of soda per acre.
10 tons manure per acre.

Plot No. 2—

300 lbs. sulphate of potash per acre.
200 lbs. superphosphate per acre.
10 tons manure per acre.

Plot No. 3—

300 lbs. sulphate of potash per acre.
400 lbs. nitrate of soda per acre.
10 tons manure per acre.

Plot No. 4—

200 lbs. superphosphate per acre.
400 lbs. nitrate of soda per acre.
10 tons manure per acre.

Plot No. 5—

200 lbs. superphosphate per acre.
300 lbs. sulphate of potash per acre.
400 lbs. nitrate of soda per acre.
10 tons manure per acre.

Plot No. 6—

12 tons manure per acre.

Field Notes.

Judging from field observations, it was evident that the soil required the three kinds of plant food, namely nitrogen, phosphoric acid, and potash, and that the use of chemical mixtures was beneficial. During the growing period, plot No. 6, the manure plot was behind the others, besides it yellowed up prematurely in the hot dry weather and was ready for harvesting a week before the others.

The value of the crop at $12.50 per hundred weight, the yields per acre, the cost of the fertilizer and manure, and the net returns per acre are given below. Barnyard manure was valued at $1 per ton, sulphate of potash at $56 per ton, superphosphate at $17.75 per ton, and nitrate of soda at $54 per ton.

TABLE I.

No. of Plot.	Quantity of Fertilizer in lbs.	Yield of crop per acre.	Value of crop per acre.	Cost of fertilizer per acre.	Cost of manure per acre.	Net returns per acre.
1	200 lbs. superphosphate 300 lbs. sulphate potash 400 lbs. nitrate of soda	1758	219·75	20·98	10·00	189·77
2	300 lbs. sulphate of potash 200 lbs. superphosphate	1314	154·25	10·18	10·00	134·07
3	300 lbs. sulphate of potash 400 lbs. nitrate of soda	1746	217·75	19·20	10·00	188·55
4	200 lbs. superphosphate 400 lbs. nitrate of soda	1650	206·25	12·58	10·00	133·67
5	200 lbs. superphosphate 300 lbs. sulphate of potash 400 lbs. nitrate of soda	1740	217·50	20·98	10·00	186·52
6	12 tons manure	1176	147·00	.....	12·00	135·00

NOTE—Plots 1 to 5 inclusive, received 10 tons manure per acre.

Remarks. As shown by the table, plot No. 1 gave the highest yield and a trifle the highest net return per acre, plot No. 3 being 22 below it. The yields from plots 1 and 5 were almost identical, indicating that the duplicate plot gave practically the same result. Plot 6 receiving the barnyard manure, gave only 1,176 lbs. per acre or 582 pounds less than plot 1 receiving the complete fertilizer. This increase, due to the complete fertilizer applied, is worth $72.75 valuing the tobacco at 12½ cents

per lb. Deducting the cost of the manure and the fertilizer from the above figures, we have a net gain per acre of $53.77. By investing $20.98 in fertilizer, $53.77 was netted in the increased yield. While this calculation is somewhat overdrawn, since a field of 10 acres would not likely show this difference in yield, nevertheless for this particular soil a conservative estimate would be; by investing $20 per acre for fertilizer, a net return of $40 per acre was realized.

A comparison of plots 2 and 1 indicated the beneficial effect of nitrate of soda. Plots 4 and 1 indicated the effect produced by sulphate of potash. These results confirmed those of former years and indicated that on this soil which analysis has shown is deficient in nitrogen and potash, an application of nitrate of soda or nitrate of soda and sulphate of potash, with a small allowance of superphosphate gave best results.

EXPERIMENT No. 2.

An acre was planted 3½ feet by 32 inches on June 5. The fertilizer was applied broadcast as a complement to 10 tons barnyard manure at the following rate:

625 lbs. nitrate of soda per acre.
325 lbs. sulphate of potash per acre.
150 lbs. superphosphate per acre.

This plot started well but after the severe ravages of the cutworms, the stand was not even. The first planting with the machine was practically all taken. This plot was lacking in uniformity and yielded only 1,200 lbs. per acre. Then again the rye that was ploughed under in this particular part of the field, was headed out at time of ploughing consequently the soil never seemed to become sufficiently moist and the benefits from the fertilizer were not forthcoming. Had it been a moist season this plot would undoubtedly have shown up better.

EXPERIMENT No. 3.

One acre was divided into two plots ½ acre each. The plots were planted the same date, at the same distance, and the methods of handling were identically the same.

The fertilizers were applied as follows:

No. 1. 600 lbs. nitrate of soda per acre.
300 lbs. sulphate of potash per acre.
100 lbs. superphosphate per acre.
10 tons manure per acre.

No. 2. 1,000 lbs. guano per acre.
10 tons manure per acre.

Plot No. 1 yielded 1,600 lbs. per acre. No. 2 yielded 1,470 lbs. per acre. The difference in favour No. 1 was $9.50 per acre after paying for fertilizers.

EXPERIMENT No. 4.

One acre of same type of soil was fertilized as follows:

500 lbs. per acre nitrate of soda.

300 lbs. per acre sulphate of potash.

10 tons manure per acre.

Yield per acre 1,600 lbs.

It will be noted that this yield was a little lower than that obtained by applying the same fertilizers to a small plot. However this return is a fair average of the results obtained from using such a combination. By consulting former experiments, we find that the yield from applying manure alone was 1,176 lbs. per acre, or 434 lbs. per acre gain from using the fertilizer above mentioned. This increase was worth $54.25. Deducting from this figure the cost of the fertilizer $21.90, we have a net gain of $32.35 per acre due directly to the fertilizer. In short by investing $21.90 in the spring we have realized $32.35 net gain at marketing time. I believe these returns to be quite within the reach of the ordinary tobacco grower who has a soil a little 'run down.'

Some growers claim larger returns from using fertilizers, but this is the candid record of results. I may add that wonderful records are sometimes misleading but a good average achievement is open to all. While this average of $33 per acre net from fertilizer is below the net average return of $40 per acre for 1911, still, considering the adversity of the exceedingly dry season and the reduced price per lb. this year, it is a fair showing.

I might add that the above combination is recommended for trial by the average grower. If the soil is thought to be lacking in that particular element, phosphoric acid, which hastens maturity, about 200 lbs. per acre superphosphate should be added to the above formula. For most soils the complete home mixed fertilizers that has been prepared according to the needs of the crop and the elements lacking in the soil, gives the best results.

EXPERIMENT No. 5.

One acre of clover sod spring-ploughed was fertilized at 1,150 lbs. per acre with a special tobacco mixture obtained from an American chemical company. This plot was planted June 28 the last planting. The yield was 1,775 lbs. per acre. While this plot gave the largest return per acre of any of the plots, still the leaf had a greenish cast and there was a certain amount of swelled stems found that were not prevalent in any of the other plots. It would point to the fact that such late planting was not advisable. This plot did not receive any manure but the effects of the fertilizer and especially the clover sod, were noticeable.

EXPERIMENT No. 6.

One acre of ground that had grown tobacco the previous season, was manured at 16 spreader loads per acre, ploughed April 24 and 1,100 lbs. per acre. Guano

applied a few days before planting. The yield was 1,480 lbs. per acre. Thus by using this chemical mixture, a net gain of $18 per acre was realized over and above the manure plot after paying for the material.

EXPERIMENT No. 7.

One acre was divided into 2 plots, each was planted the same day and handled alike. The fertilizer was broadcasted and harrowed in before planting.

The plots were treated as follows:—

No. 1. Fertilized with 550 lbs. per acre sulphate of potash, 10 tons manure per acre.

No. 2. Fertilized with 275 lbs. per acre sulphate of potash, 10 tons manure per acre.

No. 1 yielded 1,425 lbs. per acre. No. 2 1,300 lbs. per acre.

As indicated the experiment was planned with the intention of finding out the effect of the different quantities of potash on the yield. The results coincided with those of former years, the larger application giving the higher yield, but the increase was not sufficient to warrant the heavier dressing. Nevertheless it is not advisable for the average farmer to apply a large quantity of a single fertilizer like sulphate of potash, singly, unless he knows the nature of his soil—what particular elements it lacks. However, generally speaking, a sandy soil, such as the one we are dealing with, is naturally poor in all elements and more especially potash.

The balance of the Burley ground, 2 acres in area, was fertilized with a complete home mixed fertilizer. However, owing to the particular time of planting, June 27, and the very severe drought which followed, the plants did not start up well and the yield was correspondingly small being 1,200 lbs. per acre. It was thought that on about one quarter of an acre of the above area, the fertilizer literally 'burnt up' the young plant before it got started. This was the first experience of this kind and the lesson taught from the experiment was to practice earlier planting, finishing by June 15. By so doing the plants will get the benefit of a generally moist June, start quicker and thus overcome in a degree at least the possible evil effects of fertilizer in a dry period directly after planting.

If the reader has been able to follow clearly these experiments he will have learned:

First. That Burley tobacco required a large supply of available plant food, nitrogen, potash and phosphoric acid. To get this supply, try supplementing barnyard manure with 400 pounds nitrate of soda, 300 lbs. sulphate of potash and 200 pounds superphosphate per acre.

Second. That rye is an inferior cover crop unless ploughed under when 8 to 10 inches high, since it draws heavily on the soil moisture and does not add any real fertility to the soil.

Third. That an ample supply of moisture was necessary, if the ordinary commercial fertilizers were to give maximum results.

Fourth. That earlier planting, finishing say June 15th to 20th was necessary for best results.

Fifth. That a clover sod, supplemented with a commercial fertilizer containing a large proportion of potash and phosphate, gave excellent results.

Sixth. That, according to results obtained from applying sulphate of potash and nitrate of soda, this particular soil, a grey sandy loam, was lacking in plant food particularly potash and nitrogen.

Seventh. That the returns from money invested judicially in fertilizers will realize for the grower a higher rate of interest than if placed in the bank. In one case $20.98 invested in a complete home mixed fertilizer gave a net return of $53.77 in 8 months' time.

Seed Selection.

A large number of typical Burley plants were selected for seed, which was later distributed to the growers free. A 12 pound paper sack was placed over each, just before the flowers opened. The plants were handled according to methods outlined in previous reports.

The average grower should reserve say 10 to 12 choice plants for seed production. Out of this number he can probably select two or three ideal plants.

Curing Barns and Curing.

Judging from personal observation, and veritable statements from growers on this point, the writer considers that a word on the subject is in order. It is an unpardonable mistake for a grower to plant a large acrage in tobacco unless he is certain that ample curing space can be provided. The season of 1911 saw many acres of tobacco actually ruined, or the price of the leaf cut in two through allowing the crop to hang on the scaffold until too late in the fall, through overcrowding in the barn, or curing in poorly constructed sheds. It is folly to grow a crop and then lose probably 30 per cent to 50 per cent of its actual value after harvesting. By all means, provide sufficient curing space.

The prime requisite in an ordinary curing barn is that it shall be thoroughly ventilated. The side ventilation method is most popular, the air is permitted to pass in at rows of horizontal ventilators on one side of the barn, directly through and out at corresponding rows of ventilators on the opposite side. To accomplish the desired ventilation, four rows of horizontal ventilators should be arranged to run the full length of the barn, so that a current of air may pass between the butts and tips of the tobacco in each set of tiers.

Ventilators should be about 16 inches wide and 12 feet long. By bolting or fastening by hinge, a 2½ inch square pole to the four ventilators, they are easily opened and closed. For top ventilation the upright galvanized pipe with a hood attached will give just as good satisfaction as the more expensive rotary type of top ventilator.

Under normal conditions the barn should be kept open all day and closed at night during damp muggy weather. During dry weather, the barn should be kept

open during day and night, unless a very high wind prevails which would bruise and blacken the leaf.

In 1911, the Dominion Government Experimental Station at Harrow, built a combination implement and tobacco shed 28 feet by 36 feet 18 foot posts, with 2 large roller doors on each end, corrugated steel roofing, galvanized top ventilators, and horizontal side and end ventilators, that is giving entire satisfaction. It has curing space for three acres of tobacco, not including the ground floor which is used for storing implements. For utilization of space and general efficiency in construction it will bear inspection.