DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

DOMINION EXPERIMENTAL FARMS

EXPERIMENTAL STATION

HARROW, ONTARIO

REPORT OF THE SUPERINTENDENT

H. F. MURWIN, B.S.A.

FOR THE YEARS 1928, 1929 and 1930

General view of the Burley tobacco fertilizer plots on the Dominion Experimental Station, Harrow, Ontario.

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DOMINION EXPERIMENTAL STATION, HARROW, ONTARIO

REPORT OF THE SUPERINTENDENT, H. F. MURWIN, B.S.A., FOR THE YEARS 1928, 1929 AND 1930

INTRODUCTION

The Experimental Station at Harrow has undergone considerable development during the past seven years. Previous to 1924 activities of the Station were chiefly devoted to experimental work on tobacco and field husbandry. Following this period the scope of experimental work was broadened to include studies along such lines as animal husbandry, poultry husbandry, cereals, horticulture, forage crops and fibre crops. The outstanding revisions in experimental work already underway and the new lines of work undertaken during the period covered by this report occured in tobacco, forage crops, and poultry. A complete reorganization of the fertilizer studies as well as other work on tobacco was effected in 1929. Previous to 1930 the experimental work in forage crops was conducted under the direct supervision of the Division of Forage Plants at Ottawa, but in 1930 this work was entirely taken over by the Station. The poultry plant, which included the Ontario Western Egg-laying Contest, was established in 1930.

Several changes have also occurred in the technical staff at this Station during the past three years. H. A. Freeman resigned as superintendent early in 1928 and O. G. Williams, assistant, acted as superintendent until the appointment of H. F. Murwin as superintendent, effective May, 1929. R. J. Haslam, tobacco specialist in the Tobacco Division at Ottawa, was transferred to this Station in 1929. With the establishment of the poultry plant, W. T. Scott was also transferred from the Division of Poultry Husbandry at Ottawa to the Harrow Station as head poultryman in April, 1930. C. W. Owen was appointed assistant in forage crops at this Station in January, 1930. It has also been necessary to enlarge the clerical staff to accomplish the additional clerical work resulting from the increased activities at the Station and the constantly increasing correspondence.

Due credit should be given all members of the staff for their efforts in the various lines of experimental work underway, as well as for their splendid co-operation in the preparation of this report.

SEASONAL NOTES

Although the spring of 1928 opened somewhat later than usual, the prevailing weather throughout the months of April and May was quite normal with considerably less than average rainfall. In 1929 the spring was exceptionally backward with an unusual amount of rainfall. The frequent freezing and thawing during the winter months was severe on winter wheat and grasses, causing considerable winter-killing throughout the district. The 1928 season was favourable for crops in general—tobacco in particular did well—except on low, undrained fields which suffered from too much water. The backward, wet spring of 1929 was followed by a severe drought during August, which extended over the entire section of Western Ontario. The yields of tobacco, oats, and the second and third cuttings of alfalfa hay were rather low, especially on the lighter soils. The corn yields in general have increased throughout the district, due to less

corn borer damage. The fall of 1928 was very favourable for harvesting and curing tobacco; the latter part of August especially, in 1929, was too dry for best results in flue-curing tobacco in this district. The first killing frost in 1928 occurred on October 25. Early light frosts were experienced in Essex county about September 15, but a killing frost occurred in Norfolk county on September 19 and froze all tobacco that remained in the field.

Southwestern Ontario as a whole experienced one of the driest growing seasons on record in 1930, as contrasted with excessive rainfall in other parts of Ontario during the same period. The immediate vicinity of the Harrow Station obviously suffered as much from the extended drouth as any section in Western Ontario. The total rainfall recorded during the months of July and August in 1930 was only 0·92 of an inch, as compared with 4·23 inches which represents the previous eleven-year average at this Station. In addition, the precipitation during the spring months was very low, in fact, less than half normal. Therefore, it is evident that the soil moisture was very low at the outset of the drouth period. The total precipitation during the entire year 1930 was only thirteen inches, which is less than half the previous eleven-year average. A detailed report on the precipitation is given in table 2.

The weather was quite favourable from the middle of March on, resulting in a medium early spring in 1930. As a result of the low precipitation, the soil became workable at an early date and a large percentage of oats was sown during the latter part of March. Tobacco planting commenced about May 15 in both the old and new tobacco belts of Ontario. A light frost occurred during the latter part of May in Norfolk county, and necessitated resetting about one-quarter of the tobacco planted before that date. Yields of most crops were low as a result of the drouth. However, the crops produced on the lighter soils were affected much more than those produced on the heavier soils. A light frost also occurred in Norfolk county on August 15, but caused only slight damage in low areas. No killing frost occurred in the fall until the tobacco harvest was completed. Very good fall weather was experienced, but the soil was rather dry for fall ploughing.

METEOROLOGICAL DATA AT HARROW, ONT.

Meteorological data obtained during the three-year period are presented in the following tables. The mean maximum and mean minimum temperatures covering the period are given in table 1. The total precipitation and hours of sunshine for each month during this period are presented in table 2.

TABLE 1.—TEMPERATURE (°F.)

Month	Mean maximum			Mean minimum			Mean temperature			
	1928	1929	1930	1928	1929	1930	1928	1929	1930	Average 12 years
January	33·37	27·31	29·93	20·39	11·82	12·93	26·88	19·57	21·43	23·43
February	34·10	30·18	40·57	20·79	13·34	25·53	27·45	21·76	33·05	28·14
March	41·80	51·32	43·19	25·20	30·84	24·64	33·50	41·08	33·92	35·37
April	53·10	57·01	59·10	33·70	39·33	34·93	43·40	48·17	47·02	45·82
May	68·50	64·92	70·23	45·20	45·16	48·42	56·85	55·04	59·33	55·85
June	71·40	76·92	80·20	54·40	53·25	57·87	62·90	65·09	69·04	67·41
July	82·66	81·94	85·45	66·99	60·15	59·95	74·83	71·05	72·70	72·30
August	83·87	79·31	82·58	61·22	54·66	57·82	72·55	66·99	70·20	69·05
September	72·20	74·17	76·57	49·38	53·10	53·62	60·79	63·64	65·10	64·16
October	64·20	57·59	58·92	46·50	40·30	39·32	55·35	48·95	49·12	52·35
November	47·30	43·00	48·88	35·30	30·45	32·55	41·30	36·73	40·72	39·67
December	38·30	33·58	34·16	26·00	19·45	21·16	32·15	26·52	27·66	28·52

TABLE 2.—TOTAL PRECIPITATION AND SUNSHINE

Month	Total precipitation				Sunshine			
	1928	1929	1930	Average 11 years 1919-29	1928	1929	1930	Average 12 years
	in.	in.	in.	in.	hr.	hr.	hr.	hr.
January	1·77	3·19	2·47	1·86	71·8	88·9	71·5	89·4
February	1·13	2·05	1·10	1·86	109·4	116·8	88·3	92·3
March	1·14	1·76	1·00	2·68	117·6	146·6	138·4	128·6
April	0·79	3·36	1·00	2·96	178·8	169·0	146·7	167·9
May	1·91	1·70	0·98	2·08	289·9	231·0	249·3	249·2
June	2·56	1·74	1·39	2·69	211·0	241·0	269·8	267·9
July	1·89	2·20	0·59	1·84	299·7	307·0	355·6	301·5
August	1·65	0·62	0·33	2·39	296·7	244·7	270·7	256·0
September	0·42	2·04	2·07	2·57	216·1	176·0	196·8	181·9
October	1·92	1·41	1·23	1·92	165·4	137·3	126·8	154·7
November	2·16	2·64	0·45	1·91	71·8	95·4	125·3	92·6
December	0·58	3·44	0·43	1·99	77·7	27·2	51·0	59·6
Totals	17·92	26·15	13·04	26·75	2,105·9	1,980·9	2,090·2	2,041·6

TOTAL PRECIPITATION (INCHES)

1919	25·32	1923	28·38	1927	20·30
1920	28·22	1924	24·03	1928	17·92
1921	36·65	1925	26·23	1929	26·15
1922	22·92	1926	38·12	1930	13·04

Average for 11 years (1919-1929)..... 26·75.

TOBACCO

TRENDS IN TOBACCO PRODUCTION

The trends in flue-cured tobacco production have been very consistent during the past few years. The centre of production has been moving from the old belt in Essex county to the new belt in Norfolk and Oxford counties, and at present the principal producing area is unquestionably in the new belt. The acreage of flue-cured tobacco in the new belt was distinctly increased again during the 1930 season by at least 3,000 acres, while the acreage in Essex county was decreased by about 1,000 acres. The average yield per acre of flue-cured was about the same as in 1929, but the increase in production over the previous year was approximately 2,000,000 pounds, resulting in a total production of approximately 12,000,000 pounds of flue-cured tobacco.

There was also an increase of at least 4,000 acres of Burley during 1930 over the previous year, with an increase in yield per acre also, which resulted in an increase of 5,500,000 pounds of cured leaf. This increase in acreage was chiefly in Essex and Kent counties. The total production in Burley tobacco amounted to approximately 13,000,000 pounds in 1930.

Both the acreage and production of dark-fired tobacco were somewhat lower during the 1930 season. The total acreage of all types of tobacco in Ontario for 1930 was approximately 32,000 acres, which represents an increase of at least 5,000 acres over the previous season. The total production of cured leaf from all types showed a marked increase of about 7,000,000 pounds, with a total production of at least 28,000,000 pounds in 1930.

For a more detailed discussion on production and marketing reference should be made to the reports of the Tobacco Division, Department of Agriculture, Ottawa.

PLANTBEDS

In addition to producing sufficient plants of all varieties necessary to meet the requirements of the tobacco crop on the Station and co-operative experiments carried on elsewhere, plantbed experiments have been conducted in an effort to determine the most satisfactory methods of producing early, healthy, vigorous seedlings.

The projects on plantbeds include a study of different types and their construction, fall steaming versus spring steaming and general considerations regarding the best management and care of tobacco beds.

Among the various types of beds studied from 1928 to 1930, special consideration is given to those which are listed below.

(1) Cel-o-glass versus cotton and ordinary glass.
(2) Semi-hot beds versus cold beds.
(3) Fall steamed versus spring steamed beds.
(4) Straw versus cornstalks in bed construction.
(5) Unsteamed versus steam sterilized beds.
(6) Greenhouse and "A"-shaped glass plantbeds.

The general outline of tobacco plantbed construction has been discussed in previous reports. All records kept on the plants produced in the different beds were based on 100 square feet of bed space and also on the number of transplantable plants pulled from this area. The plantbeds were seeded from April 1 to 10 during the years covered by this report, and the transplanting period lasted from May 25 to June 20.

CEL-O-GLASS VERSUS COTTON AND ORDINARY GLASS

A semi-hot bed covered with cel-o-glass was compared with similarly constructed beds covered with cotton and ordinary glass respectively. The three beds were spring built and steamed for 30 minutes, maintaining a boiler pressure of approximately 100 pounds. The following table gives the number of days required to produce plants of transplantable size and also the number of transplantable size produced during the transplanting period.

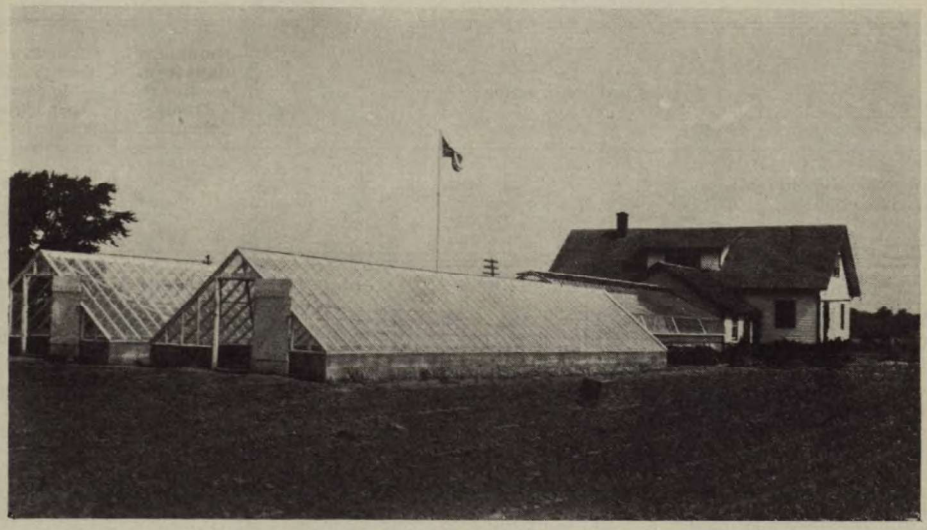
TABLE 3.—CEL-O-GLASS VS. COTTON AND ORDINARY GLASS

Type of covering	Number of days from seeding to transplanting	Number transplantable plants per 100 square feet
Ordinary glass	55	8,583
Cotton	67	4,242
Cel-o-glass	56	2,000

In this experiment the ordinary glass produced the greatest number of plants of transplantable size in the shortest period of time. Some plants under cel-o-glass were produced almost as early as under ordinary glass, but less than one-quarter the number of transplantable size were produced during the transplanting period. The cotton covered bed was twelve and eleven days later than the glass and cel-o-glass covered beds, respectively, but produced more than twice as many plants when compared with the cel-o-glass. Plants grown under the cel-o-glass were also lighter green in colour than those under cotton and ordinary glass, and were very tender, requiring a longer time to harden off.

FALL STEAMING VERSUS SPRING STEAMING

The general practice in Western Ontario is to steam sterilize tobacco plant-beds in the spring. In contrast to this practice the Station has made an effort to determine the feasibility of building beds and steaming them in the fall.



"A"-Shaped tobacco plant-beds. The greenhouse and office buildings are shown in the background.

The following table gives an average of three years' results, comparing the two practices as to the number of days required to produce sizable plants and the number of transplantable plants produced during the transplanting period.

TABLE 4.—FALL STEAMING VS. SPRING STEAMING

Steaming time	Number of days from seeding to trans-planting	Number transplant-able plants per 100 square feet
Fall	55	8,158
Spring	55	8,583

Provided they are well covered to prevent contamination from weed seed and outside unsterilized materials, fall steamed beds have proven just as efficient as beds steamed in the spring. The greatest advantages of fall steaming, however, naturally lie in the fact of reducing the rush of spring work and permitting earlier sowing of seed than might otherwise be possible.

SEMI-HOT BEDS VERSUS COLD BEDS

The semi-hot beds were built by digging a trench six feet wide—the regular length of a plant bed sash. This trench was filled with cornstalks and covered with 5 inches of ordinary garden soil. A two-inch top dressing of well rotted black muck soil was used to surface the bed. The cold bed was similarly constructed, except that no filler (such as cornstalks or straw) was used. These two beds were also compared with a cold bed constructed in a Lord and Burnham greenhouse. All the beds were steam sterilized.

A record was kept as to the number of days required to produce plants of transplantable size and the number of plants produced within the transplanting period. The following table compares the three beds and gives the average results from 1928 to 1930:—

TABLE 5.—SEMI-HOT BEDS VS. COLD BEDS

Type of bed construction	Number of days from seeding to trans-planting	Number transplant-able plants per 100 square feet
Greenhouse (cold bed)	50	9,837
Semi-hot bed	55	8,158
Cold bed	67	7,259

The type of plantbed construction is apparently less important when plants are grown in a greenhouse where the temperature is more easily controlled and less subject to extremes. The greatest number of transplantable plants was produced in the shortest period of time in the greenhouse with cold bed construction. The glass covered semi-hot bed proved to be much more efficient than the regular glass covered cold bed.

STRAW VERSUS CORNSTALKS IN PLANTBED CONSTRUCTION

The straw or cornstalks in a steam sterilized semi-hot bed acts more or less as an insulation from the cold ground and also provides good drainage. Its capacity, however, to warm up quickly and hold the heat from the sun is also important. At this Station straw has been compared with cornstalks and both of these materials can be equally well utilized in plantbed construction.

The following table compares the two materials as to the number of days required to produce sizable plants and the number of transplantable plants from 100 square feet:—

TABLE 6.—STRAW VS. CORNSTALKS

Material	Number of days from seeding to trans-planting	Number transplant-able plants per 100 square feet
Straw	52	8,176
Cornstalks	50	8,098

In some cases during the past few years shredded corn fodder was used in the place of cornstalks. The shredded corn fodder, cornstalks, and straw have all proven equally satisfactory for use in semi-hot beds. All three of these materials are equally recommended, but shredded corn fodder is very conveniently used in making up such beds.

STERILIZATION

Steam sterilization of tobacco plantbeds is found to give very satisfactory results, especially in the growth of plants; and the time saved in weeding beds often pays for the cost of steaming. The soil should be well worked up and be only moist for best results. If the soil is too wet the steam will not penetrate the soil sufficiently to kill all the weed seeds and disease-producing organisms in the soil, and poor results may follow. Properly steamed plantbeds give better

assurance of good, healthy plants; and steaming is becoming more of a general practice among growers each year.

We recommend the inverted pan method, holding the pressure in the steam boiler at 100 pounds for 30 minutes. Experimental results show that this is the best method of sterilization; and the Station has encountered practically no difficulty in producing early, healthy, vigourous seedlings when this procedure is followed.

SEED GERMINATION

Good germinating seed is of prime importance when endeavouring to produce a good stand of plants. Difficulties reported by growers in obtaining a satisfactory stand generally reflect back to seed not having a known germination test or seed testing less than 70 per cent. Good seed should germinate 80 per cent or higher. Seed of a known germination test prevents overseeding or underseeding in the plantbeds.

RATES OF SEEDING

The rate of seeding should depend on the germination percentage of the seed, method of seeding, system of watering and type of bed. Satisfactory results have been obtained at the Station by the following rates of seeding:—

(1) Ordinary glass covered and cotton beds—one ounce to 900 square feet.

(2) "A"-shaped beds and greenhouses—one ounce to 1,000 to 1,200 square feet.

The above recommendations are based on high germinating seed (80 per cent or higher) sown dry. If the seed is sprouted before sowing it is usually necessary to sow the seed somewhat thicker. We recommend sowing dry seed with sifted wood ashes because nothing is gained by sprouting the seed before sowing in this district. Dry seed will produce seedlings of a transplantable size at just as early a date as sprouted seed.

A "Skinner" system of watering washes out less seed in the plantbed than a garden hose or sprinkling can, with the result that a thicker stand of plants is usually obtained when this method of watering is practised.

TEMPERATURE AND HUMIDITY

Careful regulation of temperature and humidity in the tobacco bed is very important. The beds should be given light waterings quite often until the plants are well up. Sufficient water should be applied to keep the surface soil moist; however, difficulties may be encountered if the soil is kept too wet. The temperature should not exceed 90° F. without adequate ventilation. Damping-off is liable to occur if the soil is too moist with insufficient ventilation, especially if the plants are too thick. Heavy ventilation results in lowering both temperature and humidity and usually is quite effective in checking this disease. When the plants cover the ground fairly well, the beds should be watered more heavily and less often.

Proper ventilation also helps to prevent patches of molds in the beds. A solution of formaldehyde at the rate of 1-1000, or a dessert spoon to a $2\frac{1}{2}$-gallon sprinkling can of water, aided in the control of bed mold with no detrimental effects on the germination of seed or the subsequent growth of tobacco seedlings.

CONTROL OF TOBACCO INSECT PESTS

Definite control measures are known regarding such insects as the cutworm and hornworm, although the damage annually reported as caused by the various insect pests of tobacco is sufficient to warrant a discussion of control measures in this report.

CUTWORMS

The following poison bran mixture has proven entirely satisfactory for the control of cutworms at this Station over a period of years, and is highly recommended: Thoroughly mix 1 pound of Paris green with 50 pounds of dry bran. Also mix 1 gallon of cheap molasses with 2 gallons of water. The molasses and water should then be well mixed with the bran and Paris green, and sufficient water added to make the cutworm bait into a rather coarse granular condition which may be easily broadcast over the field. The above quantity is sufficient for one year, but we recommend using half this quantity in each of two applications. The best results have been obtained when this poison bait was broadcast over the field in the late afternoon or early evening, before transplanting.

Spraying or dusting with arsenate of lead is an effective method of controlling cutworms in the plantbed.

WIREWORMS

The poison bait used for cutworms will not control wireworms. Oftentimes cases occur in which an application of salt on the soil or the use of certain repellents mixed with the water in the setter barrel apparently have controlled wireworms, but such cases are mere coincidence and are not effective control measures. The only known effective control is the use of an early-planted catch crop such as drilled corn, followed by drilling calcium cyanide in the corn row after the wireworms are attracted. Cyanide gas is released which kills the wireworms; but this treatment is expensive and, therefore, impracticable as a general practice. As a single wireworm lives through at least three seasons, wireworm injury is almost certain in a field where trouble was experienced the previous year. Therefore, crop rotations are often an effective means of control. Fall ploughing also aids in the control of wireworms and cutworms. Wireworms prefer to work in cool soil which is not disturbed, and early cultivation usually encourages them to leave the surface soil.

HORNWORMS

Hornworms, which are sometimes called tobacco worms, are very effectively controlled by spraying with a solution consisting of 5 pounds of arsenate of lead to 50 gallons of water. Arsenate of lead may also be applied as a dust, but much better results are usually obtained by spraying than by dusting. The leaf surfaces are usually covered more uniformly by spraying. Spraying can also be done as soon as the hornworms appear, whereas dusting must wait until a good dew is on the tobacco, and damage may be caused in the meantime. The spray also sticks to the leaves better and consequently is not washed off by rains as readily as the dust. As a result of these findings, we recommend spraying with arsenate of lead as being superior to dusting for the control of hornworms.

FLEA BEETLES

Flea beetles caused considerable damage in a limited number of tobacco plantbeds throughout Southwestern Ontario during the past two years. These small, jumping beetles are very destructive to the young plants if they occur in great numbers. Flea beetle injury is characterized by small, round or irregular feeding punctures scattered over the leaf surface, which may be cut partly or entirely through the leaf. As the beetles are so small and jump so quickly when the leaves are examined, they often escape identification as the cause of the injury.

A satisfactory control for tobacco flea beetles in the plantbed is a spray consisting of arsenate of lead at the rate of 3 pounds to 50 gallons of water. The plants may also be dusted with powdered arsenate of lead, mixed with finely sifted wood ashes at the rate of 1 pound of arsenate of lead to 4 pounds of ashes. The number of times it will be necessary to spray or dust the beds will depend on several factors, such as the amount of watering necessary. The treatment should be repeated as soon as small holes are again noticed.

FERTILIZER EXPERIMENT (OLD SERIES, 1925-28)

In 1924 the old series of fertilizer experiments were transferred to new four-year rotation fields acquired by the Station. The crop rotation followed for flue-cured tobacco consisted of corn, tobacco, oats and hay, with eight tons of barnyard manure applied to the corn on fall ploughed land. The rotation for the Burley and dark tobacco fertilizer plots was hay, tobacco, corn and oats, with twelve tons of barnyard manure applied in the fall preceding the tobacco crop.

Each test was duplicated on one-twentieth acre plots. Two or more plots in the series received no commercial fertilizer and were included as check plots. At stripping time two or three grades were made and the yields calculated to an acre basis. The average results from 1925-28, inclusive, on flue, Burley and dark tobaccos are considered in the following pages.

FERTILIZER EXPERIMENTS WITH FLUE-CURED TOBACCO

BASAL FORMULA

The basal mixture consisted of 28 pounds of nitrogen from sulphate of ammonia, 96 pounds of phosphoric acid from superphosphate (16 per cent), and 96 pounds of potash from sulphate of potash. Table 7 gives the materials used in this formula.

TABLE 7.—BASAL FORMULA

Materials	Quantity per acre	Nutrients per acre		
		N	P_2O_5	K_2O
	lb.	lb.	lb.	lb.
Sulphate of ammonia	140	28	.....	.....
Superphosphate	600	.....	96	.....
Sulphate of potash	200	.....	.....	96
Total	940	28	96	96

From the above table it will be observed that the plant food materials are derived from single sources only, the nitrogen being all water-soluble.

QUANTITIES OF NITROGEN

Table 8 gives the average results from 1925-28 on varying quantities of nitrogen in the mixture from a single source. Potash and phosphoric acid were kept constant.

TABLE 8.—QUANTITIES OF NITROGEN FROM A SINGLE SOURCE

Source of nitrogen	Quantity of nitrogen	Average yield per acre	Average percentage bright leaf
	lb.	lb.	%
Sulphate of ammonia	20	1,148	63
Sulphate of ammonia	28	1,252	62
Sulphate of ammonia	36	1,286	60
Sulphate of ammonia	42	1,272	53

It can be observed from the above results that quantities of nitrogen greater than 20 pounds per acre begin to reflect on the quality by lowering the percentage of bright leaf. This reflection, however, is more pronounced if the quantity of nitrogen from sulphate of ammonia is increased beyond 36 pounds, when the percentage of bright leaf is distinctively lowered.

To further illustrate the importance of quantity of nitrogen on flue-cured tobacco soils at this Station, 20 and 28 pounds of nitrogen respectively were included in a mixture, being equally divided between sulphate of ammonia and dried blood and compared with sulphate of ammonia alone. Table 9 gives average results from 1925-28 inclusive.

TABLE 9.—QUANTITIES OF NITROGEN FROM TWO SOURCES

Sources of nitrogen	Quantity of nitrogen	Average yield per acre	Average percentage bright leaf
	lb.	lb.	%
Sulphate of ammonia	20	1,148	63
Sulphate of ammonia	10	1,159	71
Dried blood	10	.....	.....
Sulphate of ammonia	14	1,121	65
Dried blood	14	.....	.....
Sulphate of ammonia	28	1,252	62

The above results from four years of experimentation indicate that flue-cured tobacco, when grown in a four-year rotation, requires less than 28 pounds of nitrogen per acre; and from a quality standpoint a portion of this quantity should be derived from an organic source.

Another trial was made to determine the merits of different sources of organic nitrogen. In this experiment dried blood, tankage and cottonseed meal replaced one-half the sulphate of ammonia in the original mixture, therefore supplying 14 pounds of nitrogen from an organic source and 14 pounds from a mineral source. Table 10 gives the average results from 1925-28 inclusive.

TABLE 10.—SOURCES OF ORGANIC NITROGEN

Sources of nitrogen	Nitrogen supplied	Average yield per acre	Average percentage bright leaf
	lb.	lb.	%
Tankage	14	1,183	69
Sulphate of ammonia	14	.....	.....
Dried blood	14	1,121	65
Sulphate of ammonia	14	.....	.....
Cottonseed meal	14	1,095	59
Sulphate of ammonia	14	.....	.....
Sulphate of ammonia (Basal formula)	28	1,252	62

Over this period of four years tankage gave the best results, showing a higher average yield and a higher percentage of bright leaf than either dried blood or cottonseed meal. Dried blood came second and cottonseed meal last among the organic sources. The basal formula, containing no organic nitrogen, gave the highest yield but ranked lower in quality than tankage or dried blood, as indicated by the lower percentage of bright leaf.

QUANTITIES OF PHOSPHORIC ACID

The tobacco soils in Western Ontario on the average are generally accepted as being more or less deficient in phosphoric acid. For further information, however, varying quantities of this plant food material from superphosphate (16 per cent) were included in the basal mixture.

Table 11 gives results of tests conducted over a period of four years in which the quantity of phosphoric acid applied was varied.

General view of the flue-cured fertilizer plots. A display marker is located at the end of each plot.

TABLE 11.—QUANTITIES OF PHOSPHORIC ACID

Quantity of phosphoric acid	Average yield per acre	Average percentage bright leaf
lb.	lb.	%
48	1,226	65
64	1,240	68
80	1,270	64
96	1,252	62

From the above results it would seem that in a four-year rotation the critical quantity of phosphoric acid, for both yield and quality in flue-cured tobacco on soils at this Station, is somewhere between 64 and 80 pounds per

acre. The average yield was consistently improved up to this point. The highest average percentage of bright leaf was obtained with 64 pounds of phosphoric acid.

QUANTITIES OF POTASH

The relation of potash to yield and quality of flue-cured tobacco was clearly demonstrated by varying the quantity of sulphate of potash in the basal mixture. The phosphoric acid and nitrogen relations remained constant. The results of a four-year average are given in table 12.

TABLE 12.—QUANTITIES OF POTASH

Quantity of potash	Average yield per acre	Average percentage bright leaf
lb.	lb.	%
48	1,138	65
64	1,139	65
80	1,182	64
96	1,252	62

It may be observed from the above results that the quantity of potash had a direct stimulating effect on yield. When the quantity of potash was doubled from 48 pounds to 96 pounds per acre, the yield was increased by 114 pounds with only 3 per cent decrease in percentage of bright leaf.

SOURCES OF POTASH

To further determine the effect of potash when flue-cured tobacco is grown in rotation, different sources were substituted in the basal mixture. The total quantity of plant food materials remained constant. The average results of four years' work are compared in table 13.

TABLE 13.—SOURCES OF POTASH

Sources of potash	Average yield per acre	Average percentage bright leaf
	lb.	%
Sulphate of potash	1,252	62
Carbonate of potash	1,161	59
Sulphate of potash magnesia	1,139	63

In this experiment results from sulphate of potash are outstanding in respect to yield. Carbonate of potash came second, while sulphate of potash magnesia gave the lowest yield. No outstanding difference is observed in percentage of bright leaf.

FERTILIZER EXPERIMENTS WITH BURLEY TOBACCO

BASAL FORMULA

Although the plots receiving no commercial fertilizer served as a basis for computing results, a standard mixture, which consisted of plant food nutrients from single sources, was also used in this series of experiments. The following table outlines the sources and corresponding quantities used in the basal formula previous to 1929:—

TABLE 14.—BASAL FORMULA

Materials	Quantity per acre	Nutrients per acre		
		N	P_2O_5	K_2O
	lb.	lb.	lb.	lb.
Sulphate of ammonia	400	80	.....	.....
Superphosphate	400	.....	64	.....
Sulphate of potash	200	.....	.....	96
Total	1,000	80	64	96

It may be observed in the above fertilizer mixture that the nitrogen is supplied solely from sulphate of ammonia at a rate equal to 80 pounds of nitrogen per acre, the phosphoric acid from superphosphate (16 per cent) supplying 64 pounds of phosphoric acid per acre, and the potash from high-grade sulphate of potash at the rate of 96 pounds of potash per acre. This formula carries the equivalent quantity of plant food nutrients found in 1,600 pounds of 5-4-6 commercial fertilizer.

QUANTITIES OF NITROGEN

The quantity of nitrogen supplied to Burley tobacco soils by the average grower in Western Ontario is less than the equivalent of the nitrogen found in 1,000 pounds of a commercial 4-8-6, or 40 pounds of nitrogen per acre. This quantity is usually considered sufficient when used in addition to barnyard manure, sweet clover or alfalfa ploughed under. At this Station, however, it is interesting to note that even in addition to 12 tons of manure applied to the tobacco crop in the rotation, varying quantities of nitrogen have a direct effect on yield. Table 15 gives the average results of different quantities of water-soluble nitrogen from sulphate of ammonia for the period 1925-28.

TABLE 15.—QUANTITIES OF NITROGEN

Quantity of nitrogen	Average yield per acre	Average yield increase over check plots
lb.	lb.	lb.
48	1,325	260
64	1,474	409
80	1,523	458
96	1,542	477
0 (check)	1,065	.....

These results indicate the importance of supplying sufficient readily available nitrogen to Burley tobacco where yield alone is taken into consideration. When the quantity of nitrogen was doubled there was an increase in yield of 217 pounds per acre, and an increase of 477 pounds more than no commercial fertilizer.

SOURCES OF NITROGEN

In this experiment the nitrogen was reduced from 80 to 64 pounds per acre, one-half being supplied from dried blood, tankage, cottonseed meal and nitrate of soda, respectively, the other half being supplied from sulphate of ammonia. The other constituents in the mixture (phosphoric acid and potash) remained constant. The results of this test are compared in table 16.

TABLE 16.—SOURCES OF NITROGEN

Sources of nitrogen	Quantity of nitrogen	Average yield per acre	Average yield increase over check plots
	lb.	lb.	lb.
Dried blood	32*	1,489	424
Tankage	32*	1,432	367
Cottonseed meal	32*	1,513	448
Nitrate of soda	32*	1,541	476
Sulphate of ammonia	64	1,474	409
(Check)	0	1,065	.....

*Plus an additional 32 pounds of nitrogen from sulphate of ammonia.

Over a period of four years in a crop rotation system the above results show that half the nitrogen supplied from nitrate of soda gave the highest yield of Burley tobacco. The mixture in this case was all water-soluble. Cottonseed meal came second, supplying one-half the nitrogen in an organic form. Dried blood was third, also supplying half the nitrogen in organic form. Tankage, another organic source, gave the lowest yield, while the basal formula (64 pounds of all water-soluble nitrogen from sulphate of ammonia) yielded 67 pounds per acre less than sulphate of ammonia and nitrate of soda combined.

QUANTITIES OF PHOSPHORIC ACID

To determine the value of phosphoric acid in Burley tobacco soils under the four-year rotation system, different quantities of superphosphate (16 per cent) were included in the basal mixture. The nitrogen and potash relations remained constant. Table 17 gives the results of this experiment from 1925-28 inclusive.

TABLE 17.—QUANTITIES OF PHOSPHORIC ACID

Quantity of phosphoric acid	Average yield per acre	Average yield increase over check plots
lb.	lb.	lb.
32	1,520	455
48	1,512	447
64	1,523	458
80	1,569	504
0 (check)	1,065	.....

The results of this experiment show the importance of phosphoric acid in Burley tobacco soils on this Station. Eighty pounds of phosphoric acid per acre gave the highest average yield. The other quantities included in this test, namely, 32, 48, and 64 pounds, showed but slight variations on yield.

QUANTITIES OF POTASH

The importance of potash was also tested in the old series of fertilizer experiments. The results of different quantities of this plant food from sulphate of potash are compared in table 18.

TABLE 18.—QUANTITIES OF POTASH

Quantity of potash	Average yield per acre	Average yield increase over check plots
lb.	lb.	lb.
48	1,502	437
64	1,523	458
80	1,584	519
96	1,523	458
0 (check)	1,065	.....

When 12 tons of barnyard manure is also applied in a four-year rotation, 80 pounds of potash in the form of sulphate of potash is apparently sufficient for Burley tobacco soils on this Station. Additional quantities did not increase the yield.

SOURCES OF POTASH

Different sources of potash were included in the Burley tests, similar to the flue-cured fertilizer experiments. The nitrogen in this series was reduced to 64 pounds per acre, the phosphoric acid remaining constant.

TABLE 19.—SOURCES OF POTASH

Source of potash	Average yield per acre	Average yield increase over check plots
	lb.	lb.
Sulphate of potash magnesia	1,584	519
Sulphate of potash	1,539	474
Carbonate of potash	1,490	425
(Check)	1,065	.....

In this experiment sulphate of potash magnesia gave the highest average yield per acre. Sulphate of potash was intermediate, and carbonate lowest.

NO COMMERCIAL FERTILIZER VERSUS COMPLETE FERTILIZER

To demonstrate the value of commercial fertilizer for Burley tobacco, the average of the check or no treatment plots is compared with plots receiving a complete fertilizer consisting of 80 pounds of nitrogen from sulphate of ammonia, 64 pounds of phosphoric acid from superphosphates and 80 pounds of potash from sulphate of potash.

TABLE 20.—COMPLETE FERTILIZER VS. NO FERTILIZER

Treatment	Average yield per acre	Average yield increase	Value of increase at 20 cents per pound, less fertilizer cost
	lb.	lb.	$
Complete fertilizer	1,584	519	93 98
No fertilizer applied	1,065	.....	.....

These results clearly emphasize the value of commercial fertilizer on Burley tobacco soils.

The average cost per acre of this formula to the Station over a period of four years was $19.82; therefore rendering a return of $4.74 for each dollar spent for fertilizer.

FERTILIZER EXPERIMENTS WITH DARK TOBACCO

Series of experiments were conducted with quantities of materials only in the study of fertilizer requirements for dark tobacco. The general procedure was similar to that of the Burley experiments, except that the quantity of nitrogen in the dark basal mixture consisted of 64 pounds instead of 80 pounds per acre. The basal mixture for Burley is found in table 14.

QUANTITIES OF NITROGEN

In this experiment 48, 64 and 80 pounds of nitrogen from sulphate of ammonia were compared in the basal mixture. The quantities of phosphoric acid and potash remained constant.

TABLE 21.—QUANTITIES OF NITROGEN

Quantity of nitrogen	Average yield per acre	Average yield increase over check plots
lb.	lb.	lb.
48	1,265	312
64	1,325	372
80	1,316	363
0 (check)	953	.....

Comparing the above results with table 14, 96 pounds of nitrogen gave the highest yield per acre with Burley tobacco, but 64 pounds of nitrogen proved to be sufficient for dark tobacco.

QUANTITIES OF PHOSPHORIC ACID

The quantities of nitrogen and potash remained constant in this experiment, while the phosphoric acid varied in quantity from 48 to 80 pounds per acre.

TABLE 22.—QUANTITIES OF PHOSPHORIC ACID

Quantity of phosphoric acid	Average yield per acre	Average yield increase over check plots
lb.	lb.	lb.
48	1,253	300
64	1,325	372
80	1,254	301
0 (check)	953	.....

Under the same cultural methods as Burley, dark tobacco required 64 pounds of phosphoric acid per acre for maximum yield. However, the yield per acre was the main consideration in the old series of tests with dark tobacco.

QUANTITIES OF POTASH

In a similar manner the quantity of potash was varied from 48 to 96 pounds, the other constituents in the mixture being kept constant.

TABLE 23.—QUANTITIES OF POTASH

Quantity of potash	Average yield per acre	Average yield increase over check plots
lb.	lb.	lb.
48	1,241	288
72	1,311	358
96	1,325	372
0 (check)	953	.....

In a four-year rotation dark tobacco apparently responds to heavy applications of potash, as indicated by the higher quantities giving greater yields. When the quantity of potash was doubled in the mixture the yield increased 84 pounds per acre. All quantities outyielded the no treatment or check plots.

COMPLETE FERTILIZER VERSUS NO FERTILIZER

To demonstrate the fact that commercial fertilizer can be used with profit for dark tobacco, the plots receiving no fertilizer were compared with plots receiving a complete fertilizer—the basal mixture. Table 24 gives the average results of four years' experimental work in this respect.

TABLE 24.—COMPLETE FERTILIZER VS. NO FERTILIZER

Treatment	Average yield per acre	Average yield increase	Value of increase at 24 cents per pound, less fertilizer cost
	lb.	lb.	$
Complete fertilizer	1,325	372	71 00
No fertilizer applied	953	.....	.....

The average cost per acre of the fertilizer in the basal formula was $18.28. Therefore, with a value increase of $71 per acre over no treatment the actual return for each dollar spent on this fertilizer was $3.33. The quantity of plant food in the basal formula is equivalent to that found in 800 pounds of a commercial 8-8-12 or 1,600 pounds of a 4-4-6.

FERTILIZER EXPERIMENTS (NEW SERIES)

During the winter of 1929 new series of tobacco fertilizer plots were planned for the Harrow Station. As a result, the fertilizer work previously conducted at this Station and designated as the "old series" was concluded in 1928. In general the new experiments are quite similar to the "old series," except that the technique of plotting and obtaining data on quality has been changed.

PLOT TECHNIQUE

Some 28 different fertilizer treatments with each type of tobacco were conducted on quadruplicate plots $\frac{1}{32}$ of an acre in size, $\frac{1}{40}$ of an acre being harvested for yield and quality data. A total of 378 plots was included in the new series. However, in 1930 a number of treatments were added, resulting in a total of 452 fertilizer plots.

A basal fertilizer formula was included for each type of tobacco and was used as a check or a basis for comparison. This "basal formula" was repeated every fifth plot in the field, which gave every experiment at least two check plots. This method furnished either an individual check or a multiple of checks for every treatment in the series.

We anticipate conducting these treatments continuously on the same plots for a period of five years or more. The fields chosen for this work are fairly uniform. The Burley and dark-fired tobacco fields are practically virgin to tobacco, while the flue-cured ground is the old fertilizer field which has produced two or more crops of tobacco.

QUALITY EVALUATION

Subsequent to stripping into a number of groups according to the arrangement of the leaves on the plant, further assorted grades were made with respect to colour and texture. A price range was assigned to each grade with respect to its quality, and the average value per pound was determined on this basis. This average computed price is called the "grade index." The "grade index," therefore, is based on the percentage of assorted grades and the relative commercial value of each grade. This method of evaluation has been adopted and will be used in each case to define the grade value of the various treatments in this text.

FERTILIZER EXPERIMENTS WITH FLUE-CURED TOBACCO

For the production of a satisfactory crop of flue-cured tobacco, both in Canada and the United States, it has been found from experimental work and practical experience that the crop requires from 24 to 30 pounds of nitrogen, 70 to 80 pounds of phosphoric acid, and 50 to 60 pounds of potash per acre. The above quantities of nutrients are very generally used in commercial mixtures which carry equivalent quantities in 600 pounds of a 4-12-8, or 1,000 pounds of a 3-8-5 or a 3-8-6.

From the standpoint of economy in handling-charges, the use of high-analyses fertilizers, where practical, is being more strongly advocated among growers. With this feature in mind, in addition to the strong recommendation in the South for the use of a properly balanced formula, a basal mixture, consisting of 24 pounds of nitrogen (N), 72 pounds of phosphoric acid (P_2O_5), and 48 pounds of potash (K_2O), was used consistently. Table 25 outlines the various constituents used in the basal mixture for flue-cured tobacco in the new series of fertilizer experiments.

TABLE 25.—BASAL FORMULA

Materials	Quantity per acre	Nutrients per acre		
		N	P_2O_5	K_2O
	lb.	lb.	lb.	lb.
Nitrate of soda	40	6	.....	.....
Sulphate of ammonia	30	6	.....	.....
Dried blood	100	12	.....	.....
Superphosphate	450	.....	72	.....
Sulphate of potash	100	.....	.....	48
Total	720	24	72	48

It may be observed in the above mixture that one-half of the nitrogen is water-soluble and equally divided between nitrate of soda and sulphate of ammonia. The remaining half of the nitrogen is derived from an organic source, dried blood. This mixture carries the equivalent plant food contained in 600 pounds of a commercial 4-12-8.

QUANTITIES OF NITROGEN

In the old series of experiments with flue-cured tobacco, it will be noted from table 8 that 20, 28, 36 and 42 pounds of nitrogen per acre, respectively, constituted the treatments in that particular test. The new series includes 12, 24, 32 and 40 pounds per acre with the proportions of water-soluble to organic nitrogen remaining the same as in the basal mixture. Any variation made in the formula is in quantity of nitrogen only. Table 26 gives the results for 1929 and 1930.

TABLE 26.—QUANTITIES OF NITROGEN

Treatment No.	Quantity of nitrogen	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	lb.	lb.	lb.	ct.	ct.
N2	12	1,168	790	27·5	20·9
N1	24	1,231	887	25·5	17·6
N3	32	1,225	881	22·5	17·4
N4	40	1,238	916	21·1	17·8

The results of this test show that the quantity of nitrogen has a definite effect on the yield and grade value of flue-cured tobacco. Quantities greater than 12 pounds per acre increased the yield but consistently lowered the quality, which is seen in the downward trend of the grade index.

SOURCES OF WATER-SOLUBLE NITROGEN

To further test the effect of nitrogen on flue-cured tobacco, different sources replaced the water-soluble portion in the basal mixture. The results of these sources either singly or in combination are given in tables 27 and 28.

TABLE 27.—SINGLE SOURCES OF WATER-SOLUBLE NITROGEN

Treatment No.	Source of water soluble nitrogen	Quantity of water-soluble nitrogen	Average yield per acre		Average grade index	
			1929	1930	1929	1930
		lb.	lb.	lb.	ct.	ct.
N5	Urea	12	1,126	857	27·7	16·1
N12	Calcium nitrate	12	1,148	846	27·0	20·0
N8	Nitrate of potash	12	1,143	811	25·4	17·6
N7	Sulphate of ammonia	12	1,119	807	24·9	19·1
N10	Nitrophoska No. 3	12	1,171	870	24·6	21·9
N13	Ammo-phos-ko No. 1	12	.....	847	.....	19·8

When the same quantity of water-soluble nitrogen from different single sources is used in the basal mixture the yield is not particularly influenced. The grade index indicates, however, that quality may be affected to some extent.

TABLE 28.—WATER-SOLUBLE NITROGEN FROM TWO SOURCES

Treatment No.	Sources of water-soluble nitrogen	Quantity of water-soluble nitrogen	Average yield per acre		Average grade index	
			1929	1930	1929	1930
		lb.	lb.	lb.	ct.	ct.
N1	Nitrate of soda	6	1,216	875	24·9	21·3
	Sulphate of ammonia	6				
N6	Urea	6	1,206	862	26·5	17·5
	Nitrate of soda	6				
P5	Diammonium phosphate	6	1,348	861	31·7	23·4
	Nitrate of soda	6				
N14	Nitrate of soda	6		843		20·2
	Ammophos "A"	6				

Comparing the above treatments with table 27, it can readily be seen that good returns are obtained by using water-soluble nitrogen combined from two sources. Nitrate of soda plus diammonium phosphate as double sources of water-soluble nitrogen gave the best yield and also the best grade index for an average of the two years' results. In the case of double sources also, quality is more materially influenced than yield. The water-soluble nitrogen constitutes one-half of the total nitrogen in these mixtures.

NITROGEN ALL WATER-SOLUBLE

To make a further study of nitrogen requirements for flue-cured tobacco, a series of all water-soluble treatments was added in 1930. The field chosen for this experiment, being a mixed grass and clover sod and ploughed rather late in the spring, had a general effect on delaying the maturity of the crop. This condition, in conjunction with the abnormal growing season, resulted in the production of a very common tobacco from this series of plots. The grade index value is considerably below the average of the other fertilizer treatments, but nevertheless, they are comparative. The following table gives the first year's results.

TABLE 29.—NITROGEN ALL WATER-SOLUBLE

Treatment No.	Sources of water-soluble nitrogen	Quantity of water-soluble nitrogen	Average yield per acre 1930	Average grade index 1930
		lb.	lb.	ct.
	Single Sources			
WSN8	Sulphate of ammonia	24	830	12·6
WSN3	Nitrate of soda	24	806	12·1
WSN4	Urea	24	803	11·1
	Two Sources			
WSN5	Urea	12	855	15·7
	Nitrate of soda	12		
WSN2	Sulphate of ammonia	12	865	13·0
	Nitrate of soda	12		
WSN6	Urea	12	737	11·8
	Sulphate of ammonia	12		
	Three Sources			
WSN7	Urea	12	789	10·9
	Sulphate of ammonia	6		
	Nitrate of soda	6		
WSN1	Basal formula*	24	920	11·1

*One-half of nitrogen from dried blood.

As a single source of nitrogen, sulphate of ammonia is slightly superior to nitrate of soda in both yield and quality. Urea, a chemical organic, ranked third.

When more than one source of nitrogen was supplied, nitrate of soda and sulphate of ammonia rated first in yield but fell below urea and nitrate of soda in quality. Urea and sulphate of ammonia rated third.

The combination of three sources (WSN7) compares favourably with the basal formula (WSN1) in quality. The yield, however, is considerably lower when urea replaces dried blood in the mixture.

SOURCES OF ORGANIC NITROGEN

Dried blood, cottonseed meal and tankage individually supplied half of the nitrogen in an organic form and were compared in this experiment. The balance was equally divided between nitrate of soda and sulphate of ammonia. The total quantity applied per acre was the same as in the basal formula, namely, 24 pounds.

TABLE 30.—SOURCES OF ORGANIC NITROGEN

Treatment No.	Source of organic nitrogen	Quantity of organic nitrogen	Average yield per acre		Average grade index	
			1929	1930	1929	1930
		lb.	lb.	lb.	ct.	ct.
ON1	Dried blood	12	1,123	766	28·2	16·7
ON3	Cottonseed meal	12	1,110	830	28·9	20·7
ON4	Tankage	12	1,109	800	23·0	18·0

These results show that cottonseed meal gave a better average quality than tankage or dried blood in both years. The yields remained fairly constant.

QUANTITIES OF ORGANIC NITROGEN

Quantitative treatments including dried blood as an animal source of organic nitrogen and urea as a chemical organic source were varied in the basal formula to further study the value of organic nitrogen in the fertilizer mixture for flue-cured tobacco. These materials were used singly and in combination. Table 31 presents the results secured in 1930.

TABLE 31.—QUANTITIES OF ORGANIC NITROGEN

Treatment No.	Sources of organic nitrogen	Quantity of organic nitrogen	Average yield per acre, 1930	Average grade index, 1930
		lb.	lb.	ct.
ON4	Dried blood	6	806	20·0
ON1 (basal)	Dried blood	12	804	19·4
ON5	Dried blood	18	803	20·4
N6	Urea	6	862	17·5
	Dried blood	12	.....	.....
N5	Urea	12	857	16·1
	Dried blood	12	.....	.....
WSN4	Urea	24	803	11·1

NOTE.—The total nitrogen supplied in each case was 24 pounds per acre.

These results show that the quantity of dried blood in the mixture had no material effect on yield or quality of flue-cured tobacco in 1930. When the quantity of urea was raised from 6 pounds to 12 and 24 pounds in the mixture, a reduction is shown in yield and quality.

QUANTITIES OF PHOSPHORIC ACID

In referring to the section on quantities of phosphoric acid in the old series of experiments (table 11) it will be noted that 48, 64, 80 and 96 pounds of this ingredient were used. In the present series of treatments, 0, 72 and 144 pounds were included. These different quantities derived from superphosphate were varied in the basal mixture. The nitrogen and potash relations remained constant. The new comparisons are found in table 32.

TABLE 32.—QUANTITIES OF PHOSPHORIC ACID

Treatment No.	Quantity of phosphoric acid	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	lb.	lb.	lb.	ct.	ct.
P2	0	1,129	845	29·5	18·4
P1	72	1,249	861	26·3	19·8
P3	144	1,281	927	28·7	20·2

It is interesting to note from the above results that the highest quantity of phosphoric acid both in 1929 and 1930 had no detrimental effect on either yield or quality. As the quantity of phosphoric acid was increased, however, the yield in both years was steadily improved. The grade index was also improved in 1930 by increased quantities of phosphoric acid.

SOURCES OF PHOSPHORIC ACID

Various sources of phosphoric acid were substituted in the basal mixture in an effort to determine the sources which would produce the best quality and yield of flue-cured tobacco. The following tables give the results for 1930.

TABLE 33.—PHOSPHORIC ACID FROM SINGLE SOURCES

Treatment No.	Source of phosphoric acid	Average yield per acre, 1930	Average grade index, 1930
		lb.	ct.
P1	Superphosphate (16 per cent)	861	19·8
P4	Treble superphosphate	858	21·9
P6	Colloidal phosphate	781	9·2

Superphosphate and treble superphosphate gave equally good results from a yield standpoint. A higher grade value, however, was obtained from treble superphosphate, which carried or supplied 45 per cent available phosphoric acid. Colloidal phosphate carrying 20 per cent available phosphoric acid was undoubtedly the poorest source in 1930.

TABLE 34.—PHOSPHORIC ACID FROM TWO OR MORE SOURCES

Treatment No.	Sources of phosphoric acid	Quantity of phosphoric acid	Average yield per acre, 1930	Average grade index, 1930
		lb.	lb.	ct.
N10	Nitrophoska No. 3	12	870	22·0
	Superphosphate	60		
P5	Diammonium phosphate	15	860	23·4
	Treble superphosphate	57		
N13	Ammo-phos-ko No. 1	24	847	19·8
	Superphosphate	48		
N9	Ammophos "A"	26	843	20·2
	Treble superphosphate	46		

In table 33 the quantity of nitrogen remained constant at 72 pounds per acre. In table 34, however, the synthetic products (nitrophoska No. 3, diammonium phosphate, etc.) apart from being phosphoric acid carriers, in some cases supplied all or a portion of the water-soluble nitrogen in the mixture. Nitrophoska No. 3 (N10) and ammo-phos-ko No. 1 (N11) substituted from one-quarter to one-third of the potash. The first year's results show no outstanding differences.

QUANTITIES OF POTASH

Turning again to the section on previous work with flue-cured fertilizers, table 12 indicates the merits of potash on yield and quality of the cured leaf. The quantities applied per acre were 48, 64, 80 and 96 pounds. In the present series of experiments 0, 48 and 96 pounds were supplied in the form of sulphate of potash. The nitrogen and phosphoric acid in the mixture remained constant. The results for 1929 and 1930 are compared in table 35.

TABLE 35.—QUANTITIES OF POTASH

Treatment No.	Quantity of potash 1929	Average yield per acre		Average grade index	
		1929	1930	1929	19230
	lb.	lb.	lb.	ct.	ct.
K2	0	1,019	764	25·4	17·5
K1	48	1,121	758	25·9	17·5
K3	96	1,216	870	28·0	20·1

The results of this experiment definitely show that potash is an important factor in the production of flue-cured tobacco. The yield and grade index indicate that the increased yield and value of the leaf would more than cover the extra cost of fertilizer, even where the quantity of potash was doubled in the basal mixture.

SOURCES OF POTASH

In 1929 four single sources of potash were included; namely, sulphate of potash (48 per cent K_2O), carbonate of potash (63 per cent K_2O), sulphate of potash magnesia (28 per cent K_2O), and nitrate of potash (44 per cent K_2O). Nitrate of potash also supplied some water-soluble nitrogen in the mixture. Other materials were added to this series in 1930; such as, ammo-phos-ko No. 3 (12 per cent K_2O), nitrophoska No. 3 (19 per cent K_2O) and muriate in combination with sulphate. The quantities of nitrogen and phosphoric acid remained constant in all cases. Table 36 gives the results of the two-year test.

TABLE 36.—SOURCES OF POTASH

Treatment No.	Source of potash	Quantity of potash	Average yield per acre		Average grade index	
			1929	1930	1929	1930
		lb.	lb.	lb.	ct.	ct.
K1	Sulphate of potash	48	1,223	818	30·0	19·4
K4	Carbonate of potash	48	1,151	776	29·2	17·4
K5	Sulphate of potash magnesia	48	1,176	811	27·7	20·3
N8	Nitrate of potash	48	1,143	811	25·4	17·5

Comparing the above results with table 13 in the old series of fertilizer experiments, sulphate of potash has continued to prove a satisfactory source of potash for flue-cured tobacco. The quality and yield are superior in both cases over carbonate and nitrate of potash. Sulphate of potash magnesia was the best source in 1930, while carbonate and nitrate of potash were the poorest sources for both 1929 and 1930.

TABLE 37.—OTHER SOURCES OF POTASH IN COMBINATION

Treatment No.	Sources of potash	Quantity of potash	Average yield per acre, 1930	Average grade index, 1930
		lb.	lb.	ct.
K7	Muriate of potash	24	910	20·5
	Sulphate of potash	24		
N13	Ammo-phos-ko No. 1	12	847	19·8
	Sulphate of potash	36		
N10	Nitrophoska No. 3	15	870	21·9
	Sulphate of potash	33		

Nitrophoska No. 3 has shown some influence in all cases either as a source of water-soluble nitrogen, phosphoric acid or potash. This product gave rather outstanding results in yield and quality, except in one instance where muriate of potash gave the highest yield over all sources.

FERTILIZER EXPERIMENTS WITH BURLEY TOBACCO

BASAL FORMULA

In the old series of fertilizer experiments with Burley tobacco, the nitrogen in the basal formula was all water-soluble, derived from a single source, sulphate of ammonia. Furthermore, in testing out various sources of nitrogen, table 16 shows that considerably higher yields were obtained when this plant food element was derived from two sources.

Bearing these and other experimental facts in mind, a new basal mixture was formulated, approximating as nearly as possible the general fertilizer requirements for maximum yield and quality on soils at this Station. Table 38 outlines the materials used in the basal formula.

TABLE 38.—BASAL FORMULA (NEW SERIES)

Materials	Quantity per acre	Nutrients per acre		
		N	P_2O_5	K_2O
	lb.	lb.	lb.	lb.
Nitrate of soda	120	20	.....	.....
Sulphate of ammonia	180	36	.....	.....
Dried blood	200	24	.....	.....
Superphosphate	500	.....	80	.....
Sulphate of potash	250	.....	.....	120
Total	1,250	80	80	120

It may be observed from the above formula that 70 per cent of the nitrogen is water-soluble, derived from nitrate of soda and sulphate of ammonia, and 30 per cent is in the organic form from dried blood. The total quantity of nitrogen is 80 pounds per acre. The phosphoric acid is obtained from superphosphate (16 per cent), at a rate of 80 pounds of phosphoric acid per acre. The potash is supplied in the sulphate form, at a rate of 120 pounds of potash per acre. This formula carries the equivalent quantities of plant food found in 2,000 pounds of a commercial 4-4-6.

QUANTITIES OF NITROGEN

The sources of nitrogen in these tests were similar to the basal formula, 70 per cent being in the water-soluble form and 30 per cent organic. The variation was made only in quantity of nitrogen. The quantities of potash and phosphoric acid remained constant in the mixture. The results of these tests are given in table 39.

TABLE 39.—QUANTITIES OF NITROGEN

Treatment No.	Quantity of nitrogen	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	lb.	lb.	lb.	ct.	ct.
N2	40	1,441	981	21·1	12·5
N3	60	1,588	955	21·4	12·8
N1	80	1,583	969	21·6	13·2
N4	100	1,666	1,071	21·5	12·2

The above table indicates that Burley tobacco requires a moderately heavy application of nitrogen for maximum yield. The quality, however, is fairly constant up to 80 pounds of nitrogen per acre. These results compare favourably with the old series of tests (table 15) and also with the co-operative work on clay loam soils (table 49).

SOURCES OF WATER-SOLUBLE NITROGEN

The merits of various sources of water-soluble nitrogen, either singly or in combination, were considered. Equivalent quantities replaced the water-soluble portion of the nitrogen in the basal formula. The other constituents in the mixture remained constant. The following table gives the materials applied and the results obtained in 1929 and 1930:—

TABLE 40.—SOURCES OF WATER-SOLUBLE NITROGEN

Treatment No.	Sources of water-soluble nitrogen	Quantity of water-soluble nitrogen	Average yield per acre		Average grade index	
			1929	1930	1929	1930
		lb.	lb.	lb.	ct.	ct.
N6	Nitrophoska No. 3	56	1,593	1,058	22·2	13·1
N1 (basal)	Nitrate of soda	20	1,598	1,022	21·2	12·9
	Sulphate of ammonia	36				
N5	Nitrate of soda	20	1,623	1,038	19·4	13·9
	Urea	36				
K6	Nitrate of potash	20	1,563	959	21·9	13·2
	Sulphate of ammonia	36				
P6	Nitrate of soda	20	1,565	1,068	20·3	13·8
	Diammonium phosphate	31				
	Sulphate of ammonia	5				

Results from 1929 and 1930 indicate that the source of nitrogen affects the yield to a greater extent than the quality of cured leaf, when the various sources are substituted in the basal mixture. As the seasonal conditions no doubt have an effect on the availability of these compounds no definite conclusions can be drawn as yet from this experiment.

SOURCES OF ORGANIC NITROGEN

In this experiment dried blood, tankage and cottonseed meal were compared as sources of organic nitrogen supplying 30 per cent of the total nitrogen or 24 pounds per acre, the remaining 70 per cent coming from sulphate of ammonia and nitrate of soda, as in the basal formula. Table 41 contains the results obtained in 1929 and 1930.

TABLE 41.—SOURCES OF ORGANIC NITROGEN

Treatment No.	Source of organic nitrogen	Average yield per acre		Average grade index	
		1929	1930	1929	1930
		lb.	lb.	ct.	ct.
ON5	Tankage	1,662	1,188	22·8	13·3
ON1 (basal)	Dried blood	1,615	1,138	20·1	13·1
ON2	Cottonseed meal	1,587	1,117	16·3	12·8

These results show that high-grade tankage gave the highest average yield and also the highest value per pound, as indicated by the grade index in both years of the experiment. Cottonseed meal was the poorest source, and dried blood ranked second.

QUANTITIES OF ORGANIC NITROGEN

A quantitative comparison was made to test the value of different proportions of organic nitrogen in the mixture. Quantities of dried blood representing 30 per cent, 50 per cent and 70 per cent of organic nitrogen were included in the basal mixture. The water-soluble portion of nitrogen was in the form of nitrate of soda and sulphate of ammonia, complementing the percentages of organic nitrogen. The results appear in table 42.

TABLE 42.—QUANTITIES OF ORGANIC NITROGEN

Treatment No.	Percentage of organic nitrogen	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	%	lb.	lb.	ct.	ct.
ON1	30	1,646	1,162	18·9	13·1
ON3	50	1,574	1,080	18·3	12·7
ON4	70	1,604	1,135	19·8	13·3

Yield and quality were not particularly affected by the quantity of organic nitrogen used in these treatments in 1929 and 1930. The dry seasons also undoubtedly influenced this experiment to some extent.

QUANTITIES OF PHOSPHORIC ACID

To further substantiate past trials with varying quantities of phosphoric acid conducted on Burley soils at this Station, another set of tests was conducted in 1929. Four treatments ranging from no phosphoric acid to 160 pounds per acre were conducted by varying the quantities of superphosphate (16 per cent) in the basal formula mixture. The nitrogen and potash relations remained constant. Comparisons are made in table 43.

TABLE 43.—QUANTITIES OF PHOSPHORIC ACID

Treatment No.	Quantity of phosphoric acid	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	lb.	lb.	lb.	ct.	ct.
P2	0	1,286	925	18·7	10·4
P3	40	1,386	1,026	20·6	12·2
P1	80	1,567	1,122	19·3	12·3
P4	160	1,502	1,078	19·7	12·8

The apparent deficiency of phosphoric acid in the Burley soils at the Station is quite evident from these results. Data obtained in 1929 and 1930 clearly show that Burley tobacco responds to applications of phosphoric acid. These results compare favourably with similar trials made in the old series of fertilizer work (table 17) and also with co-operative tests on clay loam soils (table 50).

SOURCES OF PHOSPHORIC ACID

Both single and double sources of phosphoric acid were substituted in the basal mixture in these tests. Among the materials used were treble superphosphate, diammonium phosphate and nitrophoska No. 3, analyzing approximately 46 per cent, 53 per cent and 15 per cent phosphoric acid, respectively. Diammonium phosphate also carries 21 per cent nitrogen, while nitrophoska No. 3 contains 15·5 per cent nitrogen and 19 per cent potash in addition to the phosphoric acid. The mixture was balanced to carry the same quantities of plant food used in the basal formula. The average results from these tests are stated in table 44.

TABLE 44.—SOURCES OF PHOSPHORIC ACID

Treatment No.	Sources of phosphoric acid	Quantity of phosphoric acid	Average yield per acre		Average grade index	
			1929	1930	1929	1930
		lb.	lb.	lb.	ct.	ct.
P5	Treble superphosphate	80	.....	1,081	.....	11·9
P6	Diammonium phosphate	80	1,575	1,068	20·3	13·8
P1	Superphosphate (16 per cent)	80	1,552	1,045	19·1	12·8
N6	Nitrophoska No. 3	56	1,593	1,058	22·2	13·1
	Superphosphate	24				

The source of phosphoric acid had no significant effect on yield in 1929 and 1930. Some variation is noted, however, in the grade value of the different treatments. Diammonium phosphate was the most outstanding as a single source.

QUANTITIES OF POTASH

Varying quantities of sulphate of potash were used in the basal formula to test the effects of quantity of potash on the quality and yield of Burley tobacco. The results from quadruplicate plots are found in table 45, calculated to an acre basis.

TABLE 45.—QUANTITIES OF POTASH

Treatment No.	Quantity of potash	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	lb.	lb.	lb.	ct.	ct.
K2	0	1,391	845	14·9	9·4
K3	60	1,676	989	18·8	11·7
K1	120	1,592	1,043	15·9	12·8
K4	240	1,706	1,071	19·9	14·9

The first two years' results show that potash plays an important part in the production of good quality Burley tobacco. Plots receiving no potash were low in yield and produced an inferior grade of cured leaf. Plots receiving high quantities of potash were high-yielding and maintained the best grade value. These results correspond very closely with the old series of work at this Station (Table 18), and are also similar to data obtained from co-operative work on clay loam soils with regard to quality.

SOURCES OF POTASH

Experiments including different sources of potash were also conducted on quadruplicate plots. The average yield and grade index are given in table 46.

TABLE 46.—SOURCES OF POTASH

Treatment No.	Sources of potash	Quantity of potash	Average yield per acre		Average grade index	
			1929	1930	1929	1930
		lb.	lb.	lb.	ct.	ct.
K1 (basal)	Sulphate of potash	120	1,571	1,070	18·3	15·6
K5	Carbonate of potash	120	1,575	1,005	14·9	13·4
K8	Sulphate of potash magnesia	120	.....	1,204	.....	15·5
K6	Nitrate of potash	68	1,563	959	21·9	17·5
	Sulphate of potash	52				
K7	Muriate of potash	60	.....	1,094	.....	13·8
	Sulphate of potash	60				
N6	Nitrophoska No. 3	69	1,593	1,058	22·2	13·1
	Sulphate of potash	51				

From the above results it is interesting to note that the source of potash also had an influence on the yield and quality in Burley tobacco, quality being more generally affected.

NO COMMERCIAL FERTILIZER

This series of plots was included to demonstrate the value of commercial fertilizer for Burley tobacco. It is interesting to compare the results in table 47, which includes plots receiving no commercial fertilizer.

TABLE 47.—COMPLETE FERTILIZER VS. NO COMMERCIAL FERTILIZER

Treatment No.	Treatment	Average yield per acre		Average grade index		Returns per acre less fertilizer cost	
		1929	1930	1929	1930	1929	1930
		lb.	lb.	ct.	ct.	$	$
N1	Complete fertilizer (basal formula)	1,614	1,113	21·4	15·2	316 97	143 64
X	No commercial fertilizer	1,057	679	14·2	13·2	150 09	89 63

These results of two years clearly indicate that commercial fertilizers are highly beneficial in producing a good crop of Burley tobacco. In 1929 the fertilizer gave excellent response, because for every dollar spent for fertilizer $5.87 was realized in return. However, in a dry season (1930) when full benefit was not derived from the fertilizer applied, the average return per dollar spent for fertilizer was reduced to $2.11 in this experiment.

FERTILIZER EXPERIMENTS WITH BURLEY TOBACCO

(WOODSLEE, ONT.)

The field chosen for this experiment was a very uniform clay loam, quite typical of that class of soils found in Western Ontario. The effects of various quantities of nitrogen, phosphoric acid and potash on yield and quality of Burley tobacco were studied. Eight treatments were planned in 1929 using the same plot technique as employed on the Station, except that treatments were conducted in triplicate. The method of evaluating quality was also carried out in a similar manner to that at the Station.

The mixture used for comparison consisted of 40 pounds of nitrogen (N), 80 pounds of phosphoric acid (P_2O_5) and 60 pounds of potash (K_2O). This is the equivalent of 1,000 pounds of a commercial 4-8-6. The following table outlines the fertilizer materials and quantities supplied in this formula.

TABLE 48.—COMPARATIVE FORMULA (WOODSLEE, ONT.)

Materials	Quantity per acre	Nutrients per acre		
		N	P_2O_5	K_2O
	lb.	lb.	lb.	lb.
Sulphate of ammonia	90	10	.....	.....
Nitrate of soda	64	18	.....	.....
Dried blood	100	12	.....	.....
Superphosphate	500	.....	80	.....
Sulphate of potash	133	.....	.....	60
Total	887	40	80	60

It may be observed that the sources of nitrogen are in the same ratio as in the Station basal mixture (Table 38). Although the relative quantities of nitrogen and potash have been reduced by one-half, it was thought that the heavier soils would naturally respond to less commercial nitrogen and potash than the light sandy soils on the Station. The results of the two years' work are interesting in this respect.

QUANTITIES OF NITROGEN

Treatments supplying 40, 60 and 80 pounds of nitrogen, respectively, are given in table 49.

TABLE 49.—QUANTITIES OF NITROGEN

Treatment No.	Quantity of nitrogen	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	lb.	lb.	lb.	ct.	ct.
N7	40	1,662	1,489	19·9	18·0
N8	60	1,799	1,550	20·2	20·3
N9	80	1,830	1,611	19·8	19·5

It can be observed from these results that the quality of cured leaf was well maintained throughout these tests. However, there was a proportionate increase in yield with each additional 20 pounds of nitrogen. This clay loam soil gave definite response to heavy applications of nitrogen.

Burley fertilizer experiments, 1930. Stake No. 2 represents the boundary between the different treatments. The four rows to the right, with no fertilizers, yielded 645 pounds. The four rows to the left, with complete fertilizers, yielded 1,126 pounds. Fertilizers pay, even in a dry year.

QUANTITIES OF PHOSPHORIC ACID

In a similar manner experiments were conducted with different quantities of phosphoric acid in the mixture. Table 50 gives the results obtained.

TABLE 50.—QUANTITIES OF PHOSPHORIC ACID

Treatment No.	Quantity of phosphoric acid	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	lb.	lb.	lb.	ct.	ct.
P8	40	1,609	1,460	16·4	17·5
P7	80	1,662	1,489	19·9	18·0
P9	160	1,820	1,571	21·9	17·8

The results show that this clay loam soil also responds to heavy applications of phosphoric acid. Forty pounds of phosphoric acid per acre was not sufficient for optimum yield and quality. The double quantity (160 pounds) of phosphoric acid also proved beneficial from the standpoint of both yield and quality. These experiments illustrate the importance of applying 1,000 pounds of a commercial 4-8-6 per acre in order to obtain good yields and also good quality.

QUANTITIES OF POTASH

In this test varying quantities of potash in the form of sulphate were used in the basal formula. Table 51 gives the results from triplicate plots.

TABLE 51.—QUANTITIES OF POTASH

Treatment No.	Quantity of potash	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	lb.	lb.	lb.	ct.	ct.
K10	30	1,724	1,530	20·1	16·7
N7	60	1,662	1,489	19·9	18·0
K11	120	1,751	1,444	21·7	19·8

These results would indicate that, on clay loam soils, Burley tobacco does not respond to applications of potash as well as it does to nitrogen and phosphoric acid. In 1930 the larger quantities of potash did not increase the yield per acre. However, the grade index was noticeably improved by increased quantities of potash in the mixture.

RATE OF APPLICATION

The importance of applying sufficient fertilizer on heavy Burley tobacco soils was investigated. The Station basal formula K1 (table 38), which carries 80 pounds of nitrogen, 80 pounds of phosphoric acid and 120 pounds of potash, was also included in this series of treatments. This formula contains double the plant food when compared with treatment P8, table 50 in the phosphoric acid series, where the quantity of phosphoric acid has been reduced to 40 pounds per acre. The results of these formulae, representing the equivalent of 500 and 1,000 pounds of an 8-8-12 per acre, may be compared in table 52.

TABLE 52.—RATE OF APPLICATION

Treatment No.	Formula	Quantity of mixture per acre	Average yield per acre		Average grade index	
			1929	1930	1929	1930
		lb.	lb.	lb.	ct.	ct.
P8 (½ Station basal)	8–8–12	500	1,609	1,460	16·4	17·5
K1 (Station basal)	8–8–12	1,000	1,779	1,520	20·5	17·6
N7	4–8–6	1,000	1,662	1,489	19·9	18·0

The first formula (P8), which contains 40 pounds of nitrogen, 40 pounds of phosphoric acid and 60 pounds of potash, does not carry sufficient plant food to maintain the yield and grade index. The second formula (K1), which contains double these quantities, gives an increased yield and a slightly superior quality of leaf as indicated by the grade index.

The third formula (N7) apparently does not carry quite enough nitrogen for maximum yield, but it is otherwise sufficiently balanced to maintain the quality as shown by the improvement in the grade value of the leaf.

FERTILIZER EXPERIMENTS WITH DARK-FIRED TOBACCO

In considering a new series of fertilizer experiments for dark-fired tobacco, sufficient evidence was obtained from the old series of treatments (discussed on page 18 of this report) to indicate that this type of tobacco requires heavy applications of commercial fertilizers for maximum yield. The quantity of plant foods necessary coincide very closely with the requirements for Burley. The new fertilizer experiments were, therefore, based on this assumption, and the outline chosen is practically a duplicate of the new Burley series.

The same procedure was followed with regard to plot technique, replication, basal formula and calculation of quality, the only difference being in the method of curing. The field chosen for these experiments was fairly uniform and might be classed as a medium loam, which is heavier than the average Burley soils on the Station. The results for 1929 and 1930 are considered in this report.

QUANTITIES OF NITROGEN

These tests furnish a comparison between 40, 60, 80 and 100 pounds of nitrogen, respectively, in the basal mixture, in a manner similar to the Burley. Table 53 gives the results obtained during the two years.

TABLE 53.—QUANTITIES OF NITROGEN

Treatment No.	Quantity of nitrogen	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	lb.	lb.	lb.	ct.	ct.
N2	40	934	697	20·7	10·1
N3	60	1,146	813	23·9	13·5
N1 (basal)	80	1,374	1,080	25·5	13·7
N4	100	1,337	974	23·3	13·9

The quantity of nitrogen applied to dark-fired tobacco soils on this Station has quiet a marked effect on yield and quality. The yield and grade value were consistently increased with each additional quantity of nitrogen up to 80 pounds per acre. No improvement in either yield or quality was obtained from application of nitrogen greater than 80 pounds per acre.

A portion of the dark-fired fertilizer plots. Each stake marks a different treatment. The basal fertilizer mixture was applied in the foreground.

SOURCES OF WATER-SOLUBLE NITROGEN

The sources of nitrogen are somewhat similar to those used in the Burley tests. Nitrophoska No. 3 was added to this series in 1930. Table 54 gives the materials used and the results obtained in 1929 and 1930.

TABLE 54.—SOURCES OF WATER-SOLUBLE NITROGEN

Treatment No.	Sources of water-soluble nitrogen	Quantity of water-soluble nitrogen	Average yield per acre		Average grade index	
			1929	1930	1929	1930
		lb.	lb.	lb.	ct.	ct.
N6	Nitrophoska No. 3	56	.....	890	.....	11·8
N5	Nitrate of soda	20	1,307	926	25·9	9·9
	Urea	36				
N1 (basal)	Nitrate of soda	20	1,374	1,080	25·5	13·7
	Sulphate of ammonia	36				
K6	Nitrate of potash	20	1,069	912	19·1	12·8
	Sulphate of ammonia	36				
	Nitrate of soda	20				
P6	Diammonium phosphate	31	1,400	1,012	22·1	13·9
	Sulphate of ammonia	5				

The basal mixture apparently gave the most consistent results, as indicated in this two-year test. Urea substituting sulphate of ammonia gave good results in 1929, but appeared to be the poorest source in 1930. Diammonium phosphate supplemented sulphate of ammonia in treatment P6. The results of this treatment compared very favourably with those from the basal mixture.

SOURCES OF ORGANIC NITROGEN

Dried blood, tankage and cottonseed meal were tested as sources of organic nitrogen and supplied 30 per cent of the total nitrogen in the mixture, while the remaining 70 per cent was supplied in the water-soluble form in these treatments. The results appear in table 55.

TABLE 55.—SOURCES OF ORGANIC NITROGEN

Treatment No.	Source of organic nitrogen	Average yield per acre		Average grade index	
		1929	1930	1929	1930
		lb.	lb.	ct.	ct.
ON5	Tankage	1,498	1,106	25·5	10·9
ON1	Dried blood	1,424	1,016	26·5	10·6
ON2	Cottonseed meal	1,362	1,013	22·7	13·7

No outstanding differences were obtained from the above two-year test on organic sources of nitrogen, although tankage was high in both yield and quality in 1929. In 1930 tankage also ranked first in yield but the quality was not as good as from cottonseed meal. It is quite probable that the nitrogen from these materials remained partially unavailable to the plants during the unusually dry season of 1930.

QUANTITIES OF ORGANIC NITROGEN

The value of different proportions of organic nitrogen was also tested by using 30 per cent, 50 per cent and 70 per cent in the basal mixture in the form of dried blood. The complementing percentages were derived from nitrate of soda and sulphate of ammonia. The comparisons are made in table 56.

TABLE 56.—QUANTITIES OF ORGANIC NITROGEN

Treatment No.	Percentage of organic nitrogen	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	%	lb.	lb.	ct.	ct.
N1	30	1,424	1,016	26·5	10·6
ON3	50	1,309	1,016	21·5	14·0
ON4	70	1,299	1,005	21·7	11·0

From the standpoint of yields obtained in these tests it is quite evident that 30 per cent of the nitrogen from an organic source is sufficient. The quality, however, apparently varies to some extent with the season as indicated by the difference in the results for the two years.

NITROGEN ALL WATER-SOLUBLE

To further study the advisability of using organic nitrogen in the mixture, two all water-soluble treatments were added to the dark-fired tobacco fertilizer series in 1930. The results from duplicate plots are given in the following table:—

TABLE 57.—NITROGEN ALL WATER-SOLUBLE

Treatment No.	Sources of water-soluble nitrogen	Quantity of water-soluble, nitrogen	Average yield per acre, 1930	Average grade index, 1930
		lb.	lb.	ct.
WSN2	Urea	24	798	10·2
	Sulphate of ammonia	36		
	Nitrate of soda	20		
WSN3	Nitrate of soda	28	763	8·9
	Sulphate of ammonia	52		
WSN1 (basal)	Sulphate of ammonia	36	716	10·2
	Nitrate of soda	20		
	Dried blood	24		

The two water-soluble treatments outyielded the basal mixture by a narrow margin in this very dry season. Urea, supplying 30 per cent of the nitrogen in treatment WSN2, also gave good results.

QUANTITIES OF PHOSPHORIC ACID

The importance of phosphoric acid as a plant food material for dark-fired tobacco was considered by varying the quantity of this material in the basal mixture. The results for 1929 and 1930 are presented in table 58.

TABLE 58.—QUANTITIES OF PHOSPHORIC ACID

Treatment No.	Quantity of phosphoric acid	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	lb.	lb.	lb.	ct.	ct.
P2	0	1,090	908	24·2	10·1
P3	40	1,306	836	24·8	11·5
P1	80	1,348	1,016	27·0	12·2
P4	160	1,421	996	24·7	14·3

If these results are compared with table 43 in the Burley series, the need for phosphoric acid on tobacco soils at the Station is quite apparent. There is a substantial improvement in quality with each increased quantity of phosphoric acid in both years. The yields were consistently improved with increased quantities of phosphoric acid also in 1929, but they were not consistent in 1930.

Results obtained with varying quantities of phosphoric acid on flue, Burley and dark-fired tobaccos coincide very closely, inasmuch as fairly liberal applications are essential for good yield and quality in all three types.

SOURCES OF PHOSPHORIC ACID

Diammonium phosphate and superphosphate were compared as sources of phosphoric acid in 1929. Treble superphosphate and nitrophoska No. 3 were added to the series in 1930. Table 59 gives the average results of these tests.

TABLE 59.—SOURCES OF PHOSPHORIC ACID

Treatment No.	Sources of phosphoric acid	Quantity of phosphoric acid	Average yield per acre		Average grade index	
			1929	1930	1929	1930
		lb.	lb.	lb.	ct.	ct.
P1	Superphosphate	80	1,323	1,097	26·7	11·4
P6	Diammonium phosphate	80	1,400	1,012	25·5	13·9
P5	Treble superphosphate	80	.....	983	.....	11·4
N6	Nitrophoska No. 3	56	.....	990	.....	11·8
	Superphosphate	24				

As single sources of phosphoric acid, superphosphate and diammonium phosphate gave very similar results both in yield and grade value. Superphosphate alone gave a higher yield than the combination of superphosphate with nitrophoska No. 3, although the grade values were the same. Treble superphosphate was the least promising source in this test.

QUANTITIES OF POTASH

Potash was shown to be an important plant food material for Burley and flue-cured tobacco. The following table also gives interesting results with different quantities of sulphate of potash on dark-fired tobacco.

TABLE 60.—QUANTITIES OF POTASH

Treatment No.	Quantity of potash	Average yield per acre		Average grade index	
		1929	1930	1929	1930
	lb.	lb.	lb.	ct.	ct.
K2	0	1,321	984	17·4	11·9
K3	60	1,113	999	19·1	12·4
K1	120	1,323	1,097	26·7	11·4
K4	240	1,458	1,043	23·8	11·4

Deductions drawn from the above table coincide very closely with table 23 in the old fertilizer series, in that potash plays an important role in the production of high-grade dark-fired tobacco. The effect on quality was not as apparent in 1930, probably due to the very unusual season. The yield, however, was consistently in favour of high applications.

SOURCES OF POTASH

Sulphate, nitrate and carbonate of potash were included in the 1929 tests. A treatment including one-half muriate and one-half sulphate of potash was added in 1930. The results are compared in table 61.

TABLE 61.—SOURCES OF POTASH

Treatment No.	Sources of potash	Quantity of potash	Average yield per acre		Average grade index	
			1929	1930	1929	1930
		lb.	lb.	lb.	ct.	ct.
K1	Sulphate of potash	120	1,314	950	23·4	12·0
K5	Carbonate of potash	120	1,321	947	23·8	11·4
K6	Sulphate of potash	52	1,069	913	19·1	12·8
	Nitrate of potash	68				
K7	Sulphate of potash	60	.....	990	.....	12·0
	Muriate of potash	60				

These tests would indicate that nitrate of potash in the mixture had a depressing effect on yield in both years. Apart from this no significant differences are noted.

NO COMMERCIAL FERTILIZER

To further demonstrate the value of commercial fertilizer on dark-fired tobacco, quadruplicate plots receiving no fertilizer were included in the series. The results in table 62 compare plots receiving a complete fertilizer with those receiving no fertilizer treatment.

TABLE 62.—COMPLETE FERTILIZER VS. NO COMMERCIAL FERTILIZER

Treatment No.	Treatment	Average yield per acre		Average grade index		Returns per acre less fertilizer cost	
		1929	1930	1929	1930	1929	1930
		lb.	lb.	ct.	ct.	$	$
N1	Complete fertilizer (basal formula)	1,272	1,223	25·8	14·4	300 75	150 58
X	No commercial fertilizer	895	618	16·4	8·7	146 78	83 77

Even with a conservative yield, commercial fertilizer is shown to be highly profitable for dark-fired tobacco. The first year showed a return of $5.40 for every dollar spent for fertilizer in the basal treatment, while the second year realized $3.79.

DRILLING VERSUS BROADCASTING FERTILIZERS

Prior to 1929, duplicate plots one-twentieth acre in size received home-mixed fertilizer carrying 4 per cent nitrogen, 4 per cent phosphoric acid and 6 per cent potash, at the rate of 1,600 pounds per acre. In 1929 and 1930 one-fortieth acre plots were conducted in quadruplicate and received 2,000 pounds of home-mixed fertilizer per acre, carrying the same analyses as in previous years. The following table gives a summary of the yields on Burley and dark tobaccos for the past six years, brought to an acre basis:—

TABLE 63.—DRILLING VS. BROADCASTING FERTILIZERS

Method of application	Yield per acre						Average yield, 1925-30	Average grade index, 1929-30
	1925	1926	1927	1928	1929	1930		
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	ct.
Burley Tobacco—								
Drilled	1,713	1,325	1,653	1,789	1,614	1,113	1,535	18·3
Broadcast	1,588	1,120	1,706	1,745	1,510	1,073	1,457	15·4
Dark Tobacco—								
Drilled	.....	1,342	1,370	1,495	1,212	925	1,269	17·2
Broadcast	.....	1,090	1,360	1,450	930	855	1,137	13·5

The best method of applying fertilizer for tobacco depends largely on the season, type of tobacco grown, type of soil and quantity of fertilizer used. According to the results at the Harrow Station, however, on sandy soils and under average conditions, drilling the fertilizer in the row has proven superior to broadcasting it over the field. On the heavier soils both methods have given good results. It is necessary to slightly increase the quantity of fertilizer, however, when broadcasting is practised. The 1929 and 1930 grade index indicates that drilling gives finer leaf qualities than broadcasting on soils at this Station.

GENERAL TOBACCO FERTILIZER RECOMMENDATIONS

The standing committee on tobacco fertilizers, appointed at the Chatham conference in January, 1930, met at the Ontario Agricultural College, Guelph, on February 24 and 25, 1931, to consider the results of experimental work on tobacco fertilizers conducted in 1930, and to formulate fertilizer recommendations for the various types of tobacco grown in Ontario. The following recommendations were adopted by the committee and accepted by all interests concerned with tobacco fertilizers in Western Ontario who were in attendance.

FERTILIZERS FOR BRIGHT FLUE-CURED TOBACCO

1. Quantities of Fertilizers and Analyses of Mixtures:—
   (*a*) Use 600 to 700 pounds of a 4-12-8 mixture per acre; i.e., 4 per cent nitrogen, 12 per cent available phosphoric acid and 8 per cent potash. This quantity of fertilizer is practically equivalent to an application of 900 to 1,000 pounds of a 3-8-6 mixture per acre, but there are advantages in the use of a more concentrated mixture. The fertilizer should be applied with a drill and thoroughly mixed with the soil at least a week prior to transplanting.

   NOTE.—The foregoing analyses may be modified; provided the given ratios are maintained, the recommended sources of plant food materials given below are used, and the equivalent quantities of plant food are supplied.

2. Sources of Plant Food Materials:—
   (*a*) Nitrogen:—
      (1) Organic Sources.—At least one-quarter of the total nitrogen should be derived from high-grade organic materials of plant or animal origin, such as dried blood and cottonseed meal or high-grade tankage.
      (2) Inorganic or Mineral Sources.—At least one-quarter of the total nitrogen should be supplied from nitrate of soda, and the remaining half of the nitrogen should be derived from other standard inorganic materials such as sulphate of ammonia.

NOTE.—A portion of the inorganic nitrogen might be advantageously supplied from some of the synthetic products. Insufficient data are available at present, however, to warrant such a recommendation.

(*b*) Phosphoric Acid:—
(1) Derived from superphosphate.

(*c*) Potash:—
(1) Derived chiefly from sulphate of potash. The percentage of potash in the mixture should be about twice the percentage of nitrogen.

NOTE.—While muriate of potash is recommended in a limited way as a source of potash for flue-cured tobacco in the United States, insufficient information is available to warrant such a general recommendation under conditions in Western Ontario. In any case the percentage of chlorine in the total mixture should not exceed 2 per cent.

FERTILIZER FOR BURLEY AND DARK TOBACCOS

1. Analyses of Mixtures:—
(*a*) Lighter Soils.—Six per cent nitrogen, 8 per cent available phosphoric acid and 6 per cent potash.
(*b*) Heavier Soils.—Four per cent nitrogen, 12 per cent available phosphoric acid and 6 per cent potash.

NOTE.—The foregoing analyses may be modified, provided the recommended sources of plant food materials are used.

2. Quantity of Fertilizer:—
(*a*) Use 600 to 1,000 pounds drilled in the row and thoroughly mixed with the soil at least one week prior to transplanting. Very satisfactory results may also be obtained by broadcasting the fertilizer on the heavier soils, but it is usually necessary to slightly increase the rate of application where broadcasting is practised.

NOTE.—If analyses are modified as suggested under 1 (*a* and *b*), use equivalent quantities of plant food materials per acre.

If manure is applied at the rate of 10 to 12 tons per acre, the organic portion of the nitrogen should be reduced by one-quarter to one-third.

3. Sources of Plant Food Materials:—
(*a*) Nitrogen:—
(1) At least one-quarter of the nitrogen should be derived from high-grade organic materials of plant or animal origin, such as high-grade tankage, dried blood or cottonseed meal. The remainder of the nitrogen should be derived from standard inorganic sources, such as nitrate of soda, sulphate of ammonia and urea—one-quarter of the total nitrogen being derived from nitrate of soda.

(*b*) Phosphoric Acid:—
(1) Derived from superphosphate.
NOTE.—Some of the synthetic products, such as diammonphos and nitrophoska No. 3, appear very promising.

(*c*) Potash:—
(1) Derived from sulphate of potash, sulphate of potash magnesia, or possibly a small portion from high-grade muriate of potash. The percentage of chlorine in the mixture, however, should not exceed 2 per cent.

NOTE.—Any large quantities of muriate of potash occurring in the fertilizer should be guarded against, at least until more information is at hand in this connection.

Inasmuch as the results from Burley and dark tobacco fertilizer experiments are very similar, the recommendations for these two types are grouped under one heading.

We realize that the fertilizer used must vary somewhat over the district, depending on such factors as the type of soil, rotation and manure applied. However, the general recommendations presented above will serve as a guide for the present in tobacco fertilization.

MANURE TESTS ON BURLEY TOBACCO

VARYING QUANTITIES OF MANURE

Varying quantities of manure, consisting of 8, 12, 16, and 20 tons respectively, have been applied on four $\frac{1}{10}$ acre plots which were continuously cropped to the Standup Resistant variety of White Burley tobacco over a period of 15 years. In addition to the manure, each plot received an application of 4-8-6 commercial fertilizer at the rate of 1,000 pounds per acre. Table 64 gives a summary of the yields brought to an acre basis for the past five years.

TABLE 64.—QUANTITIES OF BARNYARD MANURE

Quantity of manure	Yield per acre					Average yield, 1926 to 1930	Average grade, index, 1929 to 1930
	1926	1927	1928	1929	1930		
ton	lb.	lb.	lb.	lb.	lb.	lb.	cts.
8	1,510	1,410	1,080	1,278	797	1,215	13·4
12	1,470	1,560	1,148	1,355	858	1,278	14·2
16	1,400	1,630	1,070	1,503	871	1,255	15·8
20	1,400	1,570	1,123	1,424	935	1,290	16·7

These plots have been receiving manure and commercial fertilizer for the past fifteen years and are evidently in a high state of fertility. Therefore, they now show but slight variations in yield. The highest application of manure, however, produced the best quality of leaf, as indicated by the two-year average grade index. The plot yields in 1930 were all much below the average, due to the very dry season. The grade index system of estimating quality was first applied to this experiment in 1929.

DIRECT VERSUS INDIRECT APPLICATIONS OF MANURE

This experiment was continued with Burley tobacco during the period covered by this report. An indirect application of manure was made in one case, applied to the corn crop preceding tobacco; while in the other case manure was applied in the spring directly to the tobacco crop. Both plots were spring ploughed, and the quantity of manure applied was the same in each case.

Over a period of years the direct method of application has given a higher average yield, but the quality of the leaf has varied from one season to another. The time of ploughing in the spring will, no doubt, have some effect on an experiment of this kind. Table 65 gives the results for the past five years and the average for this period.

TABLE 65.—DIRECT VS. INDIRECT APPLICATIONS OF MANURE (BURLEY)

Method of application	Yield per acre					Average yield per acre 1926-30	Average grade index, 1929-30
	1926	1927	1928	1929	1930		
	lb.	lb.	lb.	lb.	lb.	lb.	c.
Direct	1,523	1,594	1,485	1,663	887	1,430	15·9
Indirect	1,320	1,514	1,792	1,441	921	1,397	12·2

Manure applied indirectly to Burley tobacco evidently gives a better yield during a dry season, as was the case in 1930. The average grade index; however, calculated only for the past two years, shows the quality to be in favour of a direct application of barnyard manure to Burley tobacco in a four-year rotation.

CROP ROTATIONS WITH SPECIAL REFERENCE TO TOBACCO CULTURE

From a cultural standpoint crop rotation has many advantages in general farm practice. It not only keeps the soil in a good physical and mechanical condition by the addition of organic matter, but in many cases aids in the control of weeds, plant diseases and insect pests.

Series of large rotation plots were set apart at the Harrow Station in 1916 in an effort to study soil management in relation to tobacco culture. The plots have retained their identity from year to year and records kept of the yields of all crops produced and all fertilizers and manures applied to each plot.

CROP ROTATIONS FOR FLUE-CURED TOBACCO

In the management of flue-cured tobacco soils the main object is to hold the soil fertility, especially the nitrogen content, at a reasonably constant level; that is, if tobacco of a uniform quality is to be obtained. On the other hand, robbing the soil of its original fertility tends to affect the general quality of the tobacco crop as well as lower the yield.

The rotations followed in these experiments with flue-cured tobacco are as follows:—

(A) Four-year rotation—corn, tobacco, oats, hay.
(B) Four-year rotation—tobacco, corn, oats, hay.
(C) Five-year rotation—tobacco, corn, oats, hay, hay.

Rotation "A" received 8 tons of manure applied to the grass stubble for corn, and a complete fertilizer containing less than 3 per cent nitrogen applied to the tobacco crop. Rotations "B" and "C" received the same quantity of manure applied to the tobacco stubble for corn, with the same mixture of fertilizer applied to the tobacco crop.

The grass seed mixture for hay consisted of timothy, red top and a small quantity of red clover.

In the four-year rotation each plot has grown the four different crops (tobacco, corn, oats and hay) four times. The five-year rotation plots have been completed three times during this period. The yields obtained from the various crops in the rotations have been arranged according to the number of times each crop has been grown on the plots. The average yields of tobacco, oats, hay and corn grown between 1916 and 1930, inclusive, are found in table 66. The yields of tobacco and hay are expressed in pounds, and oats and corn in bushels.

TABLE 66.—CROP YIELDS (FLUE-CURED ROTATIONS)

Rotation designation	Yield per acre				Average of four crops
	1st crop	2nd crop	3rd crop	4th crop	
Flue-Cured Tobacco—					
"A"....lb.	727	1,185	1,164	1,167	1,061
"B"....lb.	1,030	1,317	1,318	1,414	1,270
"C"....lb.	934	1,250	1,417	.....	*1,200
Oats—					
"A"....bush.	30·5	31·2	32·8	31·1	31·4
"B"....bush.	34·9	39·0	37·5	61·1	43·1
"C"....bush.	27·9	28·1	40·7	.....	*32·1
Hay—					
"A"....lb.	2,532	2,702	2,553	2,747	2,633
"B"....lb.	1,719	2,284	2,948	3,142	2,524
"C"....lb.	1,391	2,102	2,787	.....	*2,093
Corn—					
"A"....bush.	34·2	54·3	44·7	30·0	40·8
"B"....bush.	34·7	61·0	48·0	40·3	46·0
"C"....bush.	39·8	49·7	34·1	.....	*41·2

*Average for three crops only.

In practically all cases the yields have been increased over the initial crop in the rotation. This would indicate that the soil fertility is not only being maintained but built up to some extent. The arrangement of the crops in the rotation, however, is a point of interest when growing flue-cured tobacco. Tobacco following the hay crop is rather coarse and somewhat unsuitable for the present day market; but following corn, as in rotation "A," the yield of tobacco is kept to a fairly constant level with a better average quality.

The yields of oats and hay in rotation "A" also indicate that the fertility is being maintained at a fair level while, in rotations "B" and "C" the yields have been considerably increased, indicating that the soil fertility has improved during this period. The corn crop reached its maximum yield the second crop in the different rotations. The reduction in yields from that period onward has been due largely to the destruction by the European corn borer.

From these results it would appear that soil fertility can be well maintained, if not increased, under the present system of soil management at the Station. With a cropping system suitable to maintain both the yield and quality of flue-cured tobacco, rotation "A" has been the most satisfactory rotation studied. There is a possibility, however, that a shorter rotation may be necessary for plots that have apparently become too fertile for flue-cured tobacco.

CROP ROTATIONS FOR BURLEY TOBACCO

The rotations conducted with Burley tobacco are as follows:—

(A) Three-year rotation—tobacco, corn, oats.
(B) Four-year rotation—tobacco, corn, oats, hay.
(C) Four-year rotation—corn, tobacco, oats, hay.
(D) Five-year rotation—tobacco, corn, oats, hay, hay.

In rotations "B" and "D" twelve tons of barnyard manure per acre were applied to the grass stubble for tobacco. The same application of manure was applied to the grass stubble for corn in rotation "C." In rotation "A" the same application of manure was applied to the oat stubble for tobacco. In addition to the manure the tobacco crop received a heavy application of home-mixed commercial fertilizer. The grass mixture consisted of timothy, red top and clover.

Table 67 gives the average results for the different crops in the various rotations. The crops are arranged according to the number of times they have been grown on the plot during the period 1916 to 1930, inclusive. The irregularity in yields of the hay crop has been largely due to winter-killing and drouth. The yields in table 67 are expressed either in pounds or bushels.

TABLE 67.—CROP YIELDS (BURLEY ROTATION)

Rotation designation	Yield per acre					Average
	1st crop	2nd crop	3rd crop	4th crop	5th crop	
Burley Tobacco—						
"A"....lb.	1,135	1,480	1,430	1,330	1,174	1,316
"B"....lb.	1,406	1,774	1,502	1,597	.....	1,570
"C"....lb.	1,305	1,639	1,254	1,399	.....	1,399
"D"....lb.	1,580	1,644	1,559	.....	.....	1,594
Oats—						
"A"....bush.	31·7	31·1	35·8	29·7	27·4	31·1
"B"....bush.	35·6	33·2	46·1	49·7	.....	41·1
"C"....bush.	26·8	31·5	61·1	52·8	.....	43·0
"D"....bush.	35·8	41·5	43·0	.....	.....	40·1
Hay—						
"B"....lb.	3,439	3,415	3,271	3,770	.....	3,474
"C"....lb.	4,308	.....	2,902	3,975	.....	3,728
"D"....lb.	3,688	3,115	4,587	.....	.....	3,797
Corn—						
"A"....bush.	24·4	53·6	51·4	32·3	21·8	36·7
"B"....bush.	39·1	65·9	43·0	31·9	.....	45·0
"C"....bush.	36·3	44·3	47·9	29·4	.....	39·5
"D"....bush.	43·2	66·5	37·0	.....	.....	48·9

In comparing the three, four and five-year rotations, it will be noticed that the three-year rotation ("A") has shown a gradual reduction in yield of tobacco, oats and corn for the last three crops. These plots were rather low in fertility at the beginning, and the general condition of the soil at the present time still indicates a lack of organic matter. However, the very dry seasons have been partially responsible for the light yields during the past two years. In comparison, the yields have been well maintained in the four-year and five-year rotations ("B," "C" and "D"), with the apparent indication that the hay crops have been beneficial in the maintenance of soil fertility.

The decrease in yield of corn was largely caused by the European corn borer, because during the past five years normal growth has been hindered by heavy infestations. Considering the tobacco from a quality standpoint, rotation "C" has given the best results for the present-day market. Tobacco following corn in a rotation tends to produce a thinner and brighter leaf than tobacco following a hay crop. Rotations "B" and "C" have also given good results but are best suited to the production of heavier bodied tobacco. The yields of other crops from these plots have also been very satisfactory.

CONTINUOUS PLANTING OF TOBACCO

FLUE-CURED

In 1925 an experiment was started with the object of continuing flue-cured tobacco on the same ground year after year. The soil in this field, being a light sandy loam, is fairly typical of the flue-cured soils on the Station. The plot received the same quantity of fertilizer each year and has been planted to the same variety, namely, Hickory Pryor. The field growth has been normal and the average yield of tobacco for the past six years has been 1,089 pounds. The quality of leaf has not been lowered by continuous planting to date. How-

ever, it is yet to be determined whether this type of tobacco can be successfully grown for a greater length of time on the same soil, and still maintain a good quality of leaf. The principal difficulties encountered with continuous planting of tobacco are in the control of such diseases as black root-rot and mosaic.

BURLEY

Tobacco has been planted on the same field for the fifteenth consecutive year. The soil in this plot is a light sandy loam with natural drainage, and receives an average of 14 tons of manure and 1,000 pounds of commercial fertilizer per acre each season. For the past five years it has been planted to Standup Resistant Burley.

The tobacco in this plot shows excellent growth each year and is usually quite free from mosaic. The average yield for the past five years, which includes two dry seasons, is 1,277 pounds of a fine bright tobacco suitable for cigarettes. Provided the soil is properly fertilized, it is believed that resistant strains of Burley can be successfully grown on the same soil for a number of years with good results.

VARIETY EXPERIMENTS WITH DIFFERENT TYPES OF TOBACCO

Variety experiments have been conducted for several years in a five-year rotation series of plots, and each variety has received the same treatment. Table 68 shows a summary of yields of some of the standard varieties for the past six years.

TABLE 68.—VARIETIES OF FLUE-CURED, BURLEY AND DARK TOBACCO

Variety or strain	Yield per acre						Average yield, 1925-30
	1925	1926	1927	1928	1929	1930	
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Flue-cured—							
Warne	1,686	1,185	1,385	1,691	1,592	1,282	1,470
Hickory Pryor	1,168	947	1,430	1,419	1,396	1,172	1,255
Burley—							
Station Standup	2,205	1,540	1,840	1,969	1,672	1,198	1,737
Standup Resistant	2,295	1,760	1,320	1,650	1,903	1,152	1,680
Judy's Pride	1,260	1,232	1,120	1,780	1,391	1,149	1,322
Broadleaf	2,070	2,068	1,960	1,875	1,917	1,258	1,858
Broadleaf Resistant	1,944	2,024	1,680	1,650	1,879	1,355	1,755
C.R.B.	1,260	1,298	1,760	1,688	1,606	1,030	1,440
Dark—							
Greenwood	1,890	1,782	1,400	2,062	1,669	1,148	1,659
Little Hill	1,800	1,892	1,780	1,562	1,538	920	1,582
Rudolph Improved	.....	1,540	1,560	1,812	1,716	1,213	1,568
One Sucker	.....	1,540	1,200	1,750	1,561	1,332	1,492
British Snuff	.....	.....	1,320	1,875	1,515	1,278	1,497
G.R. No. 11009	2,070	1,760	1,780	1,813	1,791	1,310	1,754
G. R. No. 11008	2,070	1,720	1,471	2,000	1,873	1,300	1,739
G.R. No. 11001	1,890	1,650	1,420	2,405	1,693	1,332	1,732

The results presented in the above table show that Warne has quite consistently given a greater yield per acre than Hickory Pryor during the six-year period in which these two standard flue-cured varieties have been compared. Although Hickory Pryor has produced a certain percentage of flashier, bright leaf, the Warne variety has produced a slighly superior quality of leaf in general.

Broadleaf produced the highest and Judy's Pride the lowest yields per acre of all Burley varieties considered in these tests. The yields of Station Standup and Broadleaf Resistant were also very good, while the yields obtained from Standup Resistant and C.R.B. were intermediate. These results were all obtained on healthy soil. When these varieties are compared on soil infested with black root-rot (*Thielavia basicola*) very different results are obtained, as will be seen in a subsequent comparison of resistant with non-resistant varieties.

The resistant strains of Green River or dark tobacco (11009, 11008 and 11001) gave the highest yields of any dark tobacco varieties tested on healthy as well as diseased soil. Greenwood ranked next, with Little Hill and the other varieties yielding somewhat lower.

VARIETAL RESISTANCE TO BLACK ROOT-ROT

A comparison was made between resistant and non-resistant varieties on healthy and diseased soil. The following table (69) presents comparative yields obtained from a number of varieties grown on soil heavily infested with black root-rot (*Thielavia basicola*) and also on healthy soil.

TABLE 69.—VARIETAL RESISTANCE TO BLACK ROOT-ROT

Variety or strain	Yield per acre on diseased soil		Yield per acre on healthy soil		Relative resistance 1930
	1929	1930	1929	1930	
	lb.	lb.	lb.	lb.	%
Flue-Cured—					
Warne (Harrow)	744	907	1,592	2,018	55·0
Hickory Pryor	.....	1,125	1,396	1,469	57·5
Burley (Resistant Varieties)—					
Standup Resistant	1,574	1,706	1,903	1,706	95·0
C.R.B	1,882	1,123	1,606	1,361	82·5
Broadleaf Resistant	1,025	1,447	1,879	1,596	72·5
Burley (Non-Resistant Varieties)—					
Station Standup	543	622	1,672	1,500	32·5
Judy's Pride	633	950	1,391	1,326	37·5
Broadleaf	178	907	1,917	1,691	52·5
Green Brier	640	680	1,425	1,283	40·0
Dark (Non-Resistant Varieties)—					
Greenwood	366	929	1,669	1,814	47·5
Little Hill	334	993	1,538	1,719	57·5
Rudolph Improved	278	756	1,716	1,875	47·5
One Sucker	122	843	1,561	1,719	57·5
British Snuff	325	1,021	1,515	2,026	50·0
Dark (G.R. Resistant Strains)—					
G.R. No. 11009	1,386	1,974	1,791	1,698	97·5
G.R. No. 11008	1,194	1,882	1,873	1,788	92·5
G.R. No. 11001	1,093	1,862	1,693	1,985	90·0

The yields in table 69 present a definite picture as to growth made by resistant as compared with non-resistant varieties grown on healthy and black root-rot infested soil. It will be noted that the standard flue-cured varieties are more resistant to black root-rot than the non-resistant varieties of either Burley or dark tobacco. However, the resistant Burley varieties and dark resistant strains are much more resistant than the standard flue-cured varieties, as shown by the yields obtained on diseased soil. To further substantiate these

results on relative resistance of different varieties, a definite number of roots from each variety was dug, washed and examined for black root-rot lesions. It should be borne in mind that resistance is of a relative nature and that the percentages given in table 69 are only specific for the 1930 season. The differences in relative resistance are usually greater during seasons with heavy rainfall.

CLASSIFICATION OF TOBACCO VARIETIES

In 1930 an experiment was started with a view of classifying commercial strains and varieties of flue-cured, Burley and dark tobaccos. Seed was obtained from various sources, both in Canada and the United States. This experiment included 55 flue-cured, 35 Burley and 42 dark varieties, making a total of 132 varieties and strains of tobacco.

Some of the points under study in this classification project are as follows: (1) type; (2) botanical and morphological differences within varieties and strains as related to inflorescence, habit of growth, etc.; (3) number of days for maturity; (4) seasonal conditions as affecting yield and quality; (5) relative resistance to disease; (6) value in relation to yield and quality; (7) general specifications as required by the trade; that is, cigarette versus pipe and chewing tobacco. The work is being carried on in co-operation with the staff of the Tobacco Division at Ottawa.

In the flue-cured type the first year's results indicate that a strain called Bonanza is quite outstanding in quality over the standard varieties at the Station. This strain was obtained from the North Carolina Agriculture Experiment Station. Another strain called Virgina Bright, obtained from W. W. Green, Bowling Green, Virginia, also showed good possibilities. During the 1930 season none of the Burleys or dark varieties were found to be superior to those already distributed from the Station.

VARIETAL ADAPTABILITY OF ONTARIO TYPES

FLUE-CURED VARIETIES

Warne has been the standard flue-cured variety in the past. It produces a medium-bodied leaf and ordinarily yields well. This variety is very hardy and is damaged less by winds than the Cash variety, for example. It is undoubtedly one of our best stalk-cut varieties from the standpoint of returns per acre under average conditions.

The Cash variety produces a flashy, bright-coloured leaf with less body than Warne. It usually yields from 100 to 200 pounds per acre less than Warne, and is typically a priming tobacco. During the 1930 season very good results were secured from priming Cash in Norfolk county, but the results were not entirely satisfactory in Essex county when Cash was harvested by the stalk-cut method.

Hickory Pryor has proven quite satisfactory in the past and produces a certain percentage of flashier bright-coloured leaf than Warne. Hickory Pryor ripens quite uniformly from the bottom to the top of the plant, resulting in a good stalk-cut variety. However, this variety appears to be somewhat more subject to the mosaic disease and is also more brittle at harvest time than Warne.

Gold Leaf resembles Warne quite closely in growth but produces a somewhat thinner leaf, resulting in a lighter yield. Although Gold Leaf is relatively a new variety in Ontario it appears very promising, especially in connection with the production of brighter flue-cured leaf.

BURLEY VARIETIES

The present trend is distinctly toward the cigarette type of Burley tobacco. The market demands a light-bodied and bright-coloured leaf, which we designate as the cigarette type. Standup Resistant naturally produces a light-bodied and bright-coloured leaf. The special merits of this variety are that it starts growing immediately after transplanting and is also distinctly resistant to black root-rot. This variety will make nearly as much growth on diseased black root-rot soil as on healthy soil, and has proven very satisfactory in this respect in the Blenheim, Ridgetown and Chatham districts. Standup Resistant has also proven to be a very satisfactory variety for the production of the cigarette type of leaf in demand.

Station Standup is recommended as a good general-purpose type of Burley when planted on healthy soil. Under favourable conditions the yield is good, the body is about average, and the colour is ordinarily good. However, Station Standup must be planted not more than 24 inches apart in the row to obtain the desired cigarette type of leaf quality. This variety is not resistant to black root-rot and makes a poor growth on diseased soil.

Judy's Pride is an old standard variety which has filled a satisfactory place in the demand for cigarette Burley during the past two years. This variety produces a thin, very bright-coloured leaf, if it is grown and cured under ideal conditions. However, if it is not properly matured in the field, poorer quality will result, as was the experience among growers this past season. This variety is also very susceptible to black root-rot and a poor growth will result if planted on diseased soil.

Broadleaf Resistant is a variety that has proven very satisfactory on the gravelly soils in the Chatham district in the past, having been grown previously to a large exent for the export trade. It produces a somewhat lighter-bodied leaf than the old-fashioned Broadleaf variety. Broadleaf Resistant is quite resistant to black root-rot, but does not produce as satisfactory a type of leaf for cigarette purposes as Standup Resistant. Both Broadleaf Resistant and Broadleaf are being grown to a lesser extent each year as a result of the greater demand for a thin, bright leaf, and the existence of these two varieties depends largely on the demand for export Burley.

C.R.B. is a new resistant variety and has some possibilities as a cigarette type of Burley. This new variety appeared quite promising in our tests at the Station, and during the past season a number of growers tested it out in the Blenheim district and elsewhere. In the opinion of the majority of these men it did not come up to the standard of Standup Resistant.

DARK VARIETIES

Greenwood is the standard dark variety which has been highly recommended. A rather narrow leaf with heavy body characterizes this variety, and under favourable conditions it cures a very even colour. The leaf is also very smooth as compared with some varieties.

Little Hill is also a fairly well recommended variety. Ordinarily the yield is quite comparable to that of Greenwood, but Greenwood produces a smoother leaf and cures more evenly than Little Hill. Both of these varieties are very susceptible to black root-rot.

Resistant strains of dark tobacco are being developed on the Station. However, further selection is necessary to prove the value of these strains for wrapper production.

CULTURAL EXPERIMENTS

FALL VERSUS SPRING PLOUGHING FOR BURLEY TOBACCO

Two plots in a four-year rotation received the same quantity of manure and fertilizer and were given same cultural treatments in general, except that one plot was manured and ploughed in the spring and the other was manured and ploughed in the fall. This test has been conducted over a period of years, and table 70 shows the results obtained.

TABLE 70.—FALL VS. SPRING PLOUGHING FOR TOBACCO

Treatment	Yield per acre					Average yield, 1925-29
	1925	1926	1927	1928	1929	
	lb.	lb.	lb.	lb.	lb.	lb.
Fall ploughing and manuring	1,532	1,566	2,059	1,911	1,796	1,773
Spring ploughing and manuring	1,486	1,450	2,007	1,725	1,689	1,671

The results given in table 70 show that over a period of years fall ploughing and manuring has proven superior to spring ploughing and manuring from the standpoint of yield. Fall ploughing for Burley tobacco also offers a better distribution of labour and aids in the control of certain insect pests.

DATES OF HARVESTING BURLEY TOBACCO

Station Standup was harvested at various intervals, namely, 21, 28 and 35 days after topping, in an effort to determine the effect of different dates of harvesting (length of time after topping) on yield and general leaf qualities of Burley tobacco. The average yields and grade value of these tests for 1929 and 1930 are presented in table 71.

TABLE 71.—DATES OF HARVESTING BURLEY TOBACCO

Date harvested	Visible signs of maturity	Average yield per acre, 1929-30	Average grade index, 1929-30	Gross return per acre
		lb.	ct.	$
21 days after topping	33 per cent mottled.	1,355	14·3	193·77
28 days after topping	76 per cent mottled.	1,339	16·7	222 61
35 days after topping	93 per cent mottled.	1,439	17·9	257 58

The value of maturity in Burley tobacco is fully demonstrated by this test. At 21 days after topping the tobacco was considered about 33 per cent mature, as judged by the yellow mottling of the leaves. When harvested at this stage and compared with later cuttings, the tobacco had not reached its maximum yield. The grade value at 21 days after topping was also considerably lower than when the tobacco remained in the field after topping a week or two longer. At 93 per cent maturity, or 35 days after topping, the grade value was further improved with an average increase of 100 pounds in yield per acre during these dry seasons.

From two years' results in this experiment it appears that, in order to obtain maximum quality with this variety of tobacco, the crop should be left standing in the field at least 28 days after topping. However, the abnormally dry seasons in which this experiment was conducted undoubtedly had some effect on the rate of maturity.

TOPPING AND SUCKERING BURLEY TOBACCO

A project was started in 1929 to determine the effect of different heights and stages of topping, combined with various degrees of suckering, on the yield and quality of Burley tobacco. Distance of planting was also taken into consideration in these tests. Two varieties, Station Standup and Judy's Pride, were chosen for this experiment.

Continuous planting with Burley tobacco. The plot in the foreground is infested with black root-rot as the result of continuous planting. It was uniformly fertilized and all planted on the same day. The rows to the left of stake No. 4 were planted to Station Standup, a non-resistant variety. The rows to the right were planted to Standup Resistant.

The distances of planting in the row were 21, 24 and 28 inches with Station Standup, and 18, 21 and 24 inches with Judy's Pride. Early and late topping were considered at the early bud and early flower stages, respectively. In the low topping 12 to 14 leaves were left on the plant, and in the high topping 15 to 17 leaves. Frequent suckerings were made when the suckers were 3 to 4 inches long, as compared with one suckering which was made just previous to harvesting.

The results of this experiment are presented in table 72.

TABLE 72.—TOPPING AND SUCKERING BURLEY TOBACCO

Distance planted	Stage topped	Height topped	Times suckered	Average yield per acre	Average grade index
in.				lb.	ct.
Judy's Pride—					
18	Early bud	Low	Often	1,436	17·4
18	Early bud	Low	Once	1,112	14·0
18	Early flower	High	Once	1,420	14·7
21	Early bud	Low	Often	1,344	17·6
21	Early bud	Low	Once	1,277	15·9
21	Early flower	High	Once	1,610	15·3
24	Early bud	Low	Often	1,318	19·1
24	Early bud	Low	Once	1,173	15·1
24	Early flower	High	Once	1,373	14·5
Station Standup—					
21	Early bud	Low	Often	1,274	18·9
21	Early bud	Low	Once	1,006	15·1
21	Early flower	High	Once	1,396	17·6
24	Early bud	Low	Often	1,465	17·7
24	Early bud	Low	Once	1,440	12·4
24	Early flower	High	Once	1,190	13·9
28	Early bud	Low	Often	1,329	19·7
28	Early bud	Low	Once	1,062	17·3
28	Early flower	High	Once	1,305	14·9

The best grade index was obtained in these tests where Burley tobacco was topped low in the early bud stage and suckered often, regardless of distance of planting. Both yield and quality were improved when the plants were suckered several times, as compared with one suckering just previous to harvest. If suckers are permitted to grow until the time of harvest they constitute a considerable portion of the developing plant and the result is a lighter yield of cured leaf. There were no great differences in yields obtained in low and high topping; however, tobacco topped high consistently resulted in a poorer grade index than when topped low and suckered often. The yields were not materially affected by the distance of planting in these tests, but closer planting tended toward the production of a higher percentage of bright leaf which is more suitable for cigarette purposes.

From a trade standpoint, the cigarette manufacturer is more vitally interested in the fluffier, brighter leaves on the Burley plant which, of course, are generally produced on the lower half of the plant. Whether the type of leaf on the upper portion of the plant can be sufficiently changed to suit the trade through cultural operations is still an experimental problem. However, the experimental work in progress at present definitely proves that cultural operations materially influence the type of leaf produced.

TOPPING AND PRIMING DARK TOBACCO

Experiments were started in 1929 to study the effects of topping and priming on maturity, yield and general leaf qualities of dark tobacco. The combined effects of early and late topping, with high and low topping and priming were studied in these tests.

The terms early and late topping represent the early bud and early flower stages, respectively. Height of topping is designated as either low or high. In the case of low topping, the plants were topped to 8 or 9 leaves, while high topping represented 11 to 12 leaves on the plant. Height of priming (the term being used to represent trimming off the bottom leaves at topping time) was represented by low priming, removing 3 leaves; intermediate priming, 5 leaves; and high priming, 6 to 7 leaves. Priming preceded topping in all cases in these experiments.

These tests were all conducted on the Greenwood variety of dark-fired tobacco. The following table (73) gives the average results of these various cultural operations, on duplicate plots, for the years 1929 and 1930.

TABLE 73.—TOPPING AND PRIMING DARK TOBACCO

Stage of topping	Height of topping	Degree of priming	Average yield per acre, 1929-30	Average grade index, 1929-30	Gross returns per acre
			lb.	ct.	$
Early	Low	Intermediate	1,227	18·5	227 00
Early	High	Intermediate	1,287	15·3	196 91
Early	Low	Low	1,229	18·2	223 68
Early	High	High	1,166	18·6	216 88
Late	Low	Intermediate	1,086	18·0	195 48
Late	High	Intermediate	1,228	13·2	162 10

The best gross return per acre was obtained from early and low topping with intermediate priming. Apparently good results can also be obtained from high topping and high priming, which means carrying the same number of leaves as in the low topping, at a higher level on the plant. From these results there appears to be a close correlation between height of topping and degree of priming in dark tobacco. It is quite evident from these data that dark tobacco must be topped low and primed high to secure the best results.

DISTANCES OF PLANTING TOBACCO

Tests were conducted during the past two seasons to determine the effect of different distances of planting on yield and general quality of tobacco. Table 74 gives the average results of 1929 and 1930 with flue-cured, Burley and dark-fired tobaccos.

TABLE 74.—DISTANCES OF PLANTING TOBACCO

Distance between plants in the row	Distance between the rows	Average yield, 1929-30	Grade index, 1929-30	Gross returns per acre
in.	in.	lb.	ct.	$
Warne (Flue-cured)—				
18	36	1,202	18·2	187 64
21	36	1,112	20·5	227 96
24	36	1,075	16·8	180 60
Hickory Pryor (Flue-cured)—				
18	36	973	20·3	197 52
21	36	956	21·8	208 41
24	36	1,074	17·1	183 65
Station Standup (Burley)—				
21	42	1,337	17·3	231 30
24	42	1,287	18·9	243 24
28	42	1,308	18·6	243 29
*Standup Resistant (Burley)**—				
18	.....	1,446	14·4	208 22
21	.....	1,457	14·6	212 72
24	.....	1,425	15·3	218 03
Judy's Pride (Burley)—				
18	42	1,242	16·9	209 90
21	42	1,388	17·6	244 29
24	42	1,302	19·9	259 10
Greenwood (Dark-fired)—				
24	42	1,232	12·6	155 23
28	42	1,254	15·3	191 86
32	42	1,082	14·6	157 97

*Results for 1930 only.

The most advantageous distance for planting tobacco depends considerably on variety of tobacco grown, soil fertility and quantity of fertilizer applied.

The results obtained at this Station during these two dry years indicate that flue-cured tobacco set 21 inches apart in the row will give the most satisfactory results and returns per acre. However, closer planting may prove even more satisfactory in a season with normal rainfall.

Where Burley is grown for export the thinner planting will give a heavier, longer leaf, while closer planting has a tendency to produce a thinner, brighter leaf more suitable for cigarette purposes. Burley tobacco should not be planted more than 24 inches apart in the row to secure the thin, bright, cigarette type of leaf in demand at present. In Kentucky, Burley tobacco is often planted closer than this distance and topped high, which results in less weight per individual leaf. However, with our shorter season in Ontario, we must strive toward producing the lighter body and brighter colour of leaf by closer planting alone.

Setting plants 28 inches apart in the row appears to be most satisfactory for the production of good wrappers in dark air-cured and dark fire-cured tobaccos.

MULCH PAPER EXPERIMENTS

In 1929 a new project was undertaken with the object of determining the effect of mulch paper on flue-cured tobacco, as well as the effect on conditions in the soil created by the paper mulch. Mulch paper known under the trade name of "Gator Hide" was employed in these tests. Five plots ·0125 of an acre in size were devoted to this experiment—three under paper, and two checks. The tobacco was planted in the usual way, in rows 38 inches apart and 21 inches in the row. Following transplanting, strips of paper 18 inches in width were placed on either side of each row and held down by wire staples. Except for no cultivation on the mulch plots, all plots received the same cultural treatments and were harvested and cured together.

Soil thermometers were placed in each plot and regular temperature readings were taken three times daily from June 20 until August 20. During the first year considerable difficulty was encountered in holding the narrow strips of paper in place, due to wind velocity at the Station. In 1930 an improvement was made in laying the paper. Full-width strips were laid before transplanting and the edges of the paper were covered with soil. This method of holding the paper in place proved very satisfactory. Transplanting was done by hand through the three-inch cross slits in the paper. A handful of soil kept the edges of these openings covered and also prevented burning of the plants.

As the results for 1929 and 1930 are contradictory, it is very difficult to draw any conclusions as to yield and quality of cured leaf until more information is obtained. The yields and quality of tobacco obtained on these plots are given in table 75.

TABLE 75.—MULCH PAPER ON TOBACCO

Treatment	Average yield per acre		Average grade index	
	1929	1930	1929	1930
	lb.	lb.	ct.	ct.
Mulch paper	1,038	1,029	28·9	23·7
No mulch paper	1,014	1,135	31·4	16·6

In the first year's results the effect of paper mulch on yield in flue-cured tobacco was insignificant. The value of the tobacco, however, was in favour of the unmulched plots, as indicated by the grade index. The second year's

results show the opposite effects, the mulch plots giving the lower yield and a decidedly higher grade index than the unmulched plots.

The differences in soil temperatures recorded in this experiment, however, are significant, as will be noted from the data presented in table 76, which represent the average temperatures recorded from June 20 to August 20 in both the mulched and unmulched plots.

TABLE 76.—SOIL TEMPERATURES IN MULCH PAPER EXPERIMENT

Time	Soil temperatures					
	Mulched		Unmulched		Difference	
	1929	1930	1929	1930	1929	1930
	°F.	°F.	°F.	°F.	°F.	°F.
8.00 a.m.	69·97	72·42	70·01	70·97	*0·04	1·45
1.30 p.m.	81·18	86·93	80·15	83·18	1·03	3·75
5.30 p.m.	84·30	88·01	83·18	84·62	1·12	3·39

*In favour of the unmulched plots.

The soil temperature differences between the mulched and unmulched plots were more pronounced in 1930, the soil temperatures in the mulched plots being consistently higher than in the unmulched plots. These differences increased considerably as the day progressed, a fact which may be of particular importance under cooler climatic conditions.

ANIMAL HUSBANDRY

STUDIES ON WINTER FEEDING OF STEERS AND HOGS

A project on feeding steers and hogs was started in 1923 and was continued during the period covered by this report. These studies were conducted in an effort to market roughage and other feeds produced on the farm, through steers and hogs, at a profit. The production of manure sufficient for the needs of the farm was also considered in these tests. As the number of steers and hogs and the feed rations varied in the two feeding periods considered in this report, each feeding period will be discussed separately.

FEEDING PERIOD 1927-28

The twenty-five mixed grade steers which were fed during the winter of 1927 and 1928 were purchased from a stockman near Woodstock, Ont. They arrived at the Station on October 22 and after a day's feed in the barnyard were put on pasture until November 24. At this time they were brought to the barnyard where they were fed until sold. The feeding was done in a shed but the steers were allowed to run in the barnyard with access to water at all times.

At the outset of this feeding period the entire lot was fed a ration consisting of corn on the stalk and alfalfa hay. They were fed all they would consume of these feeds until December 28. From this date on the steers were fed an average of twelve pounds of corn and fourteen pounds of alfalfa hay per head daily with an occasional feed of chopped oats and oil cake meal and all the shredded corn fodder they would eat. The steers made a good gain in weight and were considered fairly well finished at the time they were sold on April 10.

Thirty-five shoats were purchased locally and turned into the barnyard to follow the steers in an effort to determine the cost of producing pork under these conditions. As the steers were fed rather heavily on ear corn, considerable corn was available for the hogs, but the feed they picked up was supplemented with sufficient corn to keep them in a thrifty condition. They were finished

on corn and moistened oat chop. The entire lot of hogs made a good gain under these circumstances and was in very good condition when sold on April 26. The following tabulations present the results obtained in these studies.

STEER FEEDING RESULTS 1927–28

Number of steers in lot at beginning of experiment		25
Original cost of 25 steers at $7.45 per cwt.	$	1,692 64
Gross weight at shipping point (25 steers)		22,720 pounds
Average weight of steers at beginning of feeding period		908·8 pounds
Number of days on feed		170
Gross weight at end of feeding period (25 steers)		27,554 pounds
Total gain during feeding period		4,834 pounds
Average gain per steer		193·4 pounds
Daily gain per steer		1,14 pounds
Gross cost of feed for period	$	848 53
Cost per pound of gain during period	$	0·1755
Total cost of steers and feed consumed	$	2,541 16
Net selling price at $9.50 per cwt. (25 steers)	$	2,617 63
Total gain on lot	$	76 47
Average valuation of steers at beginning of experiment	$	67 71
Average valuation of steers at end of experiment	$	104 71
Average increase in value of steers	$	37 00
Average cost of feed per steer	$	33 94

FEED CONSUMED BY STEERS 1927–28

526·7 bushels corn at 75 cents per bushel	$	395 03
62·0 bushels oats at 50 cents per bushel		31 00
Cost of chopping oats		2 00
100 pounds oil cake meal at 3½ cents per pound		3 50
9½ acres of corn fodder at $3 per acre		28 50
33,500 pounds corn in fodder estimated 29 per cent corn		91 00
29¾ tons of alfalfa hay at $10 per ton		297 50
Total	$	848 53

RESULTS WITH HOGS FOLLOWING STEERS 1927–28

Number of hogs in lot at beginning of experiment		35
Gross weight at beginning of experiment (35 hogs)		2,630·83 pounds
Average weight of hogs at beginning of experiment		75·17 pounds
Average number of days in barnyard		178
Gross weight at end of experiment		8,299·00 pounds
Average weight of hogs at end of experiment		237·11 pounds
Gross gain on lot during experiment		5,668·17 pounds
Original cost of hogs at $10 per cwt.	$	263 08
Total cost of feed charged to hogs	$	47 84
Total cost of hogs and feed	$	310 92
Net selling price—8,299 pounds at $8.77 per cwt.	$	727 82
Net profit on lot	$	416 90

FEED CHARGED TO HOGS

18·8 bushels oats chopped at 50 cents per bushel	$	9 40
Cost of chopping grain		0 62
41·1 bushels corn at 75 cents per bushel		30 82
3½ bushels soybeans at $2 per bushel		7 00
Total	$	47 84

The data given in the winter steer feeding studies of 1927-28 show that a profit of $76.47 was realized, in addition to the manure produced which has not been included in these calculations. If the 200 tons of manure produced are valued at $2 per ton, the total profit realized on this lot of steers would be $476.47. A profit of $416.90 was also realized on the lot of thirty-five hogs during this feeding period, which shows that pork was produced at a good profit in this manner.

FEEDING PERIOD 1928-29

Twenty-four mixed grade steers were shipped to the Station from near Ottawa for the winter steer feeding studies in 1928-29. They arrived on October 23 in good condition and were put on pasture after being fed and watered in the barnyard. As a result of very favourable weather they were pastured late, but on December 8 they were brought to the barnyard for the remainder of

the feeding period. The conditions under which they were fed were very similar to those of the year previous. The ration for the entire lot consisted of corn on the cob, alfalfa hay, shredded corn fodder and a small quantity of chopped barley, oats, and wheat. The corn and alfalfa hay were fed in the morning and night, the chop and corn fodder at noon. The quantity of both corn and hay was gradually increased as the feeding period progressed. They were fed as much corn fodder as they would consume. The steers made a fair gain in weight and were considered medium well finished when sold.

Twenty-eight Duroc shoats were purchased locally and turned into the barnyard on December 28 to follow the steers. These shoats were fed very similarly to the previous lot described. The hogs also did very well during this feeding period, following the steers, and were in very good condition when sold. The following tabulations give the feed costs and results of the 1928-29 studies.

STEER FEEDING RESULTS 1928–29

Number of steers in lot at beginning of experiment		24
Net cost of 24 steers at average of $10.12 per cwt.	$	1,824 18
Freight from near Ottawa and feed en route	$	81 95
Original gross cost of 24 steers, including freight	$	1,906 13
Gross weight off car at Harrow (24 steers)		18,028·8 pounds
Average weight at beginning of experiment		751·2 pounds
Average weight when taken from pasture		856·8 pounds
Total gain for steers on pasture (45 days)		2,534·4 pounds
Average gain of steers on pasture		105·6 pounds
Gross weight at beginning of feeding period in barn-yard		20,593·2 pounds
Average number of days on feed for lot		144
Gross finished weight at end of feeding period		23,120·0 pounds
Total gain on lot of steers		5,091·2 pounds
Average gain per steer while feeding		106·53 pounds
Daily gain per steer on feed		0·74 pounds
Gross cost of feed for period	$	661 10
Cost per pound of gain during feeding period		25·86 cts.
Total cost of steers and feed consumed (including pasture)	$	2,567 23
Net selling price at $9.75 per cwt	$	2,254 20
Total loss on sale of steers	$	313 03
Average valuation of steers at start	$	79 42
Average valuation of steers at finish	$	93·925
Average increase in value of steers	$	14·505
Average cost of feed per steer	$	27·550

FEED CONSUMED BY STEERS 1928–29

414·6 bushels corn at 75 cents per bushel	$	310 95
33·0 bushels wheat at 80 cents per bushel		26 40
27·0 bushels barley at 75 cents per bushel		20 25
65·0 bushels oats at 50 cents per bushel		32 50
Cost of chopping grain		4 10
20·6 tons alfalfa hay at $10 per ton		206 00
14 acres corn fodder at $3 per acre		42 00
45 days on pasture at 1¾ cents per day per steer		18 90
Total cost of feed and pasture	$	661 10
Total cost of feed alone	$	642 20

RESULTS WITH HOGS FOLLOWING STEERS 1928–29

Number of hogs in lot at beginning of experiment		28
Gross weight at beginning of experiment (28 hogs)		3,320 pounds
Average weight of hogs at beginning of experiment		118·57 pounds
Average number of days in barnyard		115
Gross weight at end of experiment		6,384 pounds
Average weight of hogs at end of experiment		228 pounds
Gross gain on lot during experiment (28 hogs)		3,064 pounds
Average gain per hog during experiment		109·43 pounds
Average daily gain per hog during experiment		·951 pounds
Original cost of hogs at $8.75 per cwt	$	290 50
Total cost of feed charged to hogs	$	107 60
Total cost of hogs and feed	$	398 10
Net selling price—6,384 pounds at $11·3486 per cwt	$	724 50
Net profit on lot	$	326 40

FEED CHARGED TO HOGS

15 bushels wheat at 80 cents per bushel	$ 12 00
27 bushels oats at 50 cents per bushel	13 50
Cost of chopping oats and wheat	1 40
102 bushels corn at 75 cents per bushel	76 50
210 pounds mixed soybeans at 2 cents per pound	4 20
Total	$ 107 60

As a result of the relatively high purchase price and freight charges, the above data show a loss on this lot of steers. However, approximately 200 tons of manure were also produced during this feeding period, which would compensate for the loss on feed and still show a small profit. A good profit was again shown on the hogs following steers this year, amounting to a total of $326.40.

SUMMARY

When the manure produced in these studies is considered, an average profit of $281.72 per feeding period is shown on these two lots of steers. An average profit of $371.65 per feeding period is also shown on the two lots of shoats which were fed.

More gain per pound of feed consumed and also more profit was shown from the hogs than from the steers when fed in this manner.

These results show that, under normal market conditions, feeding steers followed by hogs is an effective method of marketing roughage and other feeds produced on the farm.

FIELD HUSBANDRY

Experiments in field husbandry, which include studies of various rotations and soil fertility investigations, have, in the past, been considered chiefly from the standpoint of a specific crop (tobacco) and, in consequence, the results obtained from this work are principally discussed in that portion of the report which particularly deals with tobacco.

Preliminary investigations on weed control were initiated in 1930. These studies were conducted to determine whether a correlation existed between the length of rotation and the type and number of weeds present. The information obtained during the past season indicates that a correlation does exist between the number of weeds present and the length of the rotation, inasmuch as fewer weeds were present in the shorter rotations. As hoed crops occurred in all rotations studied, the results would also indicate that weeds are more easily controlled where hoed crops occur more frequently in a rotation.

COST OF PRODUCTION STUDIES

Cost of production records were kept on various crops, principally in rotations, produced on the Station during the three-year period, and in most cases are considered in this portion of the report as a three-year average. The crops included in the three-year rotations are tobacco, corn and oats, while those used in the four-year rotations are tobacco, corn, oats, and mixed hay. Certain fixed charges are made in connection with such items as land rental, machinery, buildings, manure, etc. Due consideration must be given these fixed prices, yields, and produce values because these items vary greatly throughout the district. The labour costs in connection with these studies are undoubtedly higher than the average throughout the district, because the work on experimental plots involves slightly more labour and a special effort is also made to keep these plots in good tilth and free from weeds at all times. The yields of most crops also vary considerably, depending on the season. For example, the very dry season in 1930 caused light yields on the Station, and as a result

the cost per pound of producing most crops was considerably higher than in the past. The 1928 season was quite normal in this respect, while the 1929 season was intermediate. While these calculations may not represent the true costs of producing various crops under all conditions throughout the district, they do form a basis for definite comparisons between the costs in connection with the different crops. Data on certain of these costs of production studies appear in the following tabulations.

FIXED CHARGES (BASED ON ONE ACRE)

Land rental (7 per cent interests on cost) all crops	$ 15 00
Use of machinery (tobacco)	3 00
Use of machinery (corn, oats or hay)	2 85
Rent of buildings and lath (Burley tobacco))	17 00
Rent of buildings and lath (flue-cured tobacco)	10 00
Cost of tobacco plants (flue-cured tobacco)	12 00
Cost of tobacco plants (air-cured tobacco)	9 00
Cost of manure at $2 per ton charged to all crops as follows:—	
Three-year rotation:—	
1st year's crop	50 per cent
2nd year's crop	30 "
3rd year's crop	20 "
Four-year rotation:—	
1st year's crop	40 "
2nd year's crop	30 "
3rd year's crop	20 "
4th year's crop	10 "
Cost of mixed fertilizer charged to all crops:—	
1st year's crop	55 per cent
2nd year's crop	30 "
3rd year's crop	10 "
4th year's crop	5 "
Nitrate of soda or sulphate of ammonia applied alone:—	
1st year's crop	80 "
2nd year's crop	20
Cost of arsenate of lead for tobacco	$ 3 00
Cost of fuel for flue-cured tobacco	15 00
Labour—cost per hour of man and team	0 50
Labour—cost per hour of man	0 30

COST OF PRODUCING BURLEY TOBACCO IN A FOUR-YEAR ROTATION

(Two-year Average)

Rent of land	$ 15 00
Rent of machinery	3 00
Rent of barn and lath	17 00
Cost of plants	9 00
Cost of spray materials	3 00
Cost of fertilizer (55 per cent)	13 10
Cost of manure (40 per cent)	9 60
Labour—man and horse	109 22
Average total cost per acre	$ 178 92
Average yield per acre (pounds)	1,773
Average cost per pound	10·1 cents
Average value at 19 cents per pound	$ 336 87
Average profit per acre	$ 157 95

COST OF PRODUCING FLUE-CURED TOBACCO IN A FOUR-YEAR ROTATION

(Three-year Average)

Rent of land	$ 15 00
Rent of machinery	3 00
Rent of barn and lath	10 00
Cost of plants	12 00
Cost of spray materials	3 66
Cost of fertilizer (55 per cent)	8 55
Cost of manure (30 per cent)	4 80
Fuel for curing (coal)	18 07
Labour—curing	29 51
Labour—man and horse	109 74
Average total cost per acre	$ 214 33

Average yield per acre (pounds)	1,179
Average cost per pound	18·2 cents
Average value at 30 cents per pound	$ 353 70
Average profit per acre	139 37

Cost of Producing Flue-cured Tobacco (Continuous Planting)

(Three-year Average)

Rent of land	$ 15 00
Rent of machinery	3 00
Rent of barn and lath	10 00
Cost of plants	12 00
Cost of spray materials	3 66
Cost of fertilizer (total)	15 99
Fuel for curing (coal)	18 07
Labour—curing	29 51
Labour—man and horse	97 94
Average total cost per acre	$ 205 17
Average yield per acre (pounds)	1,099
Average cost per pound	18·7 cents
Average value at 30 cents per pound	$ 329 70
Average profit per acre	124 53

Cost of Producing Dark-fired Tobacco in a Four-year Rotation

(Three-year Average)

Rent of land	$ 15 00
Rent of machinery	3 00
Rent of barn and lath	22 50
Cost of plants	8 00
Cost of spray materials	3 66
Cost of fertilizer (55 per cent)	12 50
Cost of manure (40 per cent)	9 60
Fuel for curing (wood)	8 66
Labour—curing	12 08
Labour—man and horse	93 11
Average total cost per acre	$ 188 11
Average yield per acre (pounds)	1,229
Average cost per pound	15·3 cents
Average value at 18·3 cents per pound	$ 224 91
Average profit per acre	36 80

Cost of Producing Corn in a Four-year Rotation

(Three-year Average)

Rent of land	$ 15 00
Rent of machinery	2 85
Cost of manure (16⅔ per cent)	3 20
Cost of fertilizer (13⅓ per cent)	3 16
Cost of seed	0 38
Labour—man and horse	26 83
Average total cost per acre	$ 51 42
Average yield per acre (bushels)	34·45
Average cost, including fodder	$ 1 49
Average value of fodder	4 00
Average value of corn at $1 per bushel	34 45
Average loss per acre	12 97

Note.—Corn borer damage mainly responsible for low yields.

Cost of Producing Oats in a Four-year Rotation

(Three-year Average)

Rent of land	$ 15 00
Rent of machinery	2 85
Cost of seed	1 85
Cost of manure (20 per cent)	4 80
Cost of fertilizer (10 per cent)	2 26
Threshing at 4½ cents per bushel	2 21
Labour—man and horse	8 80
(One-half cost preparing land and seeding chargeable to grass).	
Average total cost per acre	$ 37 77

Average yield per acre (bushels)	52·8
Average cost of oats per bushel	71·5 cents
Average value of oats at 50 cents per bushel	$ 26 40
Average value of straw per acre	7 00
Average loss per acre	4 37

Cost of Producing Winter Wheat in a Four-year Rotation

(One year only)

Rent of land	$15 00
Rent of machinery	2 85
Cost of seed	3 00
Cost of manure (20 per cent)	4 80
Cost of fertilizer (30 per cent)	5 40
Threshing at 6½ cents per bushel	2 47
Labour—man and horse	9 70
Average total cost per acre	$ 43 22

Average yield per acre (bushel)	38
Average cost of wheat per bushel	$ 1 14
Average value of wheat per acre	45 60
Average value of straw per acre	7 00
Average profit per acre	9 38

Note.—This rotation was discontinued in 1929.

Cost of Producing Alfalfa Hay

(Three-year Average)

Rent of land	$ 15 00
Rent of machinery	2 85
Cost of seed (⅓)	1 57
Cost of manure (10 per cent)	1 80
Preparing land and seeding (⅛ cost)	1 63
Labour—man and horse	7 23
Average total cost per acre	$ 30 08

Average yield per acre (2 cuttings) (pounds)	pounds 6,156
Average cost of hay per ton	$ 9 77
Average value of hay at $12 per ton	36 94
Average profit per acre	6 86

CEREALS

The oat and wheat varieties studied during the three-year period were planted in standard rod-row plots. Four replications were conducted with each variety in addition to the seed plots. Some mixing occurred in the seed plots previous to 1930. Each seed plot previously consisted of five rows, three of which were rogued and harvested for seed, leaving one border row on either side. A new supply of seed was secured from the Cereal Division, at Ottawa, and seven rows were planted in each seed plot included in the 1930 tests, which left two border rows on either side. No mixing was apparent with this method of double border rows.

Most of the yields obtained in 1930 were somewhat lower than in previous years, due to the very dry growing season. However, the yields of wheat were affected much more than the yields of oats. The best yield of wheat was secured in 1928.

OAT VARIETIES

Thirteen varieties of oats were previously included in the oat variety experiment. Two varieties were added in 1929, namely, Gopher and Star. The two very early maturing varieties, Alaska and O.A.C. No. 3, were stolen from all four replications in 1929.

Data were obtained on such points as the number of days to maturity, length of straw and weight of 1,000 kernels, and are given in table 77.

TABLE 77.—OAT VARIETY STUDIES (1930)

Variety	Average number days maturing	Average length of straw	Weight per 1,000 kernels
		in.	gram.
Mansholt	103	30·3	29·80
Columbian	103	33·0	32·20
O. A. C. No. 72	103	34·8	31·20
Victory	103	32·3	28·72
Irish Victor P	102	33·0	26·00
Prolific	103	34·5	30·60
Gopher	95	29·6	22·00
Alaska	88	35·8	25·60
Banner No. 49	103	32·8	29·80
Star	103	31·8	31·84
O. A. C. No. 3	88	33·0	20·16
Longfellow	98	31·5	30·60
Legacy	99	31·3	23·52
Gold Rain	103	33·8	25·20
Laurel	95	32·3	18·80

The average number of days required for different varieties from seeding to maturity in 1930 varied considerably. Alaska and O.A.C. No. 3 are the earliest maturing varieties, while such varieties as Mansholt, O.A.C. No. 72 and Banner No. 49 are among the latest maturing varieties tested. Considerable variation also exists between the length of straw produced by the different varieties and the weight of 1,000 kernels varied from 18 to 32 grams.

The oat plots were severely damaged by water after seeding in 1928 and the yields obtained are not reliable. However, the yields obtained in 1929 and 1930 are given in table 78.

TABLE 78.—OAT VARIETY EXPERIMENT (1929–30)

Variety	Yield per acre		
	1929	1930	Average
	bush.	bush.	bush.
Mansholt	47·54	49·61	48·58
Columbian	45·88	44·19	45·04
O. A. C. No. 72	45·71	44·19	44·95
Victory	46·10	42·89	44·50
Irish Victor P	45·53	42·25	43·89
Prolific	43·25	43·73	43·49
Gopher	46·19	39·93	43·06
Alaska	.....	41·69	*41·69
Banner No. 49	43·80	39·44	41·62
Star	38·33	44·00	41·17
O. A. C No. 3	.....	41·05	*41·05
Longfellow	44·41	37·30	40·86
Legacy	41·73	37·25	39·49
Gold Rain	32·47	41·99	37·23
Laurel	29·87	24·93	†27·40

*Results for 1930 only. †Hulless variety.

Yields obtained in this experiment are good, considering the dry seasons. The most promising variety is Mansholt. This variety produced the highest yield in both 1929 and 1930, with an average of 48·58 bushels per acre. The varieties Columbian and O.A.C. No. 72 ranked second and third, respectively, in yield.

WHEAT VARIETIES

Twenty varieties were included in the winter wheat variety experiment. Data were secured on varietal characteristics similar to those in the oat variety experiment, and are presented in table 79.

TABLE 79.—WINTER WHEAT VARIETY STUDIES (1930)

Variety	Type of head	Average number days maturing	Average length of straw	Weight per 1,000 kernels
			in.	gram.
O.A.C. No. 104	Bald	277	26	42·56
Ohio	Bald	277	26	40·40
Minturki	Bearded	277	27	34·60
Egyptian Amber No. 1	Bearded	277	28	38·80
Dawson's Golden Chaff No. 61	Bald	277	25	39·40
Dawson's Golden Chaff	Bald	277	26	35·00
Neudorf	Bald	278	27	37·80
Triplet	Bald	278	25	31·20
Red Rock	Bearded	277	25	40·20
Berkley Rock	Bearded	277	28	35·80
Gladden	Bearded	278	26	35·00
Imperial Amber	Bearded	277	28	39·20
Red Wave	Bald	277	26	37·20
Trumbull	Bald	277	26	37·28
Crail Fife	Bald	280	24	32·16
Kanred	Bearded	277	24	38·72
Egyptian Amber	Bearded	280	29	33·98
Kharkov No. 2212	Bearded	279	27	30·80
Michikof	Bald	277	24	29·38
Iobred	Bearded	277	27	30·80

The average length of straw given in table 79 for 1930 is somewhat shorter than might be expected in a normal season. The wheat varieties in this test do not vary greatly in the number of days required from seeding date to maturity. The weight of 1,000 kernels, however, varied from 29 grams for Michikof to 42 grams for O.A.C. No. 104.

A summary of the yields per acre obtained from these twenty winter wheat varieties during the three-year period is given in table 80.

TABLE 80.—WINTER WHEAT VARIETY EXPERIMENT (1928-30)

Variety	Yield per acre			
	1928	1929	1930	Average
	bush.	bush.	bush.	bush.
O.A.C. No. 104	39·70	26·80	17·46	27·99
Ohio	32·30	31·19	17·36	26·95
Minturki	35·53	29·12	16·18	26·94
Egyptian Amber No. 1	34·16	28·29	16·85	26·43
Dawson's Golden Chaff No. 61	33·65	26·13	15·23	25·00
Dawson's Golden Chaff	32·06	25·86	16·94	24·95
Neudorf	33·56	26·33	14·11	24·67
Triplet	30·40	25·70	17·44	24·51
Red Rock	34·63	23·58	14·53	24·25
Berkley Rock	35·90	21·62	14·99	24·17
Gladden	33·80	22·27	15·60	23·89
Imperial Amber	33·43	22·41	15·08	23·64
Red Wave	32·80	22·02	16·08	23·63
Trumbull	34·08	19·59	15·22	22·96
Crail Fife	31·80	19·91	16·07	22·59
Kanred	28·21	19·93	16·74	21·63
Egyptian Amber	28·58	22·22	13·72	21·51
Kharkov No. 2212	26·21	19·22	16·39	20·61
Michikof	28·06	19·51	13·15	20·24
Iobred	23·51	19·48	14·44	19·14

The 1930 yields of winter wheat in this experiment were considerably below average as a result of the very dry season. The best yield was obtained from all varieties in 1928. The variety O.A.C. No. 104 ranks first in average yield for the three-year period. This variety was only surpassed by Ohio in 1929 which ranks second for the three-year average. These varieties were closely followed by Minturki and Egyptian Amber No. 1, which ranked third and fourth, respectively, in yield.

HORTICULTURE

The increasing acreage devoted to horticultural crops in the extreme south-western portion of Ontario during the past few years has chiefly been a result of the decreasing acreage of flue-cured tobacco in Essex county. As a result of this increased acreage, numerous requests for additional experimental work in horticulture have been received. New phases of experimental work in horticulture are being planned for the coming year at the Harrow Station, especially in fertilizer studies on early tomatoes and asparagus.

The principal phases of horticultural work conducted during the period covered by this report are fertilizer experiments with early potatoes, and variety tests with early tomatoes, early potatoes, sweet corn, canning peas and apples.

FERTILIZER EXPERIMENTS WITH EARLY POTATOES

In 1927 a project was started to study the quantitative value of fertilizer materials on yield of early potatoes. No. 1 certified seed of the Irish Cobbler variety was treated with formaldehyde, cut and planted at the rate of ten bags per acre. Each plot was one-tenth of an acre in size.

Basal Formula

The quantities of nitrogen, phosphoric acid and potash were varied in a basal formula consisting of sulphate of ammonia as the source of nitrogen (N), superphosphate as the source of phosphoric acid (P_2O_5) and sulphate of potash as the source of potash (K_2O). The following table (81) outlines the quantities of materials used in the basal mixture:—

TABLE 81.—BASAL FERTILIZER FORMULA FOR EARLY POTATOES

Materials	Quantity per acre	Nutrients per acre		
		N	P_2O_5	K_2O
	lb.	lb.	lb.	lb.
Sulphate of ammonia	450	90	.....	.....
Superphosphate	600	.....	96	.....
Sulphate of potash	300	.....	.....	144
Total	1,350	90	96	144

This formula furnishes 90 pounds of nitrogen, 96 pounds of phosphoric acid and 144 pounds of potash per acre. The nitrogen is all water-soluble.

Quantities of Nitrogen

The phosphoric acid and potash remained constant in the mixture, while the nitrogen alone was varied by using different quantities of sulphate of ammonia and dried blood. Table 82 gives the yields of potatoes obtained during this four-year period.

TABLE 82.—QUANTITIES OF NITROGEN

Quantity of nitrogen	Yield per acre					Average increase in yield over check
	1927	1928	1929	1930	4-year average	
lb.	bush.	bush.	bush.	bush.	bush.	bush.
Sulphate of Ammonia (Water-Soluble)—						
30	178·5	255·8	108·3	113·3	163·9	34·6
60	170·3	304·5	153·3	125·0	188·3	59·0
90 (basal)	156·6	329·2	126·6	101·7	178·5	49·2
Dried Blood (Organic)—						
30	178·5	200·8	158·3	108·3	161·5	32·2
60	188·1	240·8	186·6	115·0	182·7	53·4

NOTE.—Check represents yield of plot receiving no commercial fertilizers.

Sixty pounds of nitrogen from sulphate of ammonia gave the highest yield during this four-year test. When the nitrogen was increased from 60 to 90 pounds per acre there was no further response in yield. On the other hand, when only 30 pounds was applied the increase over check was reduced almost 50 per cent.

Quantities of Phosphoric Acid

In similar manner different quantities of phosphoric acid in the form of superphosphate were used in the basal mixture. The results are presented in table 83.

TABLE 83.—QUANTITIES OF PHOSPHORIC ACID

Quantity of phosphoric acid	Yield per acre					Average increase in yield over check
	1927	1928	1929	1930	4-year average	
lb.	bush.	bush.	bush.	bush.	bush.	bush.
32	180·0	317·5	133·0	103·3	183·5	54·2
64	179·6	269·2	113·3	85·0	161·8	32·5
96 (basal)	183·0	299·2	120·0	101·7	176·0	46·7

The early potatoes did not respond in yield to high applications of phosphoric acid on the light sandy soils on which these tests were conducted; however, some response was noted in earlier maturity on the high phosphoric acid plots.

Quantities of Potash

Different quantities of potash were also tested in the basal mixture. Table 84 gives the results from 1927-30.

TABLE 84.—QUANTITIES OF POTASH

Quantity of potash	Yield per acre					Average increase in yield over check
	1927	1928	1929	1930	4-year average	
lb.	bush.	bush.	bush.	bush.	bush.	bush.
48	183·0	219·2	161·6	91·7	163·9	34·6
96	184·0	212·5	156·6	105·0	164·6	35·3
144 (basal)	175·0	191·8	155·0	98·7	155·1	25·8

The four-year average results show that heavy applications of potash are not economical for early potatoes on soils at this Station. One-half of the quantity supplied in the basal mixture is apparently sufficient.

Complete Fertilizer versus No Commercial Fertilizer

A check plot which received no commercial fertilizer was included in this experiment to demonstrate the value of fertilizer in the production of early potatoes. Table 85 gives the comparison of yields covering the four-year period.

TABLE 85.—COMPLETE FERTILIZER VS. NO COMMERCIAL FERTILIZER

Treatment	Yield per acre					Average increase in yield over check
	1927	1928	1929	1930	4-year average	
	bush.	bush.	bush.	bush.	bush.	bush.
No fertilizer (check)	124·5	172·5	135·0	85·0	129·3	.....
Basal formula	156·6	329·2	126·6	101·7	178·5	49·2

These comparisons between the yields of potatoes obtained from the basal fertilizer plot and the plot which received no fertilizer show an increase in yield of 49·2 bushels as a result of applying a complete commercial fertilizer.

The results of this experiment indicate that very good results in both yield and early maturity should be secured on light sandy soil by the application of a 4-8-6 fertilizer mixture at the rate of 1,000 to 1,200 pounds per acre.

EARLY POTATO VARIETY TEST

Three varieties of potatoes, namely, Irish Cobbler (Eureka), Delaware and Early Rose, were included in the early potato variety test. The test consisted of six plots of each variety, one plot being harvested each week from July 4 to August 10. A fertilizer mixture consisting of 4 per cent nitrogen, 8 per cent phosphoric acid and 6 per cent potash was applied on all plots at the rate of 1,000 pounds per acre, and all plots received the same cultural treatments.

All plots were planted on April 13 and the first digging was accomplished on July 4. The following table (86) presents the yields obtained from the different diggings at weekly intervals.

TABLE 86.—EARLY POTATO VARIETY TEST

Digging date	Irish Cobbler (Eureka)		Delaware		Early Rose	
	Marketable potatoes	Yield per acre	Marketable potatoes	Yield per acre	Marketable potatoes	Yield per acre
	%	bush.	%	bush.	%	bush.
July 4	83·3	77·4	53·3	48·4	53·9	41·9
July 11	88·9	116·1	83·3	77·4	83·3	77·4
July 18	89·7	187·1	93·3	145·1	81·0	133·5
July 25	93·5	200·0	93·0	187·1	80·0	193·5
Aug. 2	89·7	187·1	96·7	193·1	77·8	174·2
Aug. 10	93·8	261·2	95·7	254·8	92·3	251·6

The potatoes were graded as No. 1 (marketable size), and No. 2 (below marketable size).

The largest sample of potatoes for early marketing was obtained from the Irish Cobbler variety. At the time of the last digging the potatoes were all fully matured and there was little difference in yield and percentage marketable among these three varieties.

EARLY TOMATO VARIETY EXPERIMENT

The early tomato variety test was continued with 34 varieties in 1928, 30 varieties in 1929 and 22 varieties in 1930. The field used for these tests was in a fairly high state of fertility and a commercial 3-8-4 fertilizer was uniformly applied each year at the rate of 500 to 600 pounds per acre. All varieties were planted on the same date.

The yield, return per acre and relative value of each variety are compared with Penn. State Earliana (Stokes), based on gross return per acre. (Earliana equals 100). The regular market price was used in 1928 to show the gross return per acre. In 1929 and 1930 this price was fixed on a sliding scale, shown in table 87, in order to avoid market fluctuations.

TABLE 87.—FIXED PRICES FOR EARLY POTATOES

Picking No.	Fixed price per pound	
	No. 1 grade	No. 2 and unmarketable grades
	cts.	cts.
1	13·7	12·5
2	13·0	11·3
3	12·5	10·5
4	12·0	10·0
5	11·5	09·0
6	11·0	08·0
7	10·0	07·0
8	09·0	06·0
9	08·0	05·0
10	07·0	04·0
11	06·0	03·0
12	05·0	02·5
13	03·8	02·5

The average date of first picking, the gross return for each year during the period and the average relative return are presented in table 88.

TABLE 88.—EARLY TOMATO VARIETY EXPERIMENT

Variety or strain	Average date of first picking	Gross returns per acre			Average relative returns 1928-30
		1928	1929	1930	
		$	$	$	
Abb—11390 ·2 No. 10 P.I. 8	July 15	.....	592 16	.....	*55·6
Alacrity 1-8-1-3-1-7-1 09719	" 16	783 68	.....	.....	*137.5
Alacrity—Ott. 3531-41	" 15	.....	1,237 56	466 78	†105.8
Alacrity—Ott. 6365	" 15	.....	.....	637 83	*130.2
Alacrity x Earlibell—Ott. 11385	" 15	.....	.....	473 82	*96.7
Alacrity x Earlibell—Ott. 6572 1-3-1-4-1	" 16	564 81	1,055 50	.....	†99.1
Alacrity x Bonny Best—11389	" 15	.....	.....	409 59	*83.6
Alacrity x Hipper (Herald) 1-6560	" 16	667 94	.....	.....	*117.2
Alacrity x Hipper (Herald)—Ott. 6568	" 15	.....	1,234 25	.....	*115.9
Avon Early (Dreer)	" 15	.....	1,055 81	.....	*99.1
Avon Early (Ferry)	" 16	543 27	.....	.....	*95.3
Avon Early (Vaughan)	" 15	.....	1,149 17	679 55	†123.4
Bloomsdale (Langdon)	" 16	209 23	.....	.....	*36.7
Bonny Best (Moore)	" 22	309 73	560 31	.....	†53.5
Bonny Best (Stokes)	" 21	362 43	535 08	221 86	53.0
Burbank (Bruce)	" 16	494 52	970 82	.....	†90.0
Burbank (Stark)	" 15	.....	.....	610 72	*124.7
Burpee Self-pruning	" 30	.....	.....	329 80	*67.3
Canadian 29-516K (McKenzie)	" 15	359 27	1,055 57	359 27	78.5
Chalk's Early Jewel (S.B.)	" 21	340 48	451 81	.....	†51.1
Earliana (Ferry)	" 18	440 55	1,098 15	524 79	95.8
Earliana Select (Moore)	" 15	597 82	1,065 50	562 75	106.6
Earliana, Penn. State (Stokes)	" 15	569 78	1,064 35	489 55	100·0
Earliana, Sparks (Ewing)	" 16	473 69	1,011 71	.....	†89·1
Early Atlantic (McKenzie)	" 16	589 33	.....	.....	*103.4
Early Detroit (Ferry)	" 28	117 50	191 22	.....	†19.3
Earliest of All (S.B.)	" 17	545 62	976 04	316 87	84·0
Earliest of All (S.B.)	" 15	.....	825 99	.....	*77.6
50-Day (Buckbee)	" 15	470 53	1,008 46	479 58	91.7
Fargo (N.D.A.C.)	" 17	588 89	814 33	482 83	92·8
First of All (McKenzie)	" 16	480 89	.....	.....	*84·3
Greater Baltimore (Ferry)	" 25	71 60	.....	.....	*12.5
Greater Baltimore (Livingston)	" 25	.....	.....	176 15	*35.9
Greater Baltimore (Stokes)	" 28	.....	.....	197 29	*40.3
Herald—Ott. 9726	" 15	.....	.....	503 18	*102.7
Herald—Ott. 11386	" 15	.....	1,063 61	.....	*99.9
Jewel (Langdon)	" 19	281 96	.....	.....	*49.4
John Baer (Moore)	" 28	.....	.....	157 92	*32.2
John Baer (S.B.)	" 19	418 18	444 47	.....	†57.5
L. G. x B.B.A.I.—Ott. 11392	" 24	.....	284 12	.....	*26.6
Dwarf Stone (Livingston)	" 28	75 02	.....	.....	*13.1
Globe (Livingston)	" 19	193 67	.....	.....	*33.9
Rosy Morn (Livingston)	" 19	101 85	.....	.....	*17.8
Marglobe (Harris)	" 22	.....	316 61	.....	*29.7
Marglobe (Pritchard)	" 25	.....	.....	213 19	*43.5
Marglobe (Stokes)	" 23	162 26	447 58	233 91	39.4
Marvana (Harris)	" 18	.....	802 42	.....	*75.3
Marvana (Pritchard)	" 16	494 99	.....	.....	*86.8
Matchless (Burpee)	" 28	.....	.....	82 47	*16.8
Pink No. 1-1-3-1 06573	" 19	379 17	.....	.....	*66.5
Pink No. 1,—Ott. 11388 (1-3, 1-9, 1-2, 1)	" 15	.....	555 40	.....	*52.1
Pink No. 2—06569	" 16	345 32	.....	.....	*60.6
Pink No. 2—Ott. 11387	" 20	.....	481 08	.....	*45.1
Princess Mary, 29-617K (McKO)	" 16	386 13	.....	.....	*67.7
Prosperity (Bolgaino)	" 16	602 24	.....	.....	*105.6
Prosperity (Patmore)	" 15	.....	938 63	.....	*88.1
Red Head (Langdon)	" 19	306 58	.....	.....	*53.8
Viking (N.D.A.C.)	" 16	542 48	963 08	.....	†92.8

* One year only. † Two years only.

The average date of first picking gives a good indication as to the rate of maturity in the different varieties and strains tested. The average gross return per acre was not shown because some of the varieties and strains were only included one or two years. Yields were considerably lower in 1930 as a result of the very dry season.

Most of the Alacrity strains, Alacrity x Hipper, Avon Early (Vaughan) and Burbank (Stark)—all produced total yields above Penn. State Earliana (Stokes), which is a standard variety in this district. However, the variety Earliana is holding a very good place throughout the three-year test. Penn. State Earliana (Stokes) also ranks twelfth among the total 58 varieties and strains tested during this three-year period, on the basis of average relative return per acre.

MULCH PAPER TESTS

Preliminary studies were conducted with mulch paper for tomatoes. The paper was laid similar to the 1930 mulch paper tests on tobacco. All cultural treatments were identical in these tests except that the mulched plots were not cultivated. The data on yields and gross return per acre were secured in the same manner as in the tomato variety test.

An average gross return per acre of $458.06 was obtained where mulch paper was used, as compared with a gross return per acre of $381.97 from the unmulched plots, which represents an average gain per acre of $76.09 in favour of mulch paper. This gain in gross return from the use of mulch paper was the result of both increased yield and slightly earlier maturity. The yields of both mulched and unmulched plots were rather low due to the dry season. However, as the moisture in all plots was identical at the outset, the test is comparative.

SWEET CORN VARIETY EXPERIMENT

A detailed study of varietal characteristics was conducted on twenty-one varieties of sweet corn in 1929. Data are presented in table 89 on the date 10 per cent ready for use, average length of ear, number of rows of kernels per ear, and average length of stalk.

TABLE 89.—SWEET CORN VARIETY EXPERIMENT

Variety	Date 10 per cent ready to use	Average length of ear	Number of rows of kernels per ear	Average length of stalk
		in.		in.
Golden Bantam (Moore)	July 28	5·5	8	52·0
Golden Bantam (McDonald)	Aug. 1	5·6	8	57·0
Early Mayflower (McDonald)	July 28	6·8	10–12	59·2
Early Cory (McDonald)	Aug. 1	6·0	10–12	62·0
New First in (Schell)	Aug. 3	6·1	8–10	57·4
White Evergreen (Burpee)	Aug. 10	5·5	14	69·1
Sixty-Day Golden (Child)	July 23	6·0	8–16	50·0
Banting (C.E.F.)	July 25	5·2	8–10	39·9
Assinaboine (Wills)	Aug. 5	6·9	8–10	48·3
Country Gentleman (D. & F.)	Aug. 17	6·1	zigzag	62·4
Golden Nugget (Farquhar)	Aug. 5	6·4	8–12	55·7
Whipple Early Yellow (Harris)	Aug. 3	6·2	8–12	64·9
Delicious (Burpee)	Aug. 12	7·0	8–14	58·2
Sunnybrook (Burpee)	Aug. 12	6·2	12	54·0
Golden Giant (Burpee)	Aug. 5	6·3	8–14	64·4
Golden Bantam (Rennie)	Aug. 5	5·7	8–12	56·6
Early Adams (Ferry)	Aug. 1	4·4	10–16	29·8
Charlevoix (Ferry)	Aug. 8	5·5	8–12	54·2
Alpha (Ferry)	July 28	6·0	8–10	42·6
Golden Nugget, Strain "A" (N.D.A.C.)	July 21	5·1	8–12	39·2

For earliness of maturity Golden Nugget Strain "A" (North Dakota Agricultural College) ranked first, followed by Sixty-Day Golden (Childs) and Banting (Central Experimental Farm). Considerable damage was caused by the corn borer in this test and, therefore, the yields are not considered. There was no correlation between the height of different varieties and degree of corn borer infestation. However, a correlation did exist between earliness of maturity and the damage caused by corn borers.

This variety test was continued in 1930 with twenty-three varieties, but the sweet corn in this experiment did not grow or develop normally as a result of the very dry season. Therefore, the data obtained are not worthy of consideration at this time.

CANNING PEAS

A number of canning pea varieties and strains have been studied during the past three years. Information on these varieties and strains as to general characteristics and suitability for canning purposes is given below:

Alaska (Dup. x Ferg.).—Ripe June 27; smooth and round with small pod; small vine; flavour poor, rather tasteless; considered only fair for canning purposes.

McLean Advancer (D. M. Ferry).—Ripe July 4; small to medium round pea with slightly flat and medium long pod; medium sized vine; good flavour and sweet; considered good for canning.

Gradus x American Wonder.—Ripe June 27; peas nearly round with large short pod; fairly large vine; flavour good, medium sweet; considered fair for canning.

Gregory Surprise x English Wonder.—Ripe July 1; medium large pea with well filled long green pods; vine medium to large; fair flavour and very sweet; considered very good for canning purposes.

Thomas Laxton (McDonald).—Ripe June 27; large round peas with large flat pod; medium sized vine; flavour flat, very mild; considered only fair for canning.

Lincoln (Invermere).—Ripe July 1; medium sized round peas with long green pod; short to medium vine; very good flavour and sweet; considered very good for canning purposes.

Kootenay (Invermere).—Ripe June 29; medium sized peas with large rather flat pod; large pale-coloured vine; good flavour; medium sweet; possibly good variety for canning ungraded.

Director (Invermere).—Ripe July 1; medium small round peas with small well filled pods; small dark green vine; flavour fair and sweet; considered fair for canning.

Bruce (Invermere).—Ripe July 4; medium sized peas with rather flat pod; fairly large vines; good flavour, medium sweet; considered excellent for canning ungraded.

No. 42 (Invermere).—Ripe July 2; small peas and small pods; very small pale green vine; flavour fair; considered only fair for canning.

No. 6 (Invermere).—Ripe July 1; medium sized peas with rather flat pod; large bright green vine; fair flavour; considered only fair for canning.

APPLE VARIETIES

Several grafts were made of each of a number of different apple varieties, both old and new, on old apple trees at the Station some six years ago. These grafts were especially made for the purpose of studying the colouring of different varieties in this district. Most of the grafts are well developed and bearing well. The set of fruit on some grafts was very heavy in 1930. Data obtained,

during the past season, on the average weight, shape, flavour and colouring of these apples are presented in table 90.

TABLE 90.—DATA ON APPLE GRAFTS WITH SPECIAL REFERENCE TO COLOURING

Variety	Average weight per apple	Description
	oz.	
Rupert	2·66	Picked July 22. A number of the largest apples dropped before this date; size small or average; colour greenish yellow; with no evidence of pink; skin thick; flavour good.
Lowland Raspberry	3·60	Picked July 29. Size medium; shape very irregular colour yellowish, with practically all of the apples showing red markings; flavour very good, but most of the fruit was bruised before picking time.
Crimson Beauty	3·35	Picked July 22. Size medium; colour excellent—greenish yellow well marked with crimson; flavour acid.
Melba	4·25	Some of this variety picked July 29. Size medium with a few fairly large apples; shape roundish and not quite regular; colour yellowish with carmine splashes; bloom light bluish; flesh white flavour good, slightly acid.
Charlamoff	3·75	Picked Aug. 6. Shape round to conical, and very irregular; colour pale yellow with numerous crimson stripes; texture coarse; flesh very dry and flavour poor.
Battle	4·75	Size medium; shape roundish conical; colour yellowish green with splashes of carmine; texture coarse; skin thick and tough; flavour very good, slightly acid.
Rosilda (Crab)		Picked Aug. 18. Size below medium; colour yellow with crimson markings; flesh yellow; flavour good, acid.
Joyce	5·25	Size medium; shape roundish; colour yellowish green with numerous crimson splashes; skin fairly thick; texture fine; flesh greenish white; flavour slightly acid.
Duchess	4·00	Part of this variety was picked on Aug. 6 and some on Aug. 20; not quite ripe at first picking, but many of the apples well coloured, showing numerous bright red stripes; size medium; flavour rather acid.
Petrel	5·33	Fruit commenced to drop from the tree so the remainder was picked; colour green, changing to dark red; flesh coarse; flavour acid.
Lipton	3·50	Shape rather small and roundish; colour greenish yellow, almost covered with dark crimson; flesh yellow and juicy; flavour pleasant.
Atlas	3·25	Size below medium; shape roundish to conical; colour greenish yellow with crimson splashes; flesh white; flavour acid.
Wealthy	4·13	Size medium; shape roundish; colour dark greenish yellow with numerous carmine stripes; flesh white, firm and juicy; flavour pleasant and inclined to be acid.
Thurso	1·75	Size very small; colour bright carmine; flesh greenish white and firm; flavour sweet.
Briscoe	1·75	Size small; shape round; colour dark crimson; flesh white and firm; flavour sweet.
Kildare	1·38	Size very small; shape round; well marked with crimson; flesh white; flavour nice.
Glenton	3·25	Size medium; shape roundish; very dark green ground practically covered with dark red; numerous distinct dots; texture coarse; flesh greenish white; flavour very good; no acid taste.
Yellow Transparent	3·00	Size medium; shape roundish; colour yellowish white with light green dots; flesh white and rather dry; flavour pleasant.

FORAGE CROPS

The experimental work with forage plants included the following crops: soybeans, sugar beets, broom corn and field corn.

The soil and seasonal conditions during the years 1928 and 1929 were such that yields from the test plots were well up to the average. The exceptionally dry, hot conditions which prevailed during the growing season of 1930, however, resulted in considerably lower than average yields of practically all varieties and strains of forage crops under test at this Station.

SOYBEANS

VARIETY TESTS FOR SEED

The seasons of 1928 and 1929 were very favourable for soybeans and all varieties yielded high. In 1928 only one variety yielded less than two tons of moisture-free fodder and only four less than thirty bushels of seed per acre. These high yields may have been partially due to a very high percentage of nodule formation owing to a previous crop of soybeans on the same field in 1924. In former years the crop was always grown on soil which had never grown a crop of soybeans before, and although the seed has always been inoculated, the percentage of nodule formation was very small.

Unfavourable weather retarded the growth of soybeans to a considerable extent in 1930 and consequently the yields obtained were considerably below average for all varieties tested. Owing to these abnormal conditions, the yields obtained in 1930 are shown separately and are compared in table 91 with the average yields for all previous years. The average figures should be taken as more indicative of what the varieties will do under normal conditions.

TABLE 91.—SOYBEAN VARIETY TEST (ROW PLANTING)

Variety	Original source of seed	Days to mature		Maturity group	Average height		Yield of seed (as harvested)	
		1930	Average 1924–29		ft.	in.	1930 bush.	Average 1924–29 bush.
Ste. Anne's No. 92	Mac. Col., P.Q.	104	108	1	1	11·5	15·82	21·68
*Early Brown	Salmon Arm, B. C.	105	109	1	2	1·5	17·57	25·90
†Mandarin	U. S. D. A.	106	113	1	2	4·0	13·63	29·53
Yellow 210	China	112	118	2	2	4·0	21·79	30·87
Yellow 17	"	117	118	2	2	9·5	19·68	31·22
Chinaton Echo	"	115	118	2	2	7·0	16·80	27·64
*Italian	(?)	117	120	2	2	6·5	18·96	30·19
†O.A.C. No. 211	O.A.C. Guelph	117	121	2	2	6·5	18·01	33·78
O.A.C. No. 81	"	121	118	2	2	8·0	20·38	28·71
Summerland	Summerland Exp. Station	121	120	2	2	11·5	19·18	23·94
Black (China)	China	122	118	2	2	3·0	16·64	25·84
Early Korean	"	127	124	2	2	8·5	25·69	35·48
Green	J. Noble, Harrow, Ont.	128	122	2	2	1·0	‡ 17·76	34·25
Manchu	Dak. Imp. Seed Co.	129	123	3	3	2·5	22·26	34·88
Black Eyebrow	"	131	123	2	3	3·0	21·12	34·96
Ito San	J. Noble, Harrow, Ont.	129	123	3	3	3·0	19·08	29·60
Golden	"	129	126	3	3	2·5	20·81	35·48
†A. K.	U. S. D. A.	132	127	3	3	6·0	21·20	37·44

*Averages for 4 years only (1926–29).
†Averages for 5 years only (1925–29).
‡43 per cent stand.

It will be noticed in table 91 that the variety Early Korean did comparatively well in 1930. While both this variety and A. K. have given very good results at Harrow, A. K. has been outstanding for this immediate district over a period of years. The variety A. K. possesses some very desirable morpho-

logical characters, such as good height and the habit of branching a good distance from the ground. The fact that both the A. K. and Early Korean varieties have yellow seeds is also a desirable characteristic from the standpoint of milling, preference being given for a pure yellow meal. It is important to note, in connection with these two varieties, that they are quite late in maturing, thus limiting their adaptability to districts with conditions similar to those prevailing at Harrow. For districts requiring earlier maturing seed, O.A.C. 211, Manchu, and Mandarin may be recommended, although these varieties produce smaller yields.

ROW PLANTING VERSUS DRILL PLANTING

Eighteen varieties of soybeans were planted in drills seven inches apart in 1929 and 1930 for the purpose of comparing with planting in rows (30 inches apart) for yield of hay. The test was extended in 1930 to include the yield of beans as well. Growth in this test was rather uneven in 1930, and the resulting yields were lower than usual. Table 92 presents the yields of cured hay produced in the drill planting as compared with row planting.

TABLE 92.—ROW VS. DRILL PLANTING OF SOYBEANS FOR FODDER

Variety	Cured hay yields per acre							
	Row planting				Drill planting			
	1930		Average 1924–29		1929		1930	
	tons	lb.	tons	lb.	tons	lb.	tons	lb.
Ste. Anne's No. 92	1	571	1	1,076	2	865	1	1,546
Early Brown	1	781	*1	1,769	2	1,676	1	975
Mandarin	1	784	†1	1,966	3	385	1	1,723
Yellow No. 210	1	1,525	1	1,855	3	190	1	1,790
Yellow No. 17	1	1,098	2	541	2	435	2	1,120
Chinaton Echo	1	910	2	204	3	523	2	229
Italian	1	1,096	*2	617	3	308	2	325
O. A. C. No. 211	1	994	†2	989	3	753	2	237
O. A. C No. 81	1	1,061	2	371	3	273	2	422
Summerland	1	1,359	2	635	3	924	2	648
Black (China)	1	1,579	2	292	3	281	2	386
Early Korean	2	572	2	1,001	3	995	2	1,284
Green	1	277	2	608	3	255	2	571
Manchu	1	1,511	2	1,116	3	736	2	754
Black Eyebrow	1	1,647	2	1,096	3	1,986	2	715
Ito San	1	1,756	2	868	2	1,811	2	705
Golden	1	1,585	2	1,003	3	1,253	2	970
A. K.	2	604	†2	1,628	3	1,490	2	1,913

NOTE.—Cured hay yields based on 15 per cent moisture content. *Average for 4 years only (1926–29) †Average for 5 years only (1925–29).

In comparing the results of drill planting with those from 30-inch rows, it will be seen that the yields of hay per acre are in all cases higher in the drill planting. The additional amount of seed necessary for this method of planting, about three times as much as when planted in rows, must be taken into consideration. The advantage in the row planting is valuable when there are weeds to contend with.

One possible use of this method of planting would appear to be in districts where alfalfa is subject to severe winter-killing. The soybean is an annual crop and soybean is regarded as equal to alfalfa in feeding value.

The variety A.K. again shows its adaptability to this locality when grown as a hay crop. Several of the other varieties yielded at the rate of 2 tons or more of dry matter per acre, which compares very well with the yield of alfalfa on the Station in 1930.

An unusual occurrence was noticed in the soybean plots in 1930, namely, a form of sterility in which all or most of the pods on the plant only partially developed and did not contain seed. The only explanation of this would appear to be the drought in addition to the extreme heat, as the cereal crops were similarly affected to a slight degree. The plots of soybeans planted in 7-inch rows appeared to suffer more as a result of this partial development of pods than the beans in 30-inch rows.

INTRODUCTION OF NEW VARIETIES

A number of new varieties and strains were introduced from various sources and tested to determine their suitability for Canadian conditions. Among the most promising are two or three selections from the Royal Botanic Gardens, London, England, which were included in the variety test in 1930.

The following varieties were secured from the United States and tested; the names of the seedsmen from whom they were obtained appearing in brackets following the names of the varieties: Wilson (Stumpp and Walters), Wilson Black (Hoffman), Virginia Soys (Hoffman), Mammoth Yellow (Hoffman), Mammoth Yellow (Stumpp and Walters). All of these varieties made a very prolific growth but are much too late for any section of Canada.

These varieties of soybeans were planted according to yield and earliness of maturity. Left to right: (1) A.K., (2) Early Korean, (3) Manchu, (4) O.A.C. 211, (5) Mandarin, (6) Early Brown. A.K. is the highest yielder and also the latest maturing variety, while Early Brown is a very early variety but ranks low in yield.

BREEDING WORK

Breeding work was started on a small scale in 1930 by endeavouring to make crosses between outstanding varieties. The small floral parts and the proximity of the flowers to the ground made this work quite difficult to accomplish with any degree of certainty. The seed obtained from these attempted crosses will be tested in 1931.

SUGAR BEETS

VARIETY EXPERIMENT

The sugar beet variety test included 32 varieties and strains in 1929 and 34 varieties and strains in 1930. This experiment included practically all of

the varieties grown in the sugar beet growing district of Western Ontario, in addition to a number of other varieties and strains.

Seed of various strains was obtained through the courtesy of the United States Department of Agriculture. A few strains and varieties of Russian origin were obtained through the co-operation of Prof. George Stewart of the Utah State Agricultural College. Through the courtesy of the Dominion Sugar Company, Ltd., of Chatham, Ont., seed of the commonly grown varieties was supplied for these tests, and a small block of land was furnished by the company for a test at Chatham. The sugar determinations were also made by the Dominion Sugar Co., Ltd.

Sugar beet variety tests were conducted during the past two years at three different points, namely, the Dominion Experimental Station, Harrow; Chatham, Ontario; Kingsville, Ontario. The data obtained on yield of beets, percentage of sugar and green weight of tops at Harrow, Kingsville and Chatham are presented in tables 93, 94 and 95, respectively.

TABLE 93.—SUGAR BEET VARIETY EXPERIMENT (HARROW, ONTARIO)

Variety or strain	Yield of beets per acre				Percentage of sugar		Green weight of tops per acre			
	1929		1930		1929	1930	1929		1930	
Michigan State College—	tons	lb.	tons	lb.	%	%	tons	lb.	tons	lb.
60500	13	835	12	674	15·9	12·5	14	1,430	12	300
61100	16	1,602	9	878	15·7	12·4	12	480	8	20
62500	13	1,336	11	190	17·2	12·9	11	1,760	10	1,060
64900	13	2	6	751	16·8	12·1	10	880	4	640
66300	16	1,003	9	713	16·3	12·1	12	120	8	20
Re. Gr. No. 19	13	1,002	9	382	17·0	12·6	12	120	10	1,060
Re. Gr. No. 25	13	1,669	11	25	17·1	14·0	10	880	9	1,260
Re. Gr. No. 28	15	336	7	1,070	16·7	12·7	12	480	5	1,880
Re. Gr. No. 30	14	1,336	10	1,362	16·3	13·8	12	480	9	
Re. Gr. No. 37	12	335	8	1,719	18·7	12·3	12	840	8	1,280
U. S. D. A.—										
554–24	9	1	7	1,898	17·9	13·7	9	1,080	8	20
Fort Collins, Colo.—										
882–24	14	669	8	891	17·1	13·2	10	880	6	1,320
1340–23	13	1,669	10	534	17·3	12·5	11	320	8	560
1612–24	15	669	10	203	16·9	13·6	11	680	8	1,640
1749–24	13	1,336	9	1,375	15·7	12·2	9	360	6	1,680
2361–23	12	1,335	9	878	16·4	12·8	8	560	7	1,300
4477–24	11	335	8	1,719	15·1	12·9	11	680	7	1,480
Dominion Sugar Co., Chatham, Ont.										
Sehreiber	14	336	9	547	16·9	14·0	10	1,960	9	
R. & G	14	2	10	38	18·4	13·8	11	320	7	1,840
Horning	15	336	9	382	17·8	12·4	12	120	8	200
Strube	13	1,669	10	203	16·8	14·4	11	1,760	8	1,280
Home Grown	14	2	8	1,719	16·5	13·2	13	280	8	740
Dippe	12	669	10	1,197	17·3	14·2	9	0	8	1,100
Dippe (dec)	14	1,502	11	25	16·3	15·5	11	140	9	1,080
Frederiksen	10	1,668	8	891	15·8	14·5	11	1,040	6	1,860
Braune	12	669	10	866	16·7	13·6	11	680	8	20
Moscow, Russia—										
Bielotzerkov	12	1,335	10	700	16·5	15·5	12	1,200	9	
Kallinik	10	1,335	8	1,057	17·9	14·9	11	680	7	580
Vierehniatehka	13	335	9	1,044	16·8	15·7	12	1,560	7	760
Ivanovka	13	1,336	9	1,541	17·0	14·1	11	320	7	1,120
Ramon	13	2	11	1,681	16·7	12·7	11	680	8	20
Uladovka	11	1,669	8	1,057	16·3	13·0	10	520	6	60
Armtorg, T. Corp., Russia—										
"N"	.....		11	25	.....	14·8	.....		7	1,300
"E"	.....		11	522	.....	14·6	.....		7	760

NOTE.—Soil sandy loam to light clay loam.

In comparing the results of the different varieties in these three tables, the fact should be borne in mind that the reliability and accuracy of the results is largely measured by the percentage of stand obtained. The stand obtained at Harrow was very close to 100 per cent throughout the test, while that at Chatham and at Kingsville was quite variable and often low. This may be explained by the fact that the work of thinning at the two last-mentioned places is done by contract beet workers. It is suggested that in a comparison of the results that they be related to those obtained at Harrow rather than studied individually.

TABLE 94.—SUGAR BEET VARIETY EXPERIMENT (KINGSVILLE, ONTARIO)

Variety or strain	Yield of beets per acre				Percentage of sugar		Green weight of tops per acre			
	1929		1930		1929	1930	1929		1930	
	tons	lb.	tons	lb.	%	%	tons	lb.	tons	lb.
Michigan State College—										
60500	9	1,778	11	810	16·4	15·3	7	1,480	7	1,120
61100	10	1,186	8	1,464	17·9	14·6	7	1,840	4	1,720
62500	8	1,731	10	1,384	17·7	15·1	8	200	7	1,300
64900	9	414	8	38	18·0	15·3	5	980	4	100
66300	11	1,188	10	1,384	16·5	15·8	6	1,320	5	980
Re. Gr. No. 19	11	505	7	1,860	17·2	16·7	8	1,640	5	440
Re. Gr. No. 25	10	1,483	11	1,344	18·5	15·2	7	400	6	1,860
Re. Gr. No. 28	9	1,436	9	176	17·4	15·8	5	1,880	4	1,720
Re. Gr. No. 30	12	1,233	11	1,701	18·1	14·0	6	960	6	780
Re. Gr. No. 37	11	505	10	671	18·2	14·4	6	1,680	5	1,700
U. S. D. A—										
554–24	8	1,050	8	1,285	17·4	15·6	6	960	5	80
Fort Collins, Colo.—										
882–24	9	1,778	13	17	17·0	14·7	5	440	5	1,700
1340–23	11	164	10	1,740	16·5	15·4	9	1,440	5	620
1612–24	10	119	9	355	17·0	15·2	6	1,320	3	1,380
1749–24	10	1,141	10	1,562	17·4	14·6	7	1,120	4	1,000
2361–23	8	197	13	1,086	15·7	15·0	4	1,540	5	1,880
4477–24	7	1,004	8	1,820	16·3	15·0	4	1,720	4	1,540
Dominion Sugar Co., Chatham, Ont.—										
Schreiber	12	1,233	10	671	17·8	15·4	7	1,480	5	1,160
R. & G	10	1,141	10	493	17·8	16·1	5	1,880	5	260
Horning	10	800	9	889	16·9	14·1	6	600	5	260
Strube	10	1,824	7	1,860	18·2	15·5	6	1,320	4	1,000
Home Grown	10	460	8	1,107	18·1	15·9	6	240	6	780
Dippe	10	1,141	8	929	18·7	15·8	5	440	4	1,360
Dippe (dec)	9	755	11	97	19·2	16·6	4	1,720	7	700
Frederiksen	10	1,483	8	1,820	17·7	14·9	5	80	4	1,540
Braune	10	1,483	12	770	17·5	14·9	5	80	6	780
Moscow, Russia—										
Bielotzerkov	10	1,483	9	1,424	18·4	16·8	5	1,520	4	1,720
Kallinik	8	1,731	9	1,246	18·8	16·2	4	1,360	5	620
Vierchniatchka	11	505	10	1,206	17·5	15·9	6	600	6	420
Ivanovka	11	505	11	97	17·8	15·9	5	1,520	6	1,140
Ramon	13	256	10	1,562	17·6	15·8	6	600	4	1,000
Uladovka	9	1,095	11	97	16·3	15·4	5	1,160	5	1,160
Armtsrong, T. Corp., Russia—										
"N"	.....	.....	9	1,424	.....	16·8	.....	.....	5	800
"E"	.....	.....	12	948	.....	14·8	.....	.....	6	780

NOTE.—Soil sandy loam to light clay loam.

The size of beet obtained in the test at Harrow was quite small in 1930, while the beets at Chatham were slightly larger than in 1929. The beets at Kingsville were also small in 1930. In practically all cases the percentage of sugar was lower in 1930 than in 1929, which may be explained by the mild autumn. A killing frost did not occur in 1930 until October 22, after the beets were lifted.

TABLE 95.—SUGAR BEET VARIETY EXPERIMENT (CHATHAM, ONTARIO)

	Yield of beets per acre				Percentage of sugar		Green weight of tops per acre			
	1929		1930		1929	1930	1929		1930	
	tons	lb.	tons	lb.	%	%	tons	lb.	tons	lb.
Michigan State College—										
60500	9	896	9	864	15·9	15·3	6	960	9	1,350
61100	12	961	15	654	17·7	15·2	7	490	8	1,910
62500	10	529	13	940	16·8	14·8	6	600	11	140
64900	10	1,462	8	977	15·3	16·5	4	1,990	5	1,610
66300	15	482	18	549	15·9	13·9	3	1,920	10	1,600
Re. Gr. No. 19	11	1,561	11	1,756	17·3	15·5	8	650	10	1,690
Re. Gr. No. 25	14	305	17	1,900	17·0	16·1	6	870	10	700
Re. Gr. No. 28	10	1,384	14	1,121	16·2	14·3	4	820	7	1,480
Re. Gr. No. 30	17	836	19	258	15·0	15·7	6	1,410	6	1,770
Re. Gr. No. 37	12	494	13	1,058	16·8	15·8	6	1,005	10	70
U.S.D.A.—										
554–24	9	1,362	9	97	15·1	16·5	5	1,430	8	1,190
Fort Collins, Colo.—										
882–24	16	1,748	14	1,651	16·2	16·2	6	330	7	1,570
1340–23	14	1,277	14	1,357	16·6	14·8	7	445	8	290
1612–24	14	1,238	14	885	17·2	16·1	5	1,880	9	1,530
1749–24	14	849	13	1,287	15·0	14·1	5	440	7	40
2361–23	14	616	15	1,243	14·4	14·0	5	1,790	5	1,970
4477–24	13	1,760	15	241	15·7	14·5	7	220	9	1,440
Dominion Sugar Co., Chatham, Ont.—										
Schreiber	13	127	13	56	16·9	15·2	5	1,475	8	200
R. & G	13	672	13	822	16·7	16·1	7	760	7	1,930
Horning	14	1,471	13	1,235	17·3	15·2	5	1,440	9	0
Strube	14	1,471	13	1,353	17·4	15·1	7	1,930	7	760
Home Grown	15	1,415	14	1,947	17·1	14·3	8	560	9	540
Dippe	12	1,739	14	178	16·7	16·6	7	850	5	1,790
Dippe (dec)	13	516	14	1,947	17·2	16·2	6	510	6	1,410
Frederiksen	14	1,549	14	591	16·6	16·4	6	1,140	5	1,880
Braune	15	171	13	1,256	15·8	14·4	6	960	7	130
Moscow Russia—										
Bielotzer'kov	15	482	13	1,589	16·5	15·2	7	130	7	580
Kallinik	11	1,250	11	578	17·5	15·6	6	330	5	1,610
Vierchniatchka	15	326	14	532	17·8	15·6	7	940	6	1,860
Ivanovka	16	348	17	250	16·0	15·3	8	1,280	6	60
Ramon	16	348	16	717	16·8	14·8	7	670	5	440
Uladovka	14	616	17	1,311	16·9	15·4	6	960	5	1,340
Armtorg, T. Corp., Russia—										
"N"	.....		15	1,361	.....	17·5	.....		5	1,070
"E"	.....		17	1,429	.....	16·4	.....		6	420

NOTE.—Soil heavy clay loam.

The quantity of sugar per acre is presented on a relative basis in table 96, which furnishes a comparison between all varieties at Harrow, Kingsville and Chatham. In this calculation the average of each test has been taken as 100 and the yield of each variety has been related to that figure. Therefore, a variety which shows a relative yield of sugar above 100 in all three tests may be considered as better than average.

Table 96 shows that several strains have a high relative yield of sugar in one or more tests, particularly the two new strains added to the test in 1930; namely, "N" and "E" which are of Russian origin.

TABLE 96.—SUGAR BEET VARIETY EXPERIMENT (RELATIVE YIELDS OF SUGAR)

Variety or strain	Harrow		Chatham		Kingsville	
	1930	Average 1927–29	1930	Average 1927–29	1930	Average 1927–29
Michigan State College—						
60500	117·6	98·6	64·8	95·1	110·8	95·7
61000	.....	95·8*	.....	99·7	.....	116·1
61100	89·3	112·0	104·6	95·3	81·0	99·5
62500	109·2	86·6	89·3	88·8	102·5	81·6
64900	58·8	106·1	62·9	94·0	77·9	108·4
65700	.....	115·1†	.....	115·9	.....	121·4
66300	86·3	106·8	114·1	108·3	107·3	113·3
68200	.....	109·6*	.....	122·2	.....	73·5
69100	.....	97·1*	.....	116·4	.....	93·4
Re. Gr. No. 19	88·3	95·5†	82·7	93·5	84·1	99·0
Re. Gr. No. 25	117·6	101·1†	129·8	97·9	112·7	105·4
Re. Gr. No. 28	73·0	108·4†	93·5	86·7	91·2	91·2
Re. Gr. No. 30	112·4	97·4†	134·9	117·1	105·4	115·6
Re. Gr. No. 37	83·1	94·7†	96·0	95·6	94·5	110·4
Re. Gr. No. 38	.....	100·6*	.....	84·2	.....	132·3
U.S.D.A.—						
554–24	83·0	83·1	67·0	80·6	85·6	85·8
Fort Collins, Colo.—						
882–24	85·0	105·6	107·9	99·7	121·4	103·1
1340–23	97·9	105·1	97·6	94·3	106·3	92·0
1612–24	104·8	113·8	104·4	109·0	88·6	106·1
1749–24	90·1	100·3	86·4	86·9	100·0	94·4
2361–23	92·1	92·9	98·2	96·0	129·0	79·3
4477–24	87·2	85·9	98·5	95·8	84·9	85·9
Dominion Sugar Co., Chatham, Ont.—						
Schreiver	99·0	111·9	88·9	98·8	101·1	106·7
R. & G	105·4	107·3	97·0	104·2	104·8	96·9
Horning	86·9	107·9	93·0	103·3	84·6	99·0
Strube	110·9	104·3	92·7	109·8	78·1	101·0
Home Grown	89·2	95·3	96·1	99·8	86·4	92·1
Dippe	114·8	95·9	105·1	87·0	85·0	97·1
Dippe (dec)	130·2	106·8*	108·9	100·8	116·5	98·7
Buszezynski	.....	86·3†	.....	92·6	.....	102·3
Frederiksen	93·4	95·6†	105·3	107·6	84·3	106·5
Braune	108·2	91·5*	120·5	105·4	117·2	103·0
Moscowm Russia—						
Bielotzerkov	122·3	92·8*	94·2	111·2	103·6	108·3
Kallinik	96·9	84·8*	79·1	90·0	99·0	91·3
Vierchniatchka	114·0	98·2*	99·9	119·3	107·1	107·9
Ivanovka	105·0	103·2*	117·7	114·4	111·6	109·8
Ramon	114·6	96·4*	108·7	120·1	108·2	126·6
Uladovka	84·5	85·7*	122·1	106·9	108·1	85·3
Armtorg, T. Corp., Russia—						
"N"	124·3	.....	123·2	.....	103·6	.....
"E"	125·4	.....	130·2	.....	117·2	.....

*Average for one year only in all three tests.
†Average for two years only in all three tests.

BROOM CORN

The same eighteen varieties of broom corn which have been studied during the past five years were included in the 1930 tests. These varieties represent three types of broom corn, namely, standard, intermediate and dwarf. The season of 1930 appeared to have considerable influence on this crop and consequently, most of the varieties yielded below average. On the other hand, these

lower yields gave a higher proportion of good brush than usual. Table 97 presents the results obtained in 1930 together with the average results secured on these varieties during the previous four-year period (1926-29).

During the five-year period the dwarf variety Acme C. I. No. 243 has produced the largest average yield of good brush, namely, 796 pounds per acre (air-dried). This variety also produced 84·5 per cent good brush, which is the largest proportion of good brush produced by any variety during the four-year period. In general, the dwarf type appears to give the highest yields and the largest proportion of good brush in this district. The fact that the dwarf varieties are easier to harvest than the taller growing types is also worthy of mention.

The season of 1930 concludes a five-year experiment with broom corn, which is probably sufficient to show the merits of the different varieties. As the crop is not being grown to any extent in this district, further tests will not be continued for the present.

TABLE 97.—BROOM CORN VARIETY TEST

Variety	Origin	Height	Air-dry yield of brush per acre				Approximate length of brush			
			1930		Average 1926-29		1930		Average 1926-29	
			Total	Good	Total	Good	Good	Poor	Good	Poor
		ft. in.	lb.	lb.	lb.	lb.	in.	in.	in.	in.
Standard Type—										
Longbush Evergreen 26-g-o	U.S.D.A.	9 10	861	539	814	500	25	20	19½	17
" 56-g-o-3	U.S.D.A.	10 0	649	436	735	460	23	18	19	17½
Standard C.I. No. 583	U.S.D.A.	9 10	669	555	817	578	23	18	19½	16
" (Illinois)	Salzer, Ill.	10 6	715	570	831	579	24	18	19½	17
Black Spanish	Oklahoma	9 10	752	555	829	545	22	18	20	17
"	Pfeifer, Ill.	9 9	768	581	790	525	22	17	19½	16
Illinois Favourite	Pfeifer, Ill.	9 9	742	602	869	632	25	19	19½	16
Intermediate Type—										
Canada Evergreen	C.E.F., Ottawa	6 8	607	534	817	506	19	15½	20	18
Black Seeded	C.E.F., Ottawa	6 3	555	456	834	449	21	16	19	15½
" (Que.)	C.E.F., Ottawa	6 10	529	425	808	474	21	16	19	15
" (1921)	C.E.F., Ottawa	6 10	513	389	804	457	19	15	19	16
C.E.F. (1922)	C.E.F., Ottawa	7 0	601	508	868	508	21	15	18½	15
Dwarf Type—										
Acme C.I., No. 243	U.S.D.A.	4 10	813	677	977	826	21½	14	19	15
Jap. Dwarf C.I., No. 442	U.S.D.A.	3 7	747	525	753	504	16	13	16	13
European C. I., No. 559	U.S.D.A.	4 10	767	646	1,169	734	21	14	19	16½
Dwarf Evergreen	Salzer, Ill.	4 11	627	506	841	636	20	15	18	14
Scarbough	Oklahoma	5 2	883	735	938	681	20	13	18	16
Improved Evergreen	Steele Briggs	4 11	747	642	806	670	21	14	17½	14

FIELD CORN

CORN BORER CONTROL—NORMAL VERSUS DELAYED PLANTING

Delayed planting of corn has been both recommended and practised to some extent in Western Ontario in an effort to reduce the damage caused by the European corn borer. If it were only a matter of planting one, two, or three weeks late the problem would be a very simple one, but unfortunately we have to consider two very important factors. First of all in using the varieties commonly grown, planting later than a certain date in a normal season means immature corn in the fall. If sufficiently late planting is made to escape the borer it is almost certain that these varieties will be too late to mature properly. This naturally suggests the use of earlier maturing varieties in the late planting. Here again, however, the problem of planting sufficiently late to escape the borer, presents a situation which must be considered. It is quite commonly known that plants do not, as a rule, develop and produce normally when seeded at other than the usual time. Planting in June, especially after the first week, may be quite different from planting during the second or third week in May. Where

the practice of late planting (June) is followed greater dependence is placed upon both soil and seasonal conditions, and should these not chance to be favourable success can hardly be expected.

The test of normal versus delayed planting of field corn to escape corn borer damage was again conducted in 1930. This test included ten varieties of corn with a varying range of maturity, and these were planted at three different times, namely, May 21, May 29, and June 7. The size of the plot used in this test was enlarged in 1930 to include 100 hills of each variety in each planting. Each planting of the ten varieties was replicated three times.

Due to the abnormal season in 1930 the yields of corn were below average. The exceptionally hot, dry weather might also have been responsible for an unusually light attack by the borer this year. The influence of the season was also noted in the maturity of the later maturing varieties. Following the dry season frequent showers early in September gave these varieties a new growth and, consequently, some of the later plantings did not mature.

The corn was again graded into classes according to its marketability and corn borer infestation. Although the yields are light it will be noted from table 98 that the proportion of corn from marketable ears, as compared with the total yield, is quite high in all cases. Table 98 presents data on the average days to mature, total yield and marketable yield obtained from the different varieties of corn planted at different dates covering the period 1928-30.

It will be observed from this table that the variety Minnesota No. 13 shows a slight increase in yield over the other varieties in both the first and second planting in 1930. However, Burr Leaming (Carter) produced the largest yield from the second planting in both 1928 and 1929. It is also significant that with all varieties the last planting gave a lower yield than the earlier ones. The fact is consistent with results in previous years and shows the inadvisability of planting corn after June 1. Little can be said as to the actual damage by corn borers in 1930.

Infestation counts were made on all the varieties in the test through the co-operation of Prof. L. Caesar, Provincial Entomologist. The counts of corn borers were made by examining ten stalks of each variety in each replication. An analysis of these data shows that 56 per cent of the total borers was found in the planting made on May 21, 31 per cent in that made May 29 and 13 per cent in that made on June 7. That the infestation was very light is shown by the fact that very few of the stalks examined contained more than two borers.

TABLE 98.—CORN BORER CONTROL—NORMAL VS. DELAYED PLANTING

Variety	Source of seed	Planting	Average days to mature	Yield of ears per acre					
				1928		1929		1930	
				Total	Marketable	Tota	Marketable	Total	Marketable
				bush.	%	bush.	%	bush.	%
Northwestern Dent	Exp Farm, Brandon, Man.	1	103	19·09	10·16	22·04	12·87	.....	.....
		2	101	23·42	14·07	23·63	15·25	.....	.....
		3	107	22·13	19·02	22·50	18·63	.....	.....
Twitchell's Pride	Exp. Farm, Fredericton, N.B.	1	106	19·43	10·16	19·75	2·06	.....	.....
		2	105	22·11	15·69	19·96	8·55	.....	.....
		3	106	21·09	15·47	17·08	10·19	.....	.....
Quebec No. 28	Macdonald College	1	104	19·74	11·95	17·51	2·58	.....	.....
		2	103	27·22	19·97	20·80	10·40	.....	.....
		3	105	26·70	21·79	20·82	13·83	.....	.....
Northwestern Dent	Macdonald College	1	118	36·86	31·47	29·07	23·03	37·13	92·0
		2	120	39·46	36·55	39·20	36·78	28·17	92·9
		3	118	48·12	47·12	39·60	35·72	26·63	89·5
Longfellow	R. J. Johnston	1	121	50·98	45·21	22·98	10·89	26·15	88·3
		2	121	46·31	40·95	32·45	22·01	31·04	92·2
		3	119	54·36	48·37	31·76	27·11	27·73	91·6
Northwestern Dent	Dak. Imp. Seed Co.	1	120	51·89	50·45	28·13	21·64	30·97	86·9
		2	122	55·85	53·10	35·60	31·41	37·24	92·2
		3	120	51·76	50·37	32·11	30·02	28·57	87·7
Minnesota No. 13	Northrup King	1	124	40·50	38·82	28·72	22·03	40·77	94·4
		2	122	50·31	45·71	36·59	33·17	38·90	97·0
		3	121	53·66	50·93	39·29	38·78	34·34	90·3
Pride Yellow Dent	Dak. Imp. Seed Co.	1	131	29·30	21·94	39·16	30·12	.....	.....
		2	129	37·67	34·46	48·81	44·33	.....	.....
		3	125	31·66	27·33	51·05	49·44	.....	.....
Silver King	A. C. Popp	1	138	46·20	42·11	.....	.....	.....	.....
		2	133	50·50	46·33	.....	.....	.....	.....
		3	126	53·12	50·23	.....	.....	.....	.....
Wisconsin No. 7	Exp. Station, Harrow	1	125	.....	.....	35·56	30·00	32·94	94·1
		2	131	.....	.....	48·25	46·03	35·30	91·4
		3	131	.....	.....	49·18	46·32	25·85	88·6
Bailey	Darcy Bondy	1	132	55·44	51·30	36·00	30·59	33·13	91·1
		2	131	50·29	45·80	44·56	42·87	28·79	85·4
		3	128	55·58	52·00	42·36	40·59	31·23	87·2
Lancaster	Hoffman	1	138	65·80	63·66	43·94	39·95	.....	.....
		2	136	66·65	59·59	50·62	49·70	.....	.....
		3	131	62·13	58·87	47·65	43·31	.....	.....
Burr Learning	G. S. Carter, Conn.	1	138	62·80	56·73	53·22	50·70	36·15	94·9
		2	137	67·53	65·93	54·63	53·13	27·89	84·6
		3	132	65·75	61·58	52·32	51·01	24·28	80·4
Canada-Learning	G. S. Carter, Conn.	1	133	.....	.....	.....	.....	32·14	90·6
		2	127	.....	.....	.....	.....	35·90	90·8
		3	121	.....	.....	.....	.....	32·78	85·8
Polar Dent	Mason, Mich.	1	132	.....	.....	.....	.....	35·68	89·3
		2	127	.....	.....	.....	.....	28·04	92·9
		3	121	.....	.....	.....	.....	23·25	90·1
Golden Glow	Mulliken, Mich.	1	117	.....	.....	.....	.....	32·73	90·0
		2	114	.....	.....	.....	.....	32·65	95·6
		3	116	.....	.....	.....	.....	27·49	93·8

At harvest time the ears were separated into four grades, as follows: Grade 1, good ears (no borers); Grade 2, good ears (with some borers); Grade 3, poor ears but fit for feed; Grade 4, poor ears not fit for feed. Grades 1 and 2 are marketable, while Grades 3 and 4 are not marketable. A detailed report of the number of bushels of each grade harvested for the individual years will be found in the reports of the Division of Forage Plants for the years 1928 and 1929.

CORN BREEDING

Breeding work was again carried on in 1930 with 95 strains of corn. A number of the crosses made in 1929 were tested in 1930 at Ottawa for fodder

and at Summerland for grain. Several of these crosses showed very good results in both tests and this phase of the work will be continued.

Counts of corn borers in ten stalks of each strain were made in 1930, and a range of from 0 to 69 borers were found. Some of the strains having a low count of corn borers in 1929 were also low in 1930. These will be given careful study in the future.

A number of crosses were made in 1930, and although considerable difficulty was experienced in artificial pollination due to the weather, a small quantity of hybrid seed was obtained which will be tested in 1931.

FIBRE CROPS

HEMP

Seven varieties and strains of hemp have been studied during the three-year period covered by this report. Previous studies show that the yield of seed produced is influenced by the distance between rows. Better yields were obtained in rows planted three feet apart than when the distance between rows was increased. As a distance of three feet between rows was considered optimum for seed production, the varieties in these studies were drilled in rows three feet apart and thinned later to a distance of six inches between plants in the row. Each plot consisted of three rows 44 feet in length, and the middle row was harvested for yield data. Eight replications of each variety were included in this test. The data obtained on average yields of seed produced are presented in table 99.

TABLE 99.—HEMP VARIETY EXPERIMENT

Variety	Yields of seed per acre			
	1928	1929	1930	3-year average
	bush.	bush.	bush.	bush.
Western	9·07	8·66	12·49	10·07
Raccolta	.....	7·12	8·22	7·67*
Chington x Raccolta	6·41	.....	7·70	7·06*
Minnesota No. 8	4·98	6·79	7·64	6·47
Chington	4·91	6·33	7·76	6·33
C.D. 610 (French)	3·85	6·17	8·60	6·21
Bologna	5·20	5·30	6·02	5·51

*Two-year average only.

The highest yield per acre of seed was obtained from the variety Western. The average yield of seed produced during the three-year period was 10·07 bushels. Minnesota No. 8 produced 6·47 bushels per acre and ranked fourth in the test.

Hemp is a dioecious plant. The male and female plants usually occur in equal numbers; but as the plants are thinned in the row, there is a possibility that the proportion of males to females may not be constant. However, the varieties considered in table 99 ranked in the same order when the yields were based on the number of female plants per plot.

These varieties and strains of hemp also vary greatly in such respects as quality of fibre produced, height of plant, and date of maturity. Minnesota No. 8 is considered the best variety for the production of fibre, but this variety produces a relatively low yield of seed. Minnesota No. 8 is one of the tallest varieties and is also late in maturity. Western produced the largest yield of seed, but is a poor fibre variety. It is one of the shortest and also one of the earliest maturing varieties in the test.

Studies on the cost of producing hemp for seed show that the total cost is slightly greater than for corn. However, the cost of producing hemp for fibre, aside from the cost of scutching, is less than the cost of producing hemp for seed. Growing hemp for fibre was tested in a limited way on Pelee Island during 1930 with satisfactory results.

POULTRY HUSBANDRY

INTRODUCTION

Experimental studies with poultry, together with an egg-laying contest, were initiated at the Harrow Station during 1930. The establishment of a poultry plant here resulted from earnest and repeated requests and a growing demand from the poultry breeders of Southwestern Ontario.

Five acres on the eastern extremity of the Station were selected as the most suitable location for the plant, including the poultryman's cottage. Building operations commenced in the fall of the year 1929, and by the midsummer of 1930 the three units of the plant were practically complete. The buildings erected were a commercial laying house, a contest laying house and a third building comprising a brooder house, feed room and poultry plant office.

With the co-operation of the Poultry Division, at Ottawa, a supply of some 1,200 baby chicks was received at Harrow as a foundation for a good flock of breeding birds. Some preliminary investigations into poultry feeding and management were undertaken during the year 1930, together with rigid selection of stock for subsequent breeding purposes with a view to improvement in production and egg-weight.

Ontario Western Egg-laying Contest. Taken on October 4, 1930, the opening date of the contest at Harrow.

The contest at Harrow, known as the Ontario Western Egg-Laying Contest, was started on October 4, 1930, just four weeks earlier than the other contests in Canada. Present accommodations in the contest house would only permit our accepting 26 pens of birds from more than 70 applications. The addition of two more sections with housing capacity for 8 more pens is contemplated in 1931. The group pen system was adopted for the Harrow Contest. Each breeder's pen is not isolated in this method of housing. Five pens of birds in the light breeds or four pens in the heavy breeds, from different

breeders, are housed in each 16 by 18 feet section of the continuous contest house. The group pen system has worked out very well at this Station in all respects except in the control of certain diseases which appear to be more difficult to combat under this system.

Because of the exceptionally large number of applications for pens in the contest that were received, together with the growing number of visitors who call for information and assistance in poultry problems, it is quite evident that the addition of poultry work to the activities of the Harrow Station has met with considerable response and approval by the poultry breeders of this district.

POULTRY PLANT

A brief description of the various units of the poultry plant follows:—

Brooder House.—The incubator and brooder house also includes a feed room and office, in addition to the three-compartment brooder to accommodate from 1,500 to 2,000 chicks. This building is 65 by 16 feet in size.

Laying House.—This building, 20 by 100 feet, is divided into five pens. Each pen is 20 by 20 feet and will accommodate 100 birds. The front is constructed of one-third glass and one-third cotton, similar to many that have given satisfaction on other experimental stations. It is also equipped with straw loft and cement floor.

Contest House.—Six sections, 16 by 18 feet, together with a central feed room 20 by 20 feet, measuring 128 by 16 feet over all. It has the same type of front, loft and floor as the laying house. The feed room is two storeys high with a root cellar.

Isolation House.—For the isolation of sick birds or those under suspicion of disease, this portable building was constructed 10 by 12 feet.

Movable Equipment.—The feed hoppers, watering devices and trap-nests are mostly of standard experimental farm type, being home-made and adopted because of their easy and economical construction.

EXPERIMENTAL WORK

The Barred Plymouth Rock breed of chickens was selected as the standard flock for the Harrow Station, upon which investigational and breeding work is being conducted.

Some preliminary poultry studies and investigations were initiated during the year, and authorization was secured from Ottawa to undertake twenty projects in poultry husbandry. Such projects include studies on various feed rations and their effect on egg-weight and production; the effect of temperature, sunshine, body weight and various other factors on production and egg-weight; costs of rearing and of egg production; and the management of poultry flocks for best results. These are some of the major studies now under way, and further work will be undertaken as time and funds will permit.

Data from several of the elementary studies undertaken during the first year are presented in this report, but it must be remembered that these results are for one year only.

SUPPLY OF CHICKS

The flock was started with some 1,200 chicks shipped to Harrow from the Central Experimental Farm, Ottawa, and the Experimental Stations at Lennoxville and La Ferme, Quebec. Six separate lots were received, consisting of hatches between April 24 and 29 and one on May 14. Part of the stock from Ottawa was from excellent pedigreed parents.

The parent stock of the chicks from Ottawa and Lennoxville had been blood-tested for bacillary white diarrhoea, but the parents of those from La Ferme were not. All chicks were toe-punched or banded to distinguish their origin, and the blood-tested stock was separated from the others as far as accommodation would allow.

Very low mortality prevailed among all chicks during the spring of 1930. A low mortality rate was also noticeable in the chicks from La Ferme, which were from stock that had not been blood-tested. Table 100 gives some interesting information in connection with the chicks which were shipped various distances to Harrow. It shows the mortality in shipping as well as during the first two months.

TABLE 100.—MORTALITY OF CHICKS SHIPPED VARIOUS DISTANCES TO HARROW, ONT.

Details	Ottawa, Ont.	Lennoxville, Que.	La Ferme, Que.	Total
Number of chicks shipped	226	72	611	909
Shipping mortality (No.)	3	Nil	4	7
Cripples	2	Nil	1	3
Starvation period to first feed	50	30	90	.....
Per cent mortality first month	2·7	4·1	3·1	3·1
Per cent mortality second month	Nil	2·8	2·2	1·6
Per cent mortality two months	2·7	6·9	5·3	4·7

There were thirteen deaths in the second monthly period in the La Ferme Experimental Station chicks that were due to the following causes: 4 drowned in drinking fountains; 6 runts killed; 3 deaths from unknown causes. Some chicks from all three farms had pasted vents but there was no serious outbreak of diarrhœa.

REARING BROILERS

All males from the flock, with the exception of those of the pedigreed stock from Ottawa, were marketed locally at broiler stage—eight to ten weeks of age or about two pounds in weight. A price of 25 cents per pound live weight was realized on the entire lot. The first broilers were marketed on July 2 and averaged 2·1 pounds each.

In view of the low price paid for broilers in this section, it was questionable as to whether it would be profitable to carry over the males from the stage when sex could be determined until they reached marketable weight. Data in this connection are presented in table 101, which shows that a fair margin of profit may be realized at a price of 25 cents per pound on a local market, with all feed bought at current prices.

TABLE 101.—COST OF REARING BARRED PLYMOUTH ROCK BROILERS

Details	First month	Second month	Total, two months
	oz.	lb.	
Average weight per bird	7·30	1·88	.....
	lb.		
Average feed consumed per bird	1·04	4·00	.....
Pounds of feed to pound of gain	2·88	2·75	.....
Feed cost per bird	.....	.....	.....
	ct.	c.	c.
Feed cost per bird	0·04	15	19
Percentage of mortality	.....	.....	4·7
Profit per bird over cost of feed at 25 cents per pound	.....	.....	31

NOTE.—These chicks were hatched between April 24 and May 14.

PULLETS

The pullets reserved for breeding purposes from the Ottawa pedigreed stock numbered 107 in all. In October, 300 pullets were selected from the flock-run stock, vitality and colour of plumage being the only features considered. All pullets were banded as they came to hand. Table 102 shows the total percentage of pullets selected from the flock-run, unpedigreed chicks. The flock-run pullets were all hatched between April 24 and 29; they were raised on the same feed, in the same houses and on the same range.

Pen-fed Barred Plymouth Rock broilers. The cost of feed in rearing to this stage (two months) was 19 cents per bird.

TABLE 102.—VITALITY OF PULLETS FROM UNPEDIGREED STOCK

Source	Total number of chicks	Number of pullets selected	Percentage of pullets selected
			%
Central Experimental Farm, Ottawa	223	83	37·2
Lennoxville, Quebec	72	20	27·8
La Ferme, Quebec	607	196	32·3

COST OF PRODUCING EGGS FROM PULLETS

With the prices of eggs at the lowest point during the winter and spring of 1930-31 that they have reached in many years, and consequently a much lower margin of profit over cost of feed, costs of producing eggs should be studied with greater interest. Table 103 gives the average cost of feed to produce one dozen eggs during four-week periods from November 4, 1930, to April 20, 1931. These results are based on an average of 400 Barred Plymouth Rock pullets which were hatched between April 24 and May 14, 1930.

TABLE 103.—COST OF PRODUCING EGGS FROM PULLETS

Period	Feed			Egg production	Cost of feed per dozen
	Grain	Mash	Cost		
	lb.	lb.	$	%	ct.
Nov. 4–Dec.	1,273	1,285	62·40	35·7	18·8
Dec. 2–Dec. 29	1,471	1,528	73·32	62·4	12·6
Dec. 30–Jan. 26	1,390	1,382	67·54	47·2	15·3
Jan. 27–Feb. 23	1,359	1,255	63·30	47·0	14·4
Feb. 24–Mar. 23	1,312	1,529	70·09	46·2	16·2
Mar. 24–April 20	1,434	1,498	71·71	43·5	17·7
Total period	8,239	8,477	408·36	47·0	15·5

It will be seen from the table (103) that the peak of production amounting to 62·4 per cent was reached during December, when the feed cost per dozen eggs produced was consequently lowest, namely, 12·6 cents per dozen. On the other hand, the greatest feed cost per dozen was experienced in November, the lowest production of the entire period of 35·7 per cent being recorded. These data clearly show that the cost of feed in producing eggs is lowered as production increases. It is, therefore, essential to strive for high production in the laying flock, especially with such prevailing low prices for eggs, if the feeding costs are to be kept sufficiently low to allow a fair margin of profit per dozen over cost of feed.

PRELIMINARY FEEDING INVESTIGATIONS

In an effort to determine whether a higher content of moisture in the daily ration would influence the size of eggs laid, and also whether higher production influences the size of eggs, the following investigations have been carried on over a period of three months. The results were calculated in four-week or 28-day periods.

The best pullets of the entire flock of Barred Plymouth Rock pullets were divided into four groups or pens, and leg-banded just as the birds came to hand. Pen 1, the control pen, was fed a well-balanced ration of tested merit, without green feed or moistened mash, which constituted the basal ration. Pen 2 was fed the basal ration plus saturated alfalfa leaf hay that had been steeped in cold water for twenty-four hours, plus a wet mash at noon. Pen 3 was fed the basal ration plus dry alfalfa hay ad libitum, and a wet mash. Pen 4 was fed the basal ration plus sugar beets ad libitum, and a wet mash.

At the end of the third period (84 days) pen 1 was losing ground rapidly in production, but egg size was increasing. Pen 2 had the highest average production without loss in weight of eggs. Pen 3 was holding a steady though lower production, and size of eggs was increasing. Pen 4 was losing in production and size of eggs was increasing.

The body and feather condition in pen 2 was unquestionably better than in pen 1, 3 or 4, and probably the good yield in this pen will be maintained on this account. Some vice was evident in pens 1, 3 and 4, because the birds ravenously devoured loose feathers, though there was very little evidence of feather pulling. This condition was not present in pen 2.

As a succulent green feed easily prepared, steeped alfalfa hay is apparently better than no green feed, dry alfalfa hay or sugar beets.

Table 104 compares the production and egg-weight data obtained in this experiment from the four pens, showing the results during each four-week period and for the entire period from January 27 to April 20.

TABLE 104.—FEEDING EXPERIMENT (PRODUCTION AND EGG-WEIGHT)

Pen number	Total birds	Total egs produced	Average egg yield per bird	Total weight of eggs produced	Average weight of eggs per dozen
				lb.	oz.
Period (Jan. 27 to Feb. 23)—					
1	78	1,3.8	16·9	151·2	22·02
2	97	1,620	16·7	187·5	22·22
3	77	1,017	13·2	117·9	22·25
4	87	1,330	15·2	155·6	22·46
Period 2 (Feb. 24 to March 23)—					
1	78	1,327	17·0	161·6	23·38
2	96	1,512	15·8	178·5	22·66
3	75	1,123	15·0	132·4	22·63
4	85	1,191	14·0	140·6	22·66
Period 3 (Mar. 24 to April 20)—					
1	78	1,104	14·2	136·5	23·73
2	95	1,650	17·4	201·9	23·49
3	74	1,116	15·1	135·9	23·38
4	83	1,079	13·0	131·9	23·47
Totals and Averages (Jan. 27 to April 20)—					
1	78	3,749	48·1	449·3	23·01
2	96	4,782	49·8	567·9	22·80
3	75	3,256	43·2	386·2	22·77
4	85	3,600	42·4	428·1	22·83

BREEDING WORK

Some of the pedigreed chicks received from Ottawa were from parents with exceptionally fine records, and the winter trap-nest records of the pullets were also good in many instances. Although it might not be considered advisable to hatch from stock so young, that had laid so well during the winter, under existing conditions it was necessary to secure some offspring from exceptional matings in order to retain certain blood lines in the event of accident or death.

As yet a breeding house has not been provided and the pens (20 by 20 feet) in the laying house were not suitable for division into smaller breeding pens. It was, therefore, necessary to coop the males and individually mate them to selected pullets.

The chicks from these matings were carefully banded, and should any on account of the early maturity of their parents show signs of poor vitality or other defects they will be destroyed. The remainder of the stock necessary for the 1931 season's work is to be procured from Ottawa. This procedure should give this Station a flock, considerably above the average, with which to continue breeding work and also allow for a drastic culling of the present stock when detail as to performance is available.

In the near future there will be a supply of reliable males and females to accommodate the demand that may be made for the improvement of farm flocks in Southwestern Ontario.

LAYING HOUSES OF DIFFERENT DEPTHS

The contest house at the Harrow Station is 16 feet wide and the laying house is 20 feet deep. Probably owing to the exposed position and the difference

in depth of the laying house and the contest house, it was distinctly noticeable that the contest house was somewhat colder and more uncomfortable during the winter months. This condition was borne out by the behaviour of the birds in the contest house, for they would seek shelter from the draught and would huddle in corners. An outbreak of colds and roup probably confirmed this questionable condition, as no trouble of this nature was experienced in the laying house.

A careful record of the variation in temperatures inside both houses has been obtained by the use of self-registering thermometers placed in similar positions in both houses, and the following summarized table (105) gives the readings obtained from January 30 to March 25 in both houses.

TABLE 105.—TEMPERATURES IN LAYING HOUSES (Jan. 30 to Mar. 25)

House	Maximum	Minimum	Mean maximum	Mean minimum
	°F	°F	°F	°F
16-foot house	50	24	42·4	35·0
20-foot house	52	26	41·0	36·2

The greatest variation in minimum temperature between the two houses was 8° F. The litter was dry in both houses. The variation in temperature was not so great, but the very uncomfortable condition which existed in the contest house was apparently due to the draughts created in this 16-foot house.

EXPANSION AND NEW BUILDINGS

During the three-year period covered by this report a number of new buildings have been erected and alterations have been made to several existing ones, all of which have been chiefly a result of the general development and expansion of the activities of the Harrow Station.

The outstanding development during this time was the establishment of a poultry plant, including an egg-laying contest, at the Station. This work necessitated the immediate construction of a poultry brooder house, a laying house and a contest house, together with a cottage on the plant for the head poultryman. This building work was started in the fall of 1929 and finally completed during the summer of 1930. Further information on these poultry buildings and the poultry plant will be found under the poultry husbandry section of this report.

In 1928 a four-acre fire-curing barn was built in order to conduct investigations in fire-curing dark tobacco.

The new method of evaluating quality in tobacco necessitated considerable time and effort, and it was necessary to remodel the tobacco stripping and sorting shop in 1930 to facilitate this grading work. Five "A"-shaped tobacco plant-beds were erected during this period. These beds are 60 by 16 feet outside, each containing 720 square feet of plantbed space. Two of such "A"-shaped beds are shown in a photograph accompanying the tobacco section of this report.

A repair shop was constructed and fitted for repairing machinery and a manure pit was also built in 1930. An addition was built on the foreman's cottage during the past year, together with the construction of two garages and a number of minor repairs. A new water system was also installed on the Station.

Some laboratory work in testing soil samples from experimental plots at the Station and from the district was initiated in 1930 by the installation of a soil-testing set which will determine the active acidity of soils.

In the spring of 1930 attention was turned toward landscaping and the beautification of grounds at the Harrow Station. Considerable work was accomplished in improving the grounds, and an extensive landscaping project was outlined for the coming year 1931.

EXTENSION AND PUBLICITY

VISITORS

A steadily increasing number of visitors called at the Harrow Station because of a general interest in experimental work or for specific information in connection with definite agricultural problems. There were 1,779 more visitors in 1930 than in 1929, as indicated by table 106. Various phases of tobacco growing, from the selection of the most suitable variety to the final harvesting and curing of the crop and preparation for market, are discussed with growers. Other crops are discussed as well, in addition to methods of controlling various insect pests and diseases, and a variety of other topics. The tobacco seed-cleaning service, which is rendered free to growers, brings a great many visitors to the Station during the winter months. Samples of such seed are taken and forwarded to the Seed Branch, Department of Agriculture, Toronto, Ont., for germination tests, which is also a free service.

CORRESPONDENCE

The farmers of Southwestern Ontario and other sections as well are making better use of the mails as a medium for obtaining desired information and advice on their specific questions and problems, especially those who are not located within a close radius of the Station.

The volume of what might be called administrative correspondence has also been on the increase, owing to the general development of the Station and new investigational work which has been undertaken during 1929 and 1930 especially.

With the commencement of the Ontario Western Egg-Laying Contest at the Station the issuance of a mimeographed report of the contest results each week became necessary. In consequence a mailing list for such reports soon became established, with nearly 100 names by the end of the calendar year 1930.

Table 106 will give the reader a fair idea of the increase in correspondence, particularly in 1930, over other years, including both letters received and letters dispatched.

TABLE 106.—LETTERS, VISITORS AND TELEPHONE CALLS

Year	Letters received	Letters despatched	Visitors to station	Telephone calls received
1928	1,349	982	1,806	413
1929	946	896	2,009	534
1930	1,539	2,203	3,788	985

COMPETITIONS AND EXHIBITIONS

The Station has assisted the Provincial Department in a number of competitions during the past two years. During the past year one member of the Station's staff judged the Norfolk County flue-cured tobacco field crop competitions and also the cured leaf samples from these competitions exhibited at the Norfolk County Fair. Another member of the staff judged the dark-fired and flue-cured tobacco field crop competitions in Essex county. All tobacco exhibits at the Essex and Chatham Winter Fairs were judged by members of the staff.

The first exhibit to be shown at fairs under the name of the Harrow Station was prepared by the Division of Extension and Publicity, Ottawa, during the past season. This exhibit consisted chiefly of tobacco and forage crops and was taken to four of the local fairs. The exhibit created considerable interest and was certainly worth while.

THE PRESS

Monthly press articles, based on results of experimental work conducted at this Station, have been prepared by members of the staff at this Station. These have been submitted to the Division of Extension and Publicity, Ottawa, for release to the newspapers of Canada for publication. Special articles for publication have also been prepared from time to time.

The Station has also direct contact with the newspapermen of the district, and we have had very good co-operation in this respect during the past year or more in particular. Very good publicity has been given the Ontario Western Egg-Laying Contest by the press in this district.

MISCELLANEOUS

In February, 1930, talks were given by members of the staff in a series of tobacco extension meetings arranged in co-operation with the Ontario Department of Agriculture. Meetings were held at such points in Southwestern Ontario as Goldsmith, Essex, Harrow, Leamington, Blenheim, Chatham, Delhi, Simcoe and Straffordville. The topics discussed treated various phases of the tobacco industry. Talks on tobacco growing were also given at several meetings arranged by Agricultural Representatives of the Ontario Department of Agriculture.

The Harrow Station was the host of the London District Jersey Breeders' Association's annual picnic in the summer of 1930. Some 300 visitors came to the Station for this occasion.

The standing committee in tobacco fertilizer technique arranged a tour during the past summer, which brought most of the leading men interested in tobacco fertilizer work in Southwestern Ontario to the Harrow Station to inspect the tobacco fertilizer plots as well as other experimental work.

The Harrow Station has produced tobacco seed of a number of both standard and new varieties to meet the steady demand for pure seed among growers.

A limited supply of different soybean varieties has been available for distribution among persons interested in investigating the possibilities of this crop in their district. These small samples were for the purpose of multiplication of the various varieties so that a supply of soybean seed may be available to meet the growing demand.

A hearty welcome is extended to the public to visit the Harrow Experimental Station and make use of the services and information pertaining to certain agricultural problems which are available.

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