

**CIHM  
Microfiche  
Series  
(Monographs)**

**ICMH  
Collection de  
microfiches  
(monographies)**



**Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques**

**© 1997**

## Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming are checked below.

- Coloured covers / Couverture de couleur
- Covers damaged / Couverture endommagée
- Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- Cover title missing / Le titre de couverture manque
- Coloured maps / Cartes géographiques en couleur
- Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- Bound with other material / Relié avec d'autres documents
- Only edition available / Seule édition disponible
- Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from filming / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- Additional comments / Commentaires supplémentaires:

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- Coloured pages / Pages de couleur
- Pages damaged / Pages endommagées
- Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- Pages discoloured, stained or foxed / Pages décolorées, tachetées ou piquées
- Pages detached / Pages détachées
- Showthrough / Transparence
- Quality of print varies / Qualité inégale de l'impression
- Includes supplementary material / Comprend du matériel supplémentaire
- Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image / Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.
- Opposing pages with varying colouration or discolourations are filmed twice to ensure the best possible image / Les pages s'opposant ayant des colorations variables ou des décolorations sont filmées deux fois afin d'obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below / Ce document est filmé au taux de réduction indiqué ci-dessous.

	10x		14x		18x		22x		26x		30x	
							✓					
	12x		16x		20x				24x		28x	32x

The copy filmed here has been reproduced thanks to the generosity of:

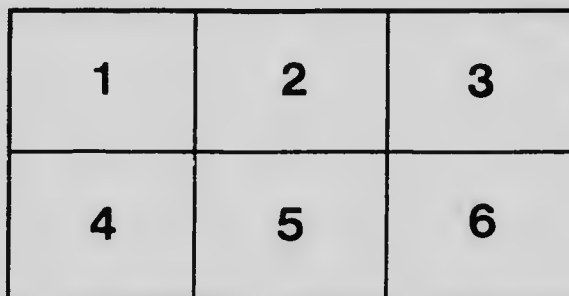
Library  
Agriculture Canada

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol  $\rightarrow$  (meaning "CONTINUED"), or the symbol  $\nabla$  (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

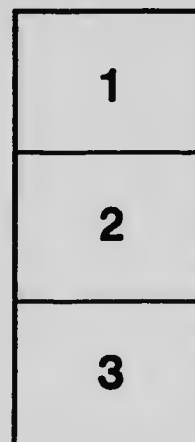
Bibliothèque  
Agriculture Canada

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

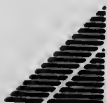
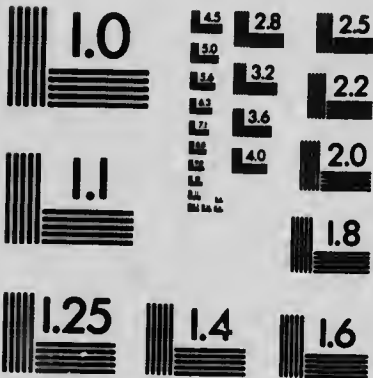
Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole  $\rightarrow$  signifie "A SUIVRE", le symbole  $\nabla$  signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.



# MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



**APPLIED IMAGE Inc**

1653 East Main Street  
Rochester, New York 14609 USA  
(716) 482 - 0300 - Phone  
(716) 288 - 5989 - "

## Ontario Agricultural College and Experimental Farm

THE RESULTS OF FIELD EXPERIMENTS WITH  
FARM CROPS—1904.

By C. A. ZAVITZ, PROFESSOR OF FIELD HUSBANDRY.

The work in the Experimental Department consists in planning the various experiments; laying out, seeding, and looking after the field plots; harvesting, threshing, weighing, and testing the grain; taking up, weighing, counting, testing and storing the potatoes and roots; cutting, weighing, and harvesting the grass, corn, and fodder crops, etc., and also in picking by hand the samples of grain grown on the plots, some to be sown on the plots the following year, and some to be distributed for co-operative experimental work throughout Ontario. But few people realize what a large amount of very careful thought is required in planning, supervising, and examining these plots, and in studying, comparing, and summarizing the results for presentation in reports, bulletins, newspaper articles, and lectures.

**EXPERIMENTAL GROUNDS.** About fifty acres of land, divided into about 2,000 plots, are used for agricultural field experiments, conducted with varieties of grain, root, tuber, grass, clover, fodder, silage, and miscellaneous crops; with artificial, green, and farmyard manures; with methods of cultivation, selection of seed, dates of seeding, etc.—all with the greatest care, and for several years in succession—in order to secure strictly accurate and reliable results. These experiments deal with the crops grown on over nine-tenths of the cultivated land in Ontario, that is, fully 10,000,000 acres.

**EXPERIMENTAL PLOTS.** The experimental grounds have a gentle slope towards the southwest, and the soil is what might be termed an average clay loam. Nearly one-quarter of the land is manured each year with twenty tons (about twelve loads) of farmyard manure per acre. It will thus be seen that the most of the land receives farmyard manure once every four years. No commercial fertilizers are used except in distinct fertilizer experiments, which occupy from two to three acres each year, and on which tests are made to ascertain the comparative value of different fertilizers with different crops. The plots vary in size according to the requirements of the different experiments, and the yields per acre are determined from the actual yields of the plots in every instance.

## RESULTS OF EXPERIMENTS.

All our field experiments are conducted for at least five years before any of them are dropped. For the results of many of the tests

which were carried on for five years previous to 1904, the reader is referred to former reports. The results of some of the experiments which have yet been conducted for only one or two years are held back until the tests can be carried through at least another summer. As different seasons vary so much in temperature, amount of rainfall, etc., the average results of experiments continued for several years are of much greater value than those secured from only one year's work. We submit the results with much confidence in their reliability and in their real, practical value. The writer has had good reason to believe that the work of the Experimental Department is being appreciated by the farmers of the Province, and that the results are being studied more and more each succeeding year. I shall limit my remarks on each separate experiment, the results of which are here presented, to a few of the points which seem to be of the greatest value to the agriculture of Ontario.

#### CONDITIONS OF THE WEATHER DURING THE PAST SUMMER.

In studying the results in the bulletin here presented, we should keep in view the conditions of the weather during the growing season. The past summer has been comparatively cool and wet. According to the report of the Bureau of Industries, the mean temperature for April was only 37.6 degrees as compared with 43.3 degrees in 1903, and 41.9 degrees above zero for the period extending from 1882 to 1903. The average temperature for each of the months of May, June, July, August, and September, for 1904, was lower than that for each of the corresponding months in the average of the past twenty-three years.

The total precipitation for the six months, starting with April, was 19.96 inches, according to the report of the Bureau of Industries for Ontario, and 19.87 inches according to the report of the Physical Department of the College at Guelph. This amount of rainfall is greater than for several years at the College, even including 1902, in which year the precipitation was also very large. According to the report of the Bureau of Industries, the average rainfall for Ontario from the year 1882 to 1903 was 15.7 inches for the six months commencing with April in each year. It will therefore be seen that the rainfall for 1904 was about 27 per cent. greater than for the average of the past twenty-three years. The rainfall at the College in July was exceedingly heavy, there being practically five inches during the month.

The first seeding which took place in the experimental plots in 1904 was on the 22nd of April. This was twenty days later than the first seeding in 1903. The grains were mostly sown during the last week in April and the early part of May. The mangels, sugar beets, carrots, and potatoes were mostly planted in May, and the corn, sorghum, turnips, rape, millet, beans, and part of the potatoes in June.

### FLUCTUATIONS IN THE AREAS OF FARM CROPS IN ONTARIO.

It is indeed interesting to study the crop production of Ontario from year to year. Owing to changed conditions brought about by means of fluctuations in the market prices of farm products, the introduction of new and improved varieties of farm crops, the amount of farm help available, the damages caused by insect pests and fungous diseases, as well as by other causes, we find considerable variations in the relative areas devoted to our principal farm crops over a series of years. A table has been compiled from the reports of the Ontario Bureau of Industries, and it is presented here to show the area devoted to each farm crop in Ontario in 1904, the average yield per acre of each crop for the past twenty-three years, and the percentage of increase or decrease in the area used for each of the crops for the past five years. The crops mentioned in the table are arranged in the order of their increase or their decrease per acre for the five years from 1899 to 1904.

Farm Crops.	Acres of each Crop in Ontario in 1904.	Yield per Acre. Average 23 Years.	Percentage Increase or Decrease in Area in last 5 Years.
Barley .....	772,434	1,301 lbs.	87 Increase
Mangels .....	71,344	459 bus.	34 "
Beans .....	50,892	1,026 lbs.	28 "
Pasture .....	3,183,673		18 "
Hay and clover .....	2,926,207	1.45 tons	17 "
Oats .....	2,654,936	1,217 lbs.	12 "
Corn for silage or fodder .....	193,115		12 "
Corn for husking .....	329,882		1 Decrease
Rye .....	130,702	913 lbs.	5 "
Turnips .....	133,207	487 bus.	19 "
Potatoes .....	133,819	115 bus.	20 "
Buckwheat .....	100,608	936 lbs.	23 "
Winter wheat .....	608,458	1,218 lbs.	42 "
Spring wheat .....	225,027	942 lbs.	44 "
Carrots .....	6,634	348 bus.	44 "
Peas .....	339,260	1,170 lbs.	84 "

From the figures here presented, it will be seen that the areas devoted to the growth of barley, mangels, and beans are being increased rapidly at the present time. It will be noticed also that the hay and pasture land has been increased 17 and 18 per cent. within the past five years. These two crops alone now cover about six million acres of Ontario land each year. The increase in the amount of pasture and hay land in recent years has probably been due, to a very great extent, to the greater number of cattle which is being kept at present as compared with former years. A very noticeable feature in connection with this study is the fact that the area devoted to each of the crops—winter wheat, spring wheat, carrots, and peas—has decreased upwards of 40 per cent. in the last five years. We find that in 1897, 896,735 acres were used for the pea crop. From that time to the present, the acre-

age has gradually decreased until in 1904 there were only 339,260 acres of peas. This great decrease in Ontario's pea crop has been brought about largely through the ravages of the pea weevil. As the acreage has been reduced to such a large extent, the few who grow peas at the present time in the older parts of the Province should be very sure to fumigate the crop with carbon bisulphide immediately after harvest, in order to check the ravages of this troublesome pest. For the method of treatment, the reader is referred to another part of this report. We submit the foregoing table, believing that it contains much useful information in studying the present conditions regarding the growing of farm crops in Ontario.

#### YIELDS PER ACRE OF DIFFERENT CLASSES OF GRAIN.

Besides making a careful study of the varieties of grain crops of any one class, it is well for us to compare the different classes of grain one with another. In the table presented under the previous heading, it will be noticed that the average number of pounds of grain per acre per annum for Ontario for the past twenty-three years has been as follows: Barley, 1301 lbs., winter wheat, 1218 lbs.; oats, 1217 lbs.; peas, 1170 lbs.; beans, 1026 lbs.; spring wheat, 942 lbs.; buckwheat, 936 lbs.; and rye 913 lbs. Thus we see that of the principal farm crops which have been grown throughout Ontario for the last twenty-three years, barley has given the largest number of pounds of grain per acre. The increase in the yield of barley over oats is fully 14 per cent.

In comparison with the results for twenty-three years, it might be interesting to notice the results of some of the same crops over Ontario for the years 1902, 1903, and 1904. Taking the average of these three we find that the annual production in yields of grain per acre are as follows: Barley, 1584 lbs.; oats, 1390 lbs.; winter wheat, 1360 lb.; peas, 1128 lbs.; spring wheat, 1082 lbs.; beans, 970 lbs.; and rye, 94 lbs. These results again show that the barley comes first, and the oats second in yield of pounds of grain per acre. It also shows that the yields of all the crops except beans have been considerably higher during the last three years than they were in the average of the past twenty-three years.

As some of these same kinds of crops were distributed throughout Ontario in the spring of 1902, 1903, and again in the spring of 1904, for co-operative experiments, a reference to the results obtained will be interesting for comparison with the results in general farm practice. It should be understood that the crops grown throughout Ontario are the averages of a large number of tests made on separate farms. The average soil on which any one crop would be grown would, therefore, not be exactly the same as the average soil used for the experiments with other crops. It should also be remembered that the results here presented are those of small plots, and not of large fields.



The results, however, were obtained from very carefully conducted experimental work.

Class of Crops.	Variety.	Average Yield per Acre.				
		Tons of Straw 3 Years.	Pounds of Grain.			Average 3 Years.
			1902.	1903.	1904.	
Emmer . . . . .	Common . . . . .	1.7	2,126	1,810	1,658	1,866
Barley . . . . .	Mandscher 1 . . . . .	1.5	1,672	2,158	1,739	1,866
Oats . . . . .	Early Brl an . . . . .	1.6	1,737	1,833	1,685	1,750
Peas . . . . .	Sibertan . . . . .	1.5	1,166	1,955	1,692	1,604
Hulless Barley . . . . .	Black . . . . .	1.4	1,536	1,448	1,607	1,530
Spring wheat . . . . .	Wild Goose . . . . .	1.4	1,302	1,078	1,169	1,163

We notice from the results of the co-operative work over Ontario that the barley has given a greater yield than the oats. We also notice that the Emmer occupies the highest place in yield of grain per acre, being slightly ahead of barley in grain production. This grain has not been grown in general cultivation throughout Ontario, but will be described more fully further on in this report. It will be observed that the yields in connection with the co-operative work throughout Ontario for the last three years have been somewhat greater than the yields given in the report of the Bureau of Industries.

An experiment was conducted at the College in 1902, in 1903, and again in 1904, in order to obtain some definite information regarding the comparative yields of the different classes of farm crops, grown and handled under as nearly uniform conditions as possible. The seeding took place on April 24th in 1902, on May 5th in 1903, and on May 4th in 1904, and the experiment was conducted in duplicate in each year. The figures here presented give the average results, therefore, of six separate experiments in growing farm crops under similar conditions within the past three years.

Average results for three years—six tests.						
Class of Crops.	Variety.	Date of ripening.	Height.	Rust.	Yield per acre.	
					Straw.	Grain.
					Tons.	Pounds.
Barley . . . . .	Mandscheur 1 . . . . .	August 5	Inches. 40	Per cent. 9	2.0	2,714
Emmer . . . . .	Common . . . . .	21	39	5	2.1	2,634
Oats . . . . .	Joanette . . . . .	16	40	7	3.0	2,634
Hulless Barley . . . . .	Black . . . . .	6	31	13	2.1	2,473
Early Oats . . . . .	Alaska . . . . .	9	42	11	2.2	2,399
Hulless Barley . . . . .	White . . . . .	9	34	5	1.8	1,942
Spring Wheat . . . . .	Wild Goose . . . . .	29	48	13	2.2	1,716
Spring Rye . . . . .	Common . . . . .	16	51	1	2.1	1,536
Vetches . . . . .	Spring . . . . .	Sept. 12	38	..	2.0	7.19

We notice from the table here presented that the barley again comes ahead of the oats in number of pounds of grain per acre. The barley is followed by the Emmer and the Joannette oats, which have given exactly the same yield of grain per acre. It might be well to here mention that, on the average, barley has about 12 to 15 per cent., Emmer about 22 per cent., and oats about 30 per cent. of hull. The Joannette variety of oats, however, has a particularly thin hull, the average percentage of hull being only about 23 per cent. Of the crops under experiment, the Mandscheuri barley, Black Hulless barley, Alaska oats, and White Hulless barley were the earliest; and the Common Spring vetches, and the Wild Goose spring wheat were the latest in reaching maturity. There is not much difference in the strength of straw of the Mandscheuri barley and the Common Emmer. Both, however, are considerably stronger than that of the Black Hulless barley. It should be remembered that the results presented in the last two tables are obtained from plots, and that the results taken from the reports of the Bureau of Industries were obtained from large areas of land.

#### BARLEY.

Barley is one of the hardiest of the cereals and can be raised through a great range of climate. It is cultivated with success north of the Arctic circle, and at high altitudes in the torrid zone. This crop has been under cultivation in the southern part of Europe from the earliest times.

Barley was formerly grown extensively in Ontario for shipment to the United States for malting purposes. The high tariff placed on barley by the United States Government, however, was instrumental in shutting out a large quantity of the Ontario barley from the markets of that country. The acreage, therefore, decreased from year to year, until the introduction of large yielding varieties for feeding purposes and the demands of the live stock industry called for a greater amount of valuable feed. By examining the reports of the Bureau of Industries, we find that the acreage of barley in Ontario has increased no less than seventy-six per cent. within the past seven years. In 1904, there were upwards of three-quarters of a million acres of Ontario lands devoted to the growing of this important crop.

VARIETIES OF SIX-ROWED BARLEY. Ontario seems particularly adapted to the growing of six-rowed barley; hence a good deal of attention has been given by the Experimental Department to secure those varieties which would likely give better results throughout the Province than the kinds which had been grown in former years. In the five years from 1889 to 1893, eighty-six different varieties of barley were grown in the experimental grounds. After five years' tests were completed, the poorest varieties were dropped from the experiment, and those which proved the most successful were retained for future experiments. New varieties were added from time to time, all of which

were tested for at least five years. A few varieties have now been grown for fifteen years in succession, without change of seed. The results of these varieties are exceedingly interesting and worthy of careful study. The following are the average yields of grain per acre of each variety for the whole period of fifteen years, and also for the last five years:

Varieties.	Average yield of grain per acre.	
	1890-1904, 15 years.	1900-4, 5 years.
Mandscheuri .. . . . . .	71.4	73.6
Common six-rowed .. . . . . .	62.4	66.7
Oderbrucker .. . . . . .	64.4	66.0
Mensury .. . . . . .	60.0	63.1

The results show that the Mandscheuri gave decidedly the greatest yield per acre of the four varieties for the whole period of fifteen years, and also for the last five years. The Mandscheuri gave an average of 9.3 bushels per acre per annum over the Common Six-rowed barley in the average results for fifteen years. The verage area devoted to barley in Ontario from 1882 to 1904 is given as 633,290 acres per annum. An increase of nine bushels of barley per acre throughout the Province would, therefore, amount to an increase of over five million bushels of barley in Ontario annually. This increase at fifty cents per bushel would amount to about two and a half million dollars. Two and a half million dollars annually would pay the running expenses of about thirty Agricultural Colleges like the one located at Guelph. The Mandscheuri barley was imported from Russia by the Ontario Agricultural College in the spring of 1889. Not only has it made a very excellent record at the College, but it has given high results in the co-operative experiments throughout Ontario and has been grown in general cultivation very successfully during the past few years. In looking up the records of the Bureau of Industries, we find that the average yield of barley throughout the Province for the period of ten years from 1895 to 1904, inclusive, is 29.3 bushels per acre; while that for the period of ten years from 1885 to 1894 inclusive was 24.85 bushels per acre. This shows an annual average increase of about 4 1/2 bushels per acre for the latter as compared with the former period of ten years. From these results, does it not appear as though the introduction of the Mandscheuri barley by the Ontario Agricultural College has been worth to the Province of Ontario within the past ten years an annual money value equal to more than fifteen times the entire cost of the College?

Among the other varieties of six-rowed barley which have been grown in the Experimental Department besides those already referred to, mention might be made of the California Brewing, Scotch Im-

proved, Imperial Six-rowed, Success, and Ohio Beardless. Of these varieties, however, the only one which has given a very high average yield per acre is the California Brewing. This, however, is a coarse barley with a very stiff beard and straw of rather poor quality.

**VARIETY OF TWO-ROWED BARLEY.** The two-rowed barley is easily distinguished from the other species by the head being somewhat elongated, and by there being only two rows of grain from one end of the head to the other. The heads of some varieties are long and slender; while those of other varieties are short, very broad at the base, and taper towards the extremity. The two-rowed barley is largely cultivated in England and Central Europe, but is not grown to any extent in Ontario, although great efforts were made a few years ago by the Dominion Government to have it grown extensively by Canadian farmers for exporting to England. With this object in view, the Canadian Government imported 10,000 bushels of the Carter's Prize Prolific barley from England, and sold the same to Canadian farmers at \$2 per bushel, in order to get it introduced. This variety, however, has not given very satisfactory results throughout the Province.

According to the results of eleven years' experiments with about sixty varieties of two-rowed barley, we find that the highest yielding kinds are not as productive as the most prolific varieties of the six-rowed class. In the average of eleven years' tests with six varieties of two-rowed barley, the greatest yields were produced by the Two-rowed Canadian, New Zealand Chevalier, Jarman's Selected Beardless, and French Chevalier.

In 1904, seventeen varieties of two-rowed barley were grown in the experimental grounds. The highest yields were produced by the Two-rowed Canadian and Selected Canadian Thorp varieties; and the lowest yields were produced by the Invincible, Standwell, and Frederickson varieties. The last three varieties were recently imported from Europe. The Standwell and the Invincible were imported from England, and the Frederickson from Germany. The Chevalier two-rowed barley has been used considerably for mixing with Siberian or Banner oats for seed purposes. As the Chevalier barley is late in maturing, it ripens about the same time as either of these varieties of oats, and a mixture composed of the Chevalier barley with one of these varieties of oats usually produces a heavy yield per acre.

**VARIETIES OF HULLESS BARLEY.** The grain of the Hulless barley usually weighs about sixty pounds per measured bushel, while the standard weight of the common varieties is forty-eight pounds per bushel. The skin of the Hulless varieties is thin and transparent, and is white, purple, or black in color. In some respects the grain resembles wheat more than barley. The straw is apt to be weak, and, when ripe, often becomes so brittle that the heads are easily broken off. Some of the varieties possess heads with six rows, and others with two rows.

We have had ten varieties of Hulless barley under experiment for five years in succession, and find that the Guy Mayle heads the list with an average of 54.4 bushels per acre, taking sixty pounds as the standard weight per measured bushel. This is followed by the Black Hulless with 51.5; the Hungarian, 50.2; the Purple, 49.2; the Winnipeg No. 2, 46.9; the Hog, 45.9; the Large Skinned, 42.8; the New White Hulless, 42.1; and the Ideal, 40.2 bushels per acre. In 1904, the highest yields were produced by the Guy Mayle, 59.7 bus.; Black Hulless, 54.9 bus.; Purple, 53.2 bus.; and Hungarian 53.1 bushels per acre.

The Guy Mayle variety, which stands at the head of the list in yield per acre for five years, and also for 1904, produces a grain of purple color, and possesses straw which is comparatively strong for a Hulless barley. This barley was distributed throughout Ontario in 1904 for co-operative experiments. In the average of thirty-three reports of successfully conducted experiments with the Guy Mayle and the Black Hulless varieties, it was found that not only did the Guy Mayle give the larger yield of grain per acre, but it was the most popular of the two varieties among the experimenters. This is considered to be the most promising variety of Hulless barley which has been grown at the College.

**PREVIOUS CROPPING OF LAND FOR BARLEY.** In the spring of 1901, a strip of land two rods in width and forty rods in length was divided into thirty-two plots. Paths five links (39.6 inches) in width were allowed between the plots. The land is very level throughout, and had been uniformly cropped previous to the date here mentioned. In the spring of 1901, the whole range was sown to early oats. No. 1 plot was seeded with Common Red Clover, No. 2 plot with Alsike Clover, No. 3 plot with Timothy, and No. 4 plot received no clover or grass seed. Similar seedings to these were repeated until the whole range was seeded according to the plan outlined above. It will, therefore, be seen that there were eight plots of Common Red Clover, eight plots of Alsike Clover, eight plots of Timothy, and eight plots left without seeding. After the oats were cut, the plots were carefully edged. Both the clover and the timothy made good growth in the autumn. In the following spring, the growth of the three crops on the twenty-four plots was excellent. The range was divided into two sections, and each section into four divisions, each division containing one plot of Common Red Clover, one plot of Alsike Clover, one plot of Timothy, and one plot without any crop. The land in No. 1 division was plowed after the first crop of the season had received its full growth and before it had been removed from the land; No. 2 division was plowed immediately after the first crop of the season had been removed; No. 3 division was plowed before the second crop had been removed; and No. 4 division was plowed immediately after the second crop had been removed from the land. The remaining sixteen plots were an exact duplicate of the first section. The land was cultivated on the surface in the autumn and was sown with mangels in the spring of 1903. The Sut-

ton's Mammoth Long Red variety was used in the first section, and the Yellow Leviathan variety in the second section. On the same land, we sowed barley in the spring of 1904, using the Mandscheuri variety on the first section, and the Oderbrucker on the second section.

Taking the average of all the experiments in 1903, we find that the Common Red Clover land produced 2.1 tons and the Alsike Clover land 3.6 tons of mangels per acre more than the Timothy land. In the average results of the experiments for 1904, we find that the Common Red Clover land produced 8 bushels, and the Alsike Clover land 7.2 bushels of barley per acre more than the Timothy land. The greatest average yield of roots per acre (35.5 tons) in 1903, and the greatest average yield of barley per acre (58.2 bushels) in 1904 were produced on land which had received the first crop of Alsike Clover as green manure. It is intended to sow these plots with another crop in 1905, in order to study the manurial effects of the different crops plowed under for a series of years. This whole experiment is being repeated at the present time, as thirty-two other plots were treated in 1904 in the same manner as the plots previously referred to were treated in 1901.

We have previously conducted a series of experiments at the College in order to ascertain the comparative value of clover and grass sod for crop production. We first grew clover and grasses upon separate plots and removed the crops, after which the land was plowed and other crops were sown. The results, therefore, show the influence of the roots remaining in the land upon the productiveness of the crops following the clovers and grasses. In 1902, barley was sown after each of four varieties of clover and three varieties of grasses in four different places in our experimental grounds. The average results of the four tests in pounds of barley per acre were as follows: Red Clover, 1516; Lucerne, 1450; Alsike Clover, 1427; Mammoth Red Clover, 1408; Meadow Fescue Grass, 1068; Orchard Grass, 1015; and Timothy, 946. It will, therefore, be seen that the Red Clover sod gave an increase over the Timothy sod of 570 pounds, or nearly 12 bushels of barley per acre.

The results of this experiment help us to appreciate the beneficial influence on the soil from the growing of clover.

**WINTER BARLEY.** Within the last twelve or fourteen years, we have sown winter barley each autumn. When the winters have been unfavorable, however, the barley has usually been winter-killed, and in those seasons in which the barley survived the winter, the results have been exceedingly good. In eight out of the past twelve years, the barley has survived the winter well, the average yield for the eight years being 64.1 bushels per acre. The crop during the last winter was considerably winter killed, but the plants which were alive in the spring made an excellent growth, and the yield obtained this season amounted to 31.8 bushels per acre. This, however, is only about one-half as large a yield as that shown for the average results for eight years. By making use of the same variety of winter barley from year to year, we hope

that it will improve in hardiness as time advances, and that possibly we may secure a variety which will withstand our winter seasons without much risk of loss through winter killing.

### OATS.

Oats have been cultivated for such a long time without any definite record in regard to their origin that their native country is still unknown. The wide range of soils on which oats can be grown successfully, and the comparatively low temperature in which they come to their maturity, have rendered them well adapted for cultivation in many countries. In some countries of the world, the cultivation of oats extends very far north, even to the 65th degree of latitude. In Ontario, the area devoted to oats each year is greater than that used for the cultivation of any other kind of grain. The number of acres used for oats in Ontario was 2,654,936 in 1904, and 2,058,487 acres in the average of the past twenty-three years. The average yield of oats per acre throughout the Province has been gradually increasing in recent years, probably due to the general introduction and cultivation of larger yielding varieties, such as the Siberian, American Banner, Ligowa, and Newmarket; and the adoption of better methods of farming. According to the reports of the Ontario Department of Agriculture, the average yield of oats per acre for the last ten years (1895-1904) is fully eleven per cent., or 3.8 bushels, higher than for the ten years previous (1885-1894).

VARIETIES OF OATS. No less than two hundred and seventy-five different varieties of oats have been grown in our experimental grounds within the past sixteen years. The object in testing such a large number is to ascertain the few very best varieties which are most suitable for the different soils and localities throughout the Province. Eight of these varieties have now been grown under exactly similar conditions, without change of seed, for fifteen years in succession. The average results for the fifteen years in weight per measured bushel, yield of straw per acre, and yield of grain per acre are as follows:

Varieties.	Weight per measured bushel.	Yield of straw per acre.	Yield of grain per acre.
	Pounds.	Tons.	Bushels.
Joanette .....	35.5	3.0	90.5
Siberian .....	35.2	2.6	87.8
Waterloo .....	32.6	2.6	87.3
Oderbrucker .....	32.7	2.5	86.7
Probsteler .....	33.4	2.5	86.2
Bavarian .....	32.6	2.8	84.8
Egyptian .....	36.3	2.9	76.9
Black Tartarian .....	30.8	2.7	71.1

During the last five years in which these eight varieties have been grown side by side, we find the yield of grain per acre to be in the

following order, starting with the highest yielding variety: Siberian, Waterloo, Probsteyer, Oderbrucker, Bavarian, Joannette, Egyptian, and Black Tartarian. It must be remembered that these oats were grown on plots and not in large fields of each variety. The land on which they were grown, however, received no commercial fertilizers, but had an application of farmyard manure at the rate of twenty tons, which is about equal to twelve good-sized loads per acre, once every four years. Besides this, the land received one green crop plowed under within the last ten years. In a four years' rotation the Oats usually followed a cultivated crop which had been manured.

In the average results for five years in growing thirty-three varieties of oats, the varieties which have given high results, other than those already mentioned in the previous paragraph, are the Vick's American Banner, Canadian Pride, Peerless, Irish Victor, Liberty, Mennonite, Michigan Wonder and New Zealand. Among those grown for less than five years, the following are the largest yielders: Ertragreichster, Yellow Russian, The Great American, and the New Golden Cluster.

Seventy-eight varieties of oats were under experiment in 1904, and the results from the plots show that the following varieties produced the greatest yield of grain per acre: American Banner, Peerless, New Zealand, Irish Victor, Michigan Wonder, German Rust Proof, Black Gotham, Liberty, and The Great American. In weight of grain, only four varieties went as high as forty pounds per measured bushel, viz., Early Dawson, White Superior Scotch, Zhelannie, and Tobolsk.

In some localities, the oat crop lodges very badly before it is cut. In these sections, it is very important to obtain a variety which is very stiff in the straw and not so likely to lodge as some of the older varieties. According to the results of our experiments, the Tartar King and the Storm King are among the very stiffest straw varieties. These are apt to stand up where some of the other varieties will become badly lodged. We notice, however, that in extreme cases, where the Tartar King variety is grown and where it does become lodged, it usually lies very flat on the ground. The Storm King was grown in 1904 for the first time, and our experience, therefore, with this variety is still very limited. A variety obtained under the name of Canadian King is very similar to the Storm King, and may possibly be another name for the same variety.

According to the results of quite extensive experimental work at the College, we find that by growing oats and barley together a larger yield of grain can be obtained than from either one grown separately. In order to grow two grains together, however, it is important to select such varieties as will mature at about the same time. As nearly all varieties of oats are considerably later in maturing than most of the varieties of barley, it is important to select some very early variety of oats to use in combination with a six-rowed barley. The follow-



in table gives the average results in number of days from seeding until maturity, strength of straw, weight per measured bushel, and average yield per acre of some of the very earliest oats we have grown at the College within the past three years :

Varieties.	Number of days in reaching maturity.	Per cent. of crops lodged.	Average results for three years.		
			Weight per measured bushel.	Yield per acre.	
				Straw.	Grain.
			lbs.	Tons.	Bushels.
Daubeney .....	98	5	34.5	2.3	85.7
Alaska .....	97	15	34.5	2.5	85.3
Black Mesdag .....	97	7	33.4	2.6	84.1
Early White Pearl .....	100	13	34.9	3.0	81.8
Early Champlon .....	99	5	34.8	2.4	86.3
Early Ripe .....	95	22	28.7	2.3	81.3

It will be seen that the Daubeney variety is one of great promise, when the complete results are taken into consideration. The Daubeney variety grows a good length of straw, stand up very well, has a spreading head and white grain, and the grain is very thin in the hull.

**CONTINUOUS SELECTION OF SEED OATS FOR TWELVE YEARS IN SUCCESSION.** For twelve years in succession, an experiment has been conducted in breeding oats by means of the selection of the seed. The selections made were large, plump, well-developed seeds: light-weighting and light-colored seeds; and also seeds from which the hulls had been removed by the separator. The test was commenced in the spring of 1903, by selecting seed from the general crop of the Joannette Black oats of the previous year. The selection made in each of the following years has been from the product of the selected seed of the previous year. The number of grains used on each plot was carefully counted and an equal number was used of each selection in each year. As the selection for this experiment has been continuous, selecting the seed each year from the crop produced in the year previous, the average results are of but little value, but the final results are interesting, valuable, and quite suggestive. In the crop produced in 1904, it was found that the large plump seed produced 94.1 bushels; the light seed, 68 bushels; and the hulled seed, 91.6 bushels per acre. As only the best quality of seed becomes hulled, we find that the oats from which the hulls had been removed gave nearly as good results as the carefully selected, large, plump seed from which the hulls had not been removed in the process of threshing. In weight per measured bushel, the crop produced from the large plump seed weighed 34.5 pounds; from the light seed, 24 pounds, and from the hulled seed, 33.1 pounds. The difference, therefore, between the large, plump, well-developed seeds and the light-weighting and light-colored seeds is very marked, and shows the great importance of sowing the former and discarding the latter. It is interesting to notice that the crop producing

from the large plump seed required only 1390 grains to weigh an ounce; while the crop produced from the light seed required 2095 grains to make the same weight.

**TREATMENT FOR SMUT IN OATS.** Two varieties of oats were selected in the spring of 1902, 1903, and again in 1904, and uniform samples of each variety were submitted to several treatments, with the object of killing the spores of smut adhering to the grain. The various treatments were as follows:

(1). *Immersion in Diluted Formalin.* The solution of formalin used for the immersion process was made by pouring one-half pint of the formalin into 21 gallons of water, and the seed oats were immersed in the solution for twenty minutes.

(2). *Sprinkling with Diluted Formalin.* One-half pint of formalin was poured into 5 gallons of water. The oats were then sprinkled with this solution and carefully stirred until the grain was thoroughly moistened.

(3). *Immersion in Hot Water.* For this treatment, the grain was placed in a bag, which was then immersed in water at about 115 degrees F. Soon afterwards it was placed in water which was kept at a temperature of between 130 degrees and 135 degrees F. The grain was occasionally stirred, and was allowed to remain in the water for a period of fifteen minutes. It was then spread out on a clean floor to dry, where it was stirred occasionally.

(4). *Immersion in Bluestone Solution for Twelve Hours.* In this treatment, the bluestone solution was made by dissolving one pound of bluestone in 25 gallons of water, and the oats were immersed in this solution for a period of twelve hours.

(5). *Immersion in Bluestone Solution for Five Minutes.* For this treatment, a strong solution was made by dissolving one pound of Copper Sulphate (Bluestone) in one gallon of water, and then immersing the oats in the solution for a period of five minutes.

(6). *Immersion in Potassium Sulphide Solution.* The potassium sulphide treatment consisted in soaking the seed for two hours in a solution made by dissolving eight pounds of potassium sulphide in 50 gallons of water.

(7). *Sprinkling with Bluestone Solution.* This solution was made by dissolving one pound of bluestone in 10 gallons of water, which was used for sprinkling over the oats until they were thoroughly moistened after being carefully stirred.

(8). *Untreated.* One sample of oats of each variety was left untreated in order that the influence of the various treatments might be observed.

It will be seen that eight lots of each variety of oats were used in the experiment each year. After the treatments had been completed a few hours the oats were carefully sown on separate plots, each of which was exactly one rod square. When the oats were coming into head, they were examined frequently and all smutted heads removed

and carefully counted. The following table gives the results in the percentage of smutted heads of oats in the average of the two tests in 1904, and also of the six tests in the three years during which this experiment has been conducted:

Treatments.	Percentage of Smutted Heads.	
	1904.	Average of 3 years.
Immersion in diluted formalin.....	.0	.0
Sprinkling with diluted formalin.....	.0	.0
Immersion in hot water.....	.0	.0
Immersion in bluestone solution for twelve hours.....	.0	.2
Immersion in bluestone solution for five minutes.....	.7	1.1
Immersion in potassium sulphide solution.....	.3	1.3
Sprinkling with bluestone solution.....	1.4	1.4
Untreated.....	11.6	7.0

The results here presented are certainly worthy of careful consideration. It will be seen that in 1904 untreated seed had about 12 per cent. of smutted heads in the resulting crop. In the average results for the three years, there was a loss of seven per cent. caused by the injury by smut from the untreated seed. In comparison with this, we have the excellent results from the treatments with formalin and hot water. In the treatment with the stronger solution of formalin, however, which was sprinkled on the grain, the yield of oats per acre was less in 1904 in the case of each variety, as compared with other treatments. Taking everything into consideration, the immersion of the oats for twenty minutes in diluted formalin, made by using one-half pint of formalin with 21 gallons of water, has given excellent results. The treatment is easily performed, comparatively cheap, and very effectual.

**INFLUENCE ON THE NURSE CROP FROM SEEDING DOWN WITH TIMOTHY AND CLOVER.** In 1904 an experiment was conducted for the first time, with the object of ascertaining whether any direct advantage or disadvantage would result to a grain crop by sowing seed of Red Clover, Alsike Clover, and Timothy at the time of sowing the grain. No less than thirty-two plots were used for this experiment. The Siberian and the Joannette varieties of oats were each used on one-half the plots. Eight plots were seeded with Common Red Clover, eight with Alsike Clover, eight with Timothy, and eight plots were left without either grass or clover seed. The oats, Timothy seed, and clover seed germinated splendidly and the crops were very satisfactory in every case. In averaging the results, it is found that there is exactly 1.14 per cent. more oats where no grass or clover were sown than where the Timothy Alsike, and Red Clover were grown with the oats. It will therefore

be seen, from the results of this experiment, that the practice of sowing grass and clover seed with the grain exerts but a very slight influence upon the yield of the grain crop.

**SMUTTED OATS, ONE, TWO, THREE AND FOUR YEARS OLD FOR SEED PURPOSES.** An experiment was conducted in 1904 for the first time, in order to ascertain whether the spores of smut on oats would be vital when two, three, or four years of age. For this experiment, the Black Tartarian and Daubeney varieties of oats were selected. Seed of each variety was taken from the crops of 1900, 1901, 1902, and 1903, and was sown on separate plots in the experimental grounds in the spring of 1904. These plots were watched very carefully, and, as any smutted heads appeared, they were removed from the plots and counted. The results show that as the seed increased in age there was a decrease in the yield of oats per acre and an increase in the percentage of smutted heads. Further work will likely be carried out along this line.

**WINTER OATS.** Winter oats have been sown in our Experimental Department in the autumn of the year on several occasions, but the crop has always become badly winter killed. In the autumn of 1903, we sowed two varieties of winter oats, which made a good growth in the fall of the year but which were completely killed out during the winter. We have never yet been successful in getting a variety of winter oats which would withstand the severe winter weather at the College.

#### WHEAT.

The wheat plant appears to have been known and valued from earliest times. It will thrive successfully in a great range of climate and the inhabitants of many countries enjoy the advantages of its cultivation. According to most authorities, there are in all seven types of wheat, and to one or the other of these types, or species, all varieties belong. The seven types of wheat are as follows:

- (1) Common, fine, or soft wheat (*Triticum vulgare*).
- (2) Turgid, or toulard wheat (*T. turgidum*).
- (3) Hard or flinty wheat (*T. durum*).
- (4) Polish wheat (*T. polonicum*).
- (5) Spelt (*T. spelta*).
- (6) Emmer or starch wheat (*T. dicoccum*).
- (7) One-grained wheat (*T. monococcum*).

Representatives of these different classes have been grown in our experimental grounds, although practically nothing is known throughout the Province about varieties of either turgid or one-rowed wheat. Considerable, however, has been said in reference to representatives of each of the other classes. Nearly all of the varieties of both spring and winter wheat which are grown in Ontario belong to type No. 1, the common wheat. Some of the best known representatives of other types are as follows: Wild Goose spring wheat, Medeah spring wheat, Algiers spring wheat, Polish spring wheat, Miracle winter wheat, etc. For the sake of convenience, we have arranged our report of varieties

of wheat as follows: Varieties of winter wheat for flour production, varieties of spring wheat for the production of macaroni, and varieties of spring wheat for feeding purposes.

**VARIETIES OF WINTER WHEAT FOR FLOUR PRODUCTION.** The past year has been an unfavorable one for winter wheat production in Ontario. According to the last report of the Bureau of Industries, we learn that no less than 189,274 acres, or nearly 24 per cent., of the area sown to winter wheat last autumn, was plowed in the spring of 1904. Some of the varieties in the experimental grounds at the College survived the winter in good condition; while some of the tender varieties were considerably winter killed.

Within the past fifteen years, about two hundred varieties of winter wheat have been grown at the College. The most of these have been grown for at least five years in succession. The highest yielding varieties for the past five years, including 1904, have produced the following average number of pounds of grain per measured bushel, and of bushels of grain per acre: Dawson's Golden Chaff, 59.9 lbs., 59.8 bus.; Imperial Amber, 61.2 lbs., 58 bus.; Prize Taker, 59.8 lbs., 57.6 bus.; Silver Dollar, 59.7 lbs., 57 bus.; Buda Pesh, 61.4 lbs., 55.4 bus.; Rudy, 61.1 lbs., 55.4 bus.; Forty-fold, 59.1 lbs., 55.4 bus.; and Egyptian Amber, 61.4 lbs., 55.2 bushels. The greatest yielders among seventy-two varieties grown in the past year, however, were the Imperial Amber, 41.3 bus.; Buda Pesh, 40 bus.; Crimean Red, 39.9 bus.; Rudy, 38.1 bus.; Tasmania Red, 36 bus.; Dawson's Golden Chaff, 35.7 bus.; and Egyptian Amber, 35 bushels per acre. The weight per measured bushel for this season has been exceptionally light, as can be seen from the following: Tasmania Red, 58.6 lbs.; Imperial Amber, 57.6 lbs.; Dawson's Golden Chaff, 55.7 lbs.; Turkey Red, 55.5 lbs.; and Early Genessee Giant, 52.3 pounds. The Dawson's Golden Chaff possessed the stiffest straw and the Red Hussar the weakest straw in 1904. All varieties rusted more or less in 1904, the Ironclad, Tasmania Red, and Pride of America being the freest. The Hessian fly did only a small amount of damage the past year.

**VARIETIES OF SPRING WHEAT FOR FLOUR PRODUCTION.** Spring wheat throughout Ontario seemed to give promising results until about the time of ripening, when the rust attacked the straw considerably, and the weather conditions seemed unfavorable for the production of a plump sample. In some sections the spring wheat was an utter failure. In the experiments at the College, most of the varieties gave a fair yield per acre, but the quality was unusually poor, as nearly all of the varieties came considerably under the standard in weight per measured bushel.

Eleven varieties of flour producing spring wheats have been grown in the Experimental Department under similar conditions for six years in succession. In the average results for the six years, the varieties here referred to have given the following yields per acre: Pringle's Champion, 35.1 bus.; Saxonka, 34.8 bus.; Red Fife, 34.5 bus.; Color-

ado, 34.1 bus.; Blue Democrat, 34 bus.; Preston, 33.5 bus.; White Russian, 33.3 bus.; Wellman's Fife, 33.1 bus.; Red Fern, 33.1 bus.; Herison Bearded, 32.2 bus.; and Seven Headed, 30.1 bushels. Of the newer varieties which have been under experiment for only three years, the following are among the heaviest yielders: Kolben, 28.9 bushels, and Climax, 25.4 bushels

VARIETIES OF SPRING WHEAT SUITABLE FOR THE PRODUCTION OF MACARONI. Those varieties of spring wheat suitable for the production of macaroni mostly belong to type No. 3, viz., the hard or flinty wheat (*T. durum*). Some seven varieties in all have been grown at the College for several years in succession. The average results of six years' experiments with six of these varieties are as follows:

Varieties.	Weight	Yield	Yield
	per measured bushel.	of straw per acre.	of grain per acre.
	Lbs.	Tons.	Bushels.
Wild Goose . . . . .	62.0	2.3	42.1
Medeah . . . . .	59.8	2.4	38.6
Sorrentina . . . . .	59.2	2.3	38.4
Bart Tremania . . . . .	60.1	2.3	37.3
Algiers . . . . .	58.8	2.3	36.6
Ontario . . . . .	55.1	2.9	29.0

It will be seen from the average results of the macaroni wheats for six years, that the Wild Goose variety has given the largest yield of grain per acre, and also the heaviest weight of grain per measured bushel. In the average results for 1904, the greatest yields were produced by the Wild Goose and the Medeah, and the lowest by the Ontario variety.

Another wheat which has been grown more or less in Egypt, Algiers, Spain, Italy, and Eastern Europe, and to a very limited extent in America, and which has been used to a greater or less extent for the manufacture of macaroni, is the representative of the species *Triticum polonicum*, and is known under such names as Polish Wheat, Corn Wheat, Colorado Giant Rye, etc. Many extravagant claims have been made for this grain in the Western States within the last two years. The straw of this variety is of medium length and is almost solid. The heads are large, and the outer chaff projects beyond the inner chaff in a peculiar manner. The grains are very hard and are about one and a half times as large as those of the Wild Goose spring wheat. We first grew the Polish wheat at the College in 1889. Careful tests of comparative results, along with other varieties, have been made at least ten years. In the average of the ten years' experiments, we find that the yield per acre of the Polish wheat is 22.1 bushels, and that of the Wild Goose 36.3 bushels per acre. The Wild Goose variety, therefore, gave an average yield of about 60 per cent. more than that of the Polish wheat.

According to the results of the experiments made with different macaroni wheats at the College, it will be seen that the Wild Goose variety has given the most satisfactory results in yield of grain per acre. This variety is exceedingly hard and contains a large amount of gluten. The flour produces bread of excellent quality but which is of a yellowish color, which gives it an unattractive appearance. As the wheat is very hard, it is difficult to grind, but many millers are now using a limited quantity of the flour of the Wild Goose variety to strengthen that of some of the softer kinds of both winter and spring wheats. A considerable amount of the Wild Goose spring wheat has been shipped to Italy, and to other parts of Europe, for the manufacture of macaroni, and it is largely that demand which has increased the price of the Wild Goose spring wheat in Ontario during recent years.

VARIETIES OF SPRING WHEAT FOR FEEDING PURPOSES. Emmer and Spelt are two distinct types of wheat, there being a number of varieties belonging to each type. The grain of both the Emmer and the Spelt is tightly enclosed within the chaff, from which only a small portion is separated in the process of threshing. The heads of Emmer are short and compact, and are nearly always bearded; while those of Spelt are long, narrow, open, and are usually bald. The spikelets of Emmer overlap each other like shingles on a roof, which thus makes the head close, smooth, and regular. The portion of the stem adhering to the spikelets after threshing is much smaller and more pointed in the Emmer than in the Spelt. The spikelets of the Emmer are flattened on the inner side, while those of the Spelt are arched. The grain of the former is much harder, and the chaff much softer, than that of the latter. Emmer is considered a very hardy plant, being much superior to Spelt in this respect. Three varieties of Emmer and ten varieties of Spelt have been grown in the Experimental Department of the College. The following table gives the average of three years' results of each of three of the principal varieties of Emmer and four of the principal varieties of Spelt which were tested in 1902, 1903, and 1904:

Classes of Crop.	Varieties.	Average results for three years.					
		Percentage of			Pounds per bushel 2 years.	Yield per acre.	
		Rust.	Crop lodged.	Hull with grain.		Tons of straw.	Pounds of grain.
Emmer.....	Common.....	3	36	22	36.8	2.7	3,467
	Iowa.....	2	36	21	37.3	2.4	3,248
	Russian.....	2	34	22	36.3	2.3	3,204
Spelt.....	Red.....	20	6	32	25.4	2.2	2,364
	Alstrom.....	20	4	33	24.4	2.0	2,184
	White.....	19	5	34	23.7	1.7	1,895
	Dasyanthum...	23	25	40	22.6	2.1	1,637

It will be seen from the foregoing table that all the varieties of Emmer have given decidedly better results than the best varieties of Spelt which we have grown. In the co-operative experiments throughout Ontario in 1901, 1902, 1903, and 1904, Emmer produced a larger average yield of grain per acre than the best variety of oats or the best variety of barley which was distributed. It is quite probable that the Emmer will be grown considerably throughout Ontario for the production of good, clean straw and a large yield of grain, to be used as a food for live stock. For feeding purposes, the grain and the surrounding chaff are usually ground together in the same manner as oats are ground into meal.

**SOWING EMMER AND SPELT ON DIFFERENT DATES.** Both Emmer and Spelt were sown on eight different dates in the spring of 1903, and again in the spring of 1904, starting on April 2nd in 1903 and on April 22nd in 1904, and finishing on May 21st in 1903 and on June 10th in 1904, and allowing one week between each two dates of seeding. The average results of the experiment for two years are presented in tabulated form.

Dates of Seeding.	Average results for two years.					
	Lbs. per measured bushel.		Tons of straw per acre.		Lbs. of grain per acre.	
	Spelt.	Emmer.	Spelt.	Emmer.	Spelt.	Emmer.
1st.....	24.0	38.3	1.8	2.1	2,393	2,080
2nd.....	26.1	38.0	1.5	2.1	1,993	3,038
3rd.....	25.6	38.0	1.7	1.9	1,829	2,827
4th.....	24.4	37.6	1.6	2.1	1,384	3,010
5th.....	23.9	37.6	1.6	2.2	1,277	3,064
6th.....	23.2	37.2	1.7	2.4	1,010	2,830
7th.....	22.1	36.8	1.5	2.8	785	2,782
8th.....	24.1	35.5	1.6	2.1	577	2,332

The average results of the experiment in sowing Emmer and Spelt in 1903 and 1904, on the average dates of April 12th, April 19th, April 26th, May 3rd, May 10th, May 17th, May 24th, and May 31st, show that decidedly the best yield of Spelt was obtained from the first seeding; while there was but little difference in the yield per acre of the Emmer sown on the 1st, 2nd, 4th, and 5th dates. The figures indicate the great importance of sowing Spelt as early in the spring as the land is warm and dry enough to work to good advantage. In the case of Emmer, however, comparatively late seeding gives about as good results as the seeding which takes place at an early date. The figures of this report, as well as those in the report of the varieties of Emmer and Spelt given previously, show very forcibly the superiority of the Emmer over the Spelt as a grain producer in this section of the Province.



**MATURITY OF WINTER WHEAT FOR SEED PURPOSES.** Seed taken from wheat which was allowed to become very ripe before it was cut produced a greater yield of both grain and straw, and a heavier weight of grain per measured bushel than that produced from wheat which was cut at any one of four earlier stages of maturity, according to the average results of fourteen separate tests.

**SELECTION OF SEED.** Selections of seed made from two varieties of winter wheat and tested for six years produced average annual results in bushels of grain per acre, tons of straw per acre, and pounds per measured bushel as follows: Large plump seed, 46.9 bushels, 2.6 tons, and 59.4 pounds; Small plump seed—40.4 bushels, 2.2 tons, and 59.2 pounds; Shrunken seed—39.1 bushels, 2.1 tons, and 59.1 pounds; and Broken seed—9.3 bushels, .6 tons, and 54.2 pounds, respectively.

**QUALITY OF WINTER WHEAT TO SOW.** The average yield, less the amount of seed used, from sowing one bushel, one and one-half bushels, and two bushels of each of two varieties of winter wheat per acre in each of six years, have been 39.7 bushels, 42.3 bushels, and 42.4 bushels per acre, respectively.

**SOUTHERN AND NORTHERN GROWN WINTER WHEAT SEED.** Seed wheat grown a thousand miles south of Guelph gave practically the same results as Ontario grown seed in the average experiments of two years.

**DATES OF SOWING WINTER WHEAT.** Winter wheat sown at the College during the first ten days of September in each of nine years has yielded 5.2 bushels per acre more than that sown from the 16th to the 20th of September.

**METHODS OF SOWING WINTER WHEAT.** The average results of sixteen experiments, covering a period of eight years, show that on well cultivated land winter wheat which was drilled in with a machine, and that which was sown broadcast by hand, gave practically the same yields of grain per acre.

**GREEN MANURING FOR WINTER WHEAT.** Land on which field peas were used as a green manure yielded 6.5 bushels of wheat per acre more than land on which buckwheat was used as a green manure, and 2.3 bushels per acre more than land which was worked as a bare fallow, in the average of eight separate tests.

**TREATMENT OF WINTER WHEAT FOR SMUT.** In each of five years, experiments have been conducted in treating winter wheat in different ways to kill the stinking smut, and the results have been very satisfactory. In the autumn of 1903, seven different treatments were made with each of two varieties of wheat. In the crop of the present year, the wheat produced from treated seed had no smut, and that from untreated seed had 3.6 per cent. of smutted heads. The treatment which proved very simple, cheap and effective was the immersion of the seed wheat for twenty minutes in a solution made by adding one pint of formaldehyde (formalin) to forty-two gallons of water. The past year was the first time that we used the formalin treatment as a part of this

experiment. In the average of five years' experiments, it was found that untreated wheat had 368 smut balls per pound of wheat; while that treated with potassium sulphide, bluestone, and hot water had only nine, two, and one smut balls, respectively. The copper sulphate (bluestone) treatment consisted in immersing the seed twelve hours in a solution made by dissolving one pound of copper sulphate in twenty-four gallons of water, and then immersing the seed for five minutes in lime water made by slacking one pound of lime in ten gallons of water. The hot water treatment consisted in immersing the wheat for fifteen minutes in water at 132 degrees F. After each treatment, the grain was spread out and stirred occasionally until dry enough to sow.

#### RYE.

Rye can sometimes be grown advantageously in those districts in which the soil is unsuited for other cereal crops. It is the characteristic food-grain of middle and northern Europe, and is used extensively by fully one-third of the population of Europe.

**WINTER RYE.** Several varieties of winter rye have been grown in our experimental plots for a number of years with good success. In the autumn of 1903, five varieties were sown in the same section of the field as the winter wheat. They all came through the winter well, surpassing many of the varieties of winter wheat in this respect. In five years' experiments with two varieties of winter rye, we find that the Mammoth gave an average yield of 60.5, and the Common variety of 57.8 bushels per acre. These are very large yields, showing that winter rye is a very hardy crop, withstanding the severity of even some of the severe winters which we have had within the past five years. In the experiments for 1904, the Mammoth gave 56.4; and the Common, 55.5; the Thousand-fold, 54.8; and the Washington variety, 51.8 bushels of grain per acre. It will therefore be seen that the Mammoth variety produced a greater yield per acre in 1904, and in the average of the past five years.

**SPRING RYE.** Four varieties of spring rye were grown in our experimental plots in the past season, the following being the results in yield of grain per acre: Dakota Mammoth, 34.9 bus.; Prolific Spring, 26.7 bus.; Common, 24.7 bus.; and Saatroggen, 24.3 bushels. Two of these varieties have been grown for seven years in succession, and the average results have been as follows: Dakota Mammoth, 38.8 bushels, and Prolific Spring, 35.1 bushels per acre. It will therefore be seen that among the spring varieties, the Dakota Mammoth has given very satisfactory results in yield of grain per acre. This variety has also produced slightly the heaviest weighing grain per measured bushel, the average for seven years being 57.4 pounds.

#### BUCKWHEAT.

Buckwheat is a native of Northern Asia, and has been grown as a cultivated crop for fully one thousand years. It grows and produces

a marketable crop on very poor soil, and it thrives admirably in cold climates. It is mainly grown for the production of grain, but it is also grown to a limited extent for soiling purposes and for plowing under as a green manure.

We have grown eight varieties of buckwheat in our experimental grounds within the past few years. Three varieties, namely, the Japanese, the Silver Hull, and the Common Grey, have each been grown in our trial grounds for eight years in succession. In the average results for the eight years, we find that the Silver Hull variety takes the lead with 20.2 bushels per acre. This, however, is closely followed by the Japanese variety, which produced a yield of 19.7 bushels per acre. The Common Grey, under similar conditions, gave only 16.6 bushels per acre. The last two or three years have been very unfavorable for the Japanese variety. According to the experiments conducted both at the College and throughout Ontario, the Japanese buckwheat appears to give the best results in seasons which are comparatively warm and dry; and the Silver Hull variety in cool, damp seasons such as we have had in 1902, 1903, and 1904. The results for the last year are quite different from the average of the last eight years, the following being the yield per acre of each variety: Japanese, 11.7 bushels; Silver Hull, 37.5 bushels; and Common Grey, 20.3 bushels per acre. Therefore, in the past season, the Silver Hull variety has yielded more than three times as much as the Japanese buckwheat. The Silver Hull variety possesses very plump grain, which is thin in the hull and weighs well per measured bushel.

#### FIELD PEAS.

The common field pea is a leguminous plant and a native of Italy. It has been in cultivation many hundred years, and is chiefly grown for its grain. It is also used in mixing with oats for the production of green fodder or hay. For soiling purposes, it produces a large yield of very nutritious food, but when fed alone is not generally relished by farm stock. The seed is exceptionally rich and is of great value for using with other grain in fattening cattle and hogs. The straw is used extensively as a food for sheep, and is sometimes mixed with other coarse fodder for feeding to dairy cows. Field peas are sometimes used as a green manure with very excellent satisfaction.

Owing to the ravages of the pea weevil (*Bruchus pisorum*), frequently called the pea bug, the acreage of peas has been greatly reduced in Ontario during the past six or seven years. In many sections of the southwestern part of the Province, the farmers have given up the growing of peas entirely for a time, owing to the great damage caused by the pea weevil. As the acreage has been reduced to such a large extent, we would very strongly advise any persons who grow peas in the southwestern part of Ontario in 1905 to cut the peas a little on the green side, then cure and thresh them as soon as possible.

and immediately treat them with carbon bisulphide. Within a period of seven years, about thirty different treatments of peas were made in the Experimental Department for the destruction of the pea weevil. In handling the crop, care was taken throughout to pull the peas at the proper time, to haul them to the barn when dry, and to thresh them as soon as possible. Immediately after threshing, the peas were put into cotton or jute bags. As soon as thirty bushels of peas were threshed they were placed in a fumigation box for treatment. One pound of carbon bisulphide was poured into three flat pans, which were placed on the top of the peas; the cover was then put on the box and weighted with heavy stones. After forty-eight hours the cover was removed and the box ventilated. The pans had become dry, as the liquid had changed into a gas, which, being much heavier than air, had sunk down amongst the peas penetrating them and killing the weevils. The quantity of carbon bisulphide used by us was larger than that usually recommended, as a pound or a pound and a half is generally considered sufficient for one hundred bushels of peas, but we wished to be on the safe side. In practically all cases the weevils were destroyed at the first treatment, no matter whether they were in the larva form, in the pupa stage, or had become fully developed. The treatment can be made in any comparatively air-tight receptacle, whether a barrel, box, or specially made fumigation house.

Carbon bisulphide is a colorless or slightly yellowish liquid, one-fourth heavier than water. It is extremely volatile, i. e., it evaporates very rapidly when exposed to the air, and when pure will not injure or stain the finest goods. The commercial liquid has an acrid taste, and an odor like that of rotten eggs. The vapor is more than two and a half times as heavy as air. Carbon bisulphide may be purchased in small quantities from any druggist at about 30 cents per pound, or 40 cents per pint. For large quantities, better rates can be given by the druggist. The gas, or vapor, which comes from carbon bisulphide is not only combustible, but it is very explosive when mixed with air. Great care should therefore be taken to treat the peas in the daytime only, for a light or a flame of any kind brought near the liquid may cause a serious explosion; and smoking near it should be positively prohibited. Moreover, the vapor should not be inhaled, as it is very injurious, even a small portion causing headache, giddiness, and nausea. The treatment with carbon bisulphide should be made in boxes, barrels, or "bug houses," located some distance from the insured buildings on the farm.

With the strict observance of the preceding precautions, no one should hesitate to use the carbon bisulphide. As a matter of fact, we have never heard of any bad results following its use in the treatment of peas. This happy condition of things may be explained when we say that all who used the liquid were wise enough to be cautious. There is, moreover, no danger that the vapor will injure the peas or render them unsafe as a food. Experiments have shown that the liquid can

even be poured upon articles of food, and, after thorough exposure to the air, not a trace of it will remain.

There is as yet but little trouble from the pea weevil in the extreme eastern and northern portions of the Province, where peas can still be grown to good advantage. Although we have not made comparative tests of different varieties of peas in our experimental grounds during the past two years, a reference might here be made to the results of former experiments. Fully one hundred varieties of field peas have been grown in our experimental plots within the past fifteen years. For a very rich soil, the White Wonder gave the greatest yield of grain per acre; for a soil of medium quality, the Early Britain gave a very high yield, and the New Canadian Beauty gave a moderately high yield of seed of excellent quality; and for poorer soils, the Prussian Blue and the Tall White Marrowfat, which are both very long strawed varieties, gave excellent results.

Although we have mentioned previously that no comparative experiments of different varieties of field peas have been conducted during the past two years, the Early Britain variety was grown and ripened in 1904, and was carefully examined in order to ascertain the ravages of the pea weevil. As determinations regarding the percentage of weevilly peas of this variety have been made since 1894, the percentage of crop infested with the weevils each year gives us some information regarding the ravages of this pest in this section of the Province. The following gives the percentage of weevilly peas of the Early Britain variety for each of the eight years: 1894, 2; 1895, 7; 1896, 11; 1897, 34; 1898, 49; 1900, 75; 1901, 96; and 1904, 61 per cent. It will therefore be seen that the damage caused by the pea weevil in 1904 was only about two-thirds as great as it was three years ago. As the farmers in the vicinity of Guelph have stopped growing peas to a considerable extent within the past two years, the ravages of the pea weevil seem to be somewhat reduced.

#### FIELD BEANS.

Field beans are not grown very extensively throughout Ontario, except in the southwestern part, and especially in the counties of Essex and Kent. Fourteen varieties of beans were under experiment in our trial grounds at the College in 1904. The yields were comparatively low this season, probably due to the cold, wet weather in this part of the Province. The seven highest yielding varieties in the past season were: New Prize Winner, 17.4 bushels; Schofield Pea, 16.6 bushels; White Wonder, 15.3 bushels; Small White Field, 15.3 bushels; Burlingame Medium, 14.8 bushels; the Pearce's Improved Tree, 14.8 bushels per acre. In the average results for eight years of thirteen varieties of beans, which have been grown for that length of time, we find that those varieties which gave the greatest yields per acre were the White Wonder, 21.8 bushels; Pearce's Improved Tree, 21.3 bushels; Burlingame Medium, 20.8

bushels; Medium or Navy, 20.7 bushels; and Schofield Pea, 20.5 bushels per acre. In average weight per measured bushel for eight years, there was a variation from 57 pounds for the Large White Haricots to 65.7 pounds for the Snowflake variety. Twelve out of the thirteen varieties, however, gave upwards of 62 pounds per measured bushel in the average of eight years' experiments.

#### SOY, SOJA, OR JAPANESE BEANS.

Many of the varieties of Soy beans require too long a season to give satisfactory results in Ontario. As the result of experiments conducted for a series of years, however, we have found the Early Yellow variety to give good satisfaction as a grain producer, and the Medium Green variety as a fodder crop. We believe that as the Medium Green variety becomes better known, it will be grown for the purpose of cutting green and mixing with corn when filling the soil. We also believe that the Early Yellow variety can be grown quite successfully for grain production on many farms of Ontario. The grain is exceedingly rich, containing more protein than any of the ordinary farm crops grown in Ontario. A small quantity of the Soy beans, ground and mixed with other meal, will increase the quality of the meal considerably. Owing to the unfavorable weather conditions for the Soy beans in 1904, the crop was not as satisfactory as usual. We generally get about 1,200 pounds of grain per acre, but the best yielding variety of Soy beans in 1904 produced only 880 pounds of the ripened seed per acre.

#### HORSE BEANS.

The Horse bean is a coarse, rank-growing annual legume which is used quite extensively in Europe as a forage plant. There are several named varieties of horse beans, a number of which have been grown at the College. They have been under test in the Experimental Department for practically each season during the past fifteen years. In most seasons, they give very poor results. The yield of ripe seed in 1904 was only 200 pounds per acre. On the whole, the Horse beans seem to be unsuited for general cultivation throughout Ontario.

#### GRASS PEAS.

The Grass pea is a leguminous plant, which produces long, flat vines; slender leaves; white blossoms; medium-sized pods; and hard, angular, white, or greenish white, grains. It is entirely proof against the attacks of the pea weevil. In many respects, it resembles the Bitter Vetch (*Lathyrus sativus*) of Europe, which, however, has blue flowers and brown seeds. It also appears to be free from the poisonous principle which the Bitter Vetch is said to possess. This is borne out by the extensive and satisfactory use of the Grass peas as a food for farm stock.

In the average results of tests made for a period of seven years, it was found that the annual yield of grain was 25.7 bushels, and the yield of straw 2.2 tons per acre. During the last two or three years,

however, the seasons have been very unfavorable for the growth of the Grass peas, as they have for practically all kinds of leguminous crops. The yield per acre of Grass peas at the College in 1904 was only 992 lbs., or about 16 1-2 bushels per acre.

#### COW PEAS.

The Cow peas, which thrive so admirably in the southern States, require a comparatively long season from the time they are sown until they reach maturity. We have tested a large number of varieties, no less than ten being under experiment in 1904. We have as yet been unable to secure any varieties of Cow peas which have given satisfactory results at the College.

#### HAIRY VETCHES FOR SEED.

For four years in succession, Hairy vetches have been sown in the autumn and ripened in the following year, with the result that an average of 8.6 bushels of seed per acre has been obtained. The vetches sown in the autumn seem more productive of seed than those sown in the spring of the year. In past years, the Hairy vetch seed has been principally imported from Germany, and has usually cost about \$5.00 per bushel. The Hairy vetches produce a crop which seems specially useful as a pasture for farm stock, especially hogs; a cover crop in orchards; or a green manure for plowing under to enrich the soil.

#### ALFALA FOR SEED PRODUCTION.

For three years in succession, efforts have been made to produce Lucerne or Alfalfa seed in the experimental plots at the College. Owing, probably, to the unfavorable weather conditions, the yield of seed has been rather light in each of the three years.

#### CORN FOR GRAIN.

Owing to the cool, wet weather of the past season, corn for grain production gave a very poor crop. At the usual time of corn planting, the weather was cool and the land too wet to plant corn. Consequently, the seed was not planted until the early part of June. The growth throughout the season was rather slower than usual, and the first nipping frost occurred comparatively early this season, thus preventing the maturity of those varieties which usually ripen quite well at Guelph. The names of some of those varieties which gave the best satisfaction in 1904 are as follows, commencing with the best corn: King Phillip, Wisconsin Little Dent, Genessee Valley, Red Blazed, Extra Early Huron Dent, Farmers' Friend, Farmers' Surprise, University No. 13, Longfellow, Early Strawberry, Compton's Early, Golden Leneway Dent, Salzer's North Dakota, Tuscarora, and King of the Earlies. For the four years previous to 1904, the average yields per acre for the highest yielding varieties of corn for grain production were as follows: King Phillip, 58 bus.; Farmers' Friend, 54 bus.; Longfellow, 54 bus.;

Genessee Valley, 53 bus. ; Canada Yellow, 48 bus. ; Red Blazed, 47 bus. ; Burlington Hybrid, 45 bus. ; Salzer's North Dakota, 43 bus. ; and Compton's Early, 42 bushels per acre. The King Phillip variety, which came at the top of the list in 1904, and also in the average of the four years previous, is a reddish flint variety which we have sent out in connection with the co-operative experiments over Ontario for the last two or three years. It has given very good satisfaction throughout the Province, giving the largest yield of grain per acre over Ontario in 1904.

#### SORGHUM FOR SEED.

Several varieties of sorghum, including different kinds of sugar cane, kaffir corn, broom corn, millo maize, etc., have been grown in the experimental grounds from year to year. Owing to the cool, backward season, however, none of the varieties ripened seed satisfactorily in 1904.

#### MILLET FOR SEED.

In the average results for five years, in testing fifteen varieties of millet for seed production, it is found that the Siberian Millet (47.5 bus.) Hungarian Grass (45.2 bus), and the California Millet (42.1 bus.), have been the heaviest yielders. These, however, have been quite closely followed by the German or Golden (38.8 bus.) and Early Harvest (38.7 bushels per acre). In comparison with these, it might be mentioned that the lowest yields were obtained from the White French, 14 bus. ; Golden Wonder, 18.5 bus. ; and the Red French, 19.3 bushels per acre. In the results of testing twenty-one varieties in 1904, we find the greatest yields produced by the Siberian Millet, Steel Trust Millet, Hungarian Grass, California Millet, German or Golden Millet, Early Harvest Millet, and Tamboy Millet.

#### SUNFLOWER SEED.

Seven varieties of sunflowers have been grown in the experimental grounds. Three of these varieties have now been grown for six years in succession. Allowing 20 pounds for the measured bushel, the average results for the six years are as follows: White Beauty, 68.7 bus. ; Mammoth Russian, 65.5 bus. ; and Black Beauty, 57.8 bushels per acre. It will thus be seen that all the varieties have produced heavy yields of seed per acre, and of the three leading varieties the White Beauty has given excellent satisfaction, producing an average yield of 1,374 pounds of seed per acre per annum.

#### FLAX SEED.

Four varieties of flax have been grown in the Experimental Department. The common variety has now been under experiment for nine years, the average yield per acre for the whole period being 13.5 bushels of grain. The yield of flax at the College has been very low in some seasons, and this has brought the average down to the figures



here given. In 1904 the common flax gave a yield of a little over 21 bushels of seed per acre.

#### SOWING SPRING GRAIN ON SIX DIFFERENT DATES.

Not only is it important that we give proper attention to the varieties of seed which we sow and to the careful selection of the seed, but it is also of very great importance to have the seed sown at exactly the right time in the spring of the year. In order to obtain some reliable and specific information regarding the actual results of sowing grains at different times in the spring of the year, an experiment has been conducted at the College in each of five years by sowing spring wheat, barley, oats, and peas, on each of six different dates in the spring. The experiment was conducted in duplicate each season. The first seeding took place when the land was warm enough and dry enough to work to good advantage. One week was allowed between each two seedings, unless unfavorable weather compelled a change of a day or two in the date of seeding. The average date of the first seeding was April 18th, and of the last seeding May 23rd. The average results of this experiment are reported in the accompanying table and are illustrated in the accompanying diagram. The average results for the five years in per cent. of rust, in weight of grain per measured bushel and in yield of straw and of grain per acre for each of the four classes of grain and for each of the six different dates of seeding of each kind of grain will be found in the table here given :

Class of crop.	Seeding.	Per cent. of rust, average 4 years.	Average results for five years.		
			Weight per measured bushel.	Yield of straw per acre.	Yield of grain per acre.
Spring wheat.....	1st seeding .....	4.5	60.1	1.22	21.9
	2nd " .....	5.5	59.6	1.13	18.2
	3rd " .....	5.3	59.0	.97	15.4
	4th " .....	7.8	58.9	.87	13.0
	5th " .....	8.5	56.5	.63	8.4
	6th " .....	11.3	54.0	.77	6.7
Barley .....	1st " .....	4.0	52.3	1.20	48.2
	2nd " .....	4.3	52.6	1.19	45.9
	3rd " .....	5.5	51.8	1.05	39.8
	4th " .....	6.3	50.3	1.04	37.1
	5th " .....	11.8	48.2	.94	27.6
	6th " .....	14.0	45.1	.85	18.4
Oats .....	1st " .....	10.8	33.9	2.00	75.2
	2nd " .....	15.8	34.5	2.10	76.0
	3rd " .....	19.3	32.1	1.83	64.2
	4th " .....	25.0	29.9	1.72	55.8
	5th " .....	25.3	27.3	1.56	45.2
	6th " .....	23.8	24.2	1.72	37.0
Peas .....	1st " .....	43.5	56.6	.92	25.4
	2nd " .....	56.0	56.6	1.07	28.8
	3rd " .....	49.0	57.6	1.10	28.5
	4th " .....	54.5	57.4	1.02	25.5
	5th " .....	59.5	57.0	.87	21.5
	6th " .....	57.0	57.0	.95	18.5

*Comparative Yields of Spring Grains Sown on Six Dates  
One Week Apart  
Commencing as Early as the Land was Dry Enough for Sowing.*

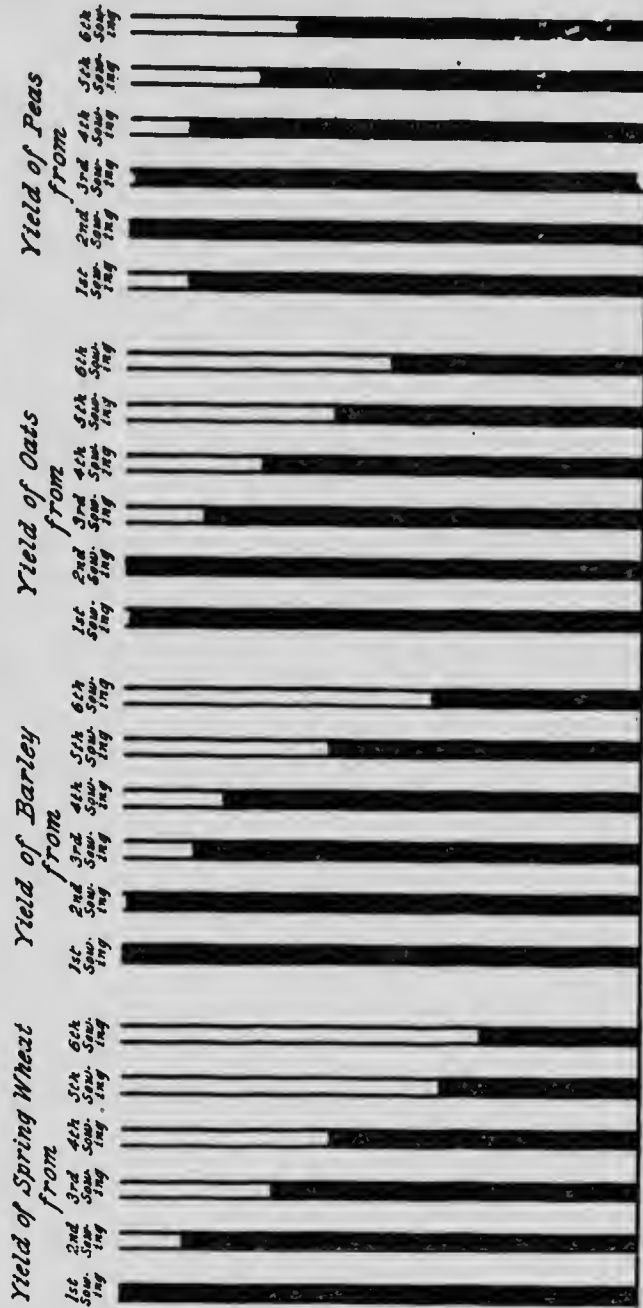


DIAGRAM ILLUSTRATING ONE OF THE CASES IN THE AGRICULTURAL MUSEUM AT THE COLLEGE, SHOWING THE YEARS' RESULTS IN SOWING SPRING GRAINS AT DIFFERENT DATES.

The results here presented show that the greatest average yield of grain per acre was produced by the spring wheat and by the barley from the first, and by the oats and the peas from the second date of seeding. This also holds good in regard to the straw per acre, with the single exception that in the case of peas the seed sown on the third date produced a little higher yield than that sown on the second date. In weight of grain per measured bushel, the first two dates of seeding are decidedly the best with spring wheat, barley, and oats, but in the case of peas the highest weights of grain per measured bushel were obtained from the third and fourth seedings. It will be observed that as the date of seeding was delayed the percentage of rust in the resulting crop was gradually increased, with only one slight exception. The results indicate the importance of sowing spring wheat, barley, oats, and peas in the order here given, starting with the spring wheat and finishing with the peas.

An exceedingly important lesson may be learned from the results of this experiment, which show that for every day's delay in the seeding after the first week was passed in which the seeding took place, there was an average decrease of 56 lbs. of oats, 53 lbs. of barley, 29 lbs. of spring wheat, and 23 lbs. of peas per acre.

#### GROWING GRAINS IN MIXTURES FOR THE PRODUCTION OF GRAIN AND STRAW.

Within the past fifteen years, a large amount of experimental work has been carried on in order to glean some reliable information regarding the comparative values of growing grains in combination in comparison with the growing of the same grains separately for the production of grain and straw. Some of the experiments have been completed, while others will need to be repeated in future seasons before the final conclusions can be drawn. The results of the experiments already conducted are very interesting and quite suggestive.

FOUR KINDS OF SPRING GRAIN GROWN SEPARATELY AND IN VARIOUS COMBINATIONS. For five years in succession, an experiment was conducted in growing peas, oats, barley, and wheat, separately, and in all the combinations which could be formed, having two, three, or four grains in each mixture. This formed an experiment of fifteen different crops, which were grown in comparison one with the other. The experiment was conducted in duplicate each year. The results go to show that the grain which was grown in mixtures produced larger yields per acre than the same kinds of grain grown separately in nearly the whole of the tests. Of the different mixtures used, the oats and barley gave the heaviest average yield of threshed grain per acre.

OATS AND BARLEY MIXED AND SOWN IN DIFFERENT PROPORTIONS. It was decided in the spring of 1899 to conduct an experiment in sowing nine different proportions of oats and barley in order to determine which mixture and which quantity of seed would give the best results

in the production of grain and straw. The experiment has therefore been conducted for six years in succession. The following table gives the quantities of oats and barley sown together, and the average yield of grain per acre in the average of six years' experiments :

Oats.	Barley.	Yield per acre.
		Pounds.
$\frac{1}{2}$ bushel .. . . . . .	$\frac{1}{2}$ bushel .. . . . . .	2,240
$\frac{1}{3}$ bushel .. . . . . .	$\frac{1}{3}$ bushel .. . . . . .	2,163
$\frac{1}{4}$ bushel .. . . . . .	$\frac{1}{4}$ bushel .. . . . . .	2,214
$\frac{1}{5}$ bushel .. . . . . .	$\frac{1}{5}$ bushel .. . . . . .	2,206
$\frac{1}{6}$ bushel .. . . . . .	$\frac{1}{6}$ bushel .. . . . . .	2,290
$\frac{1}{7}$ bushel .. . . . . .	$\frac{1}{7}$ bushel .. . . . . .	2,201
$\frac{1}{8}$ bushel .. . . . . .	$\frac{1}{8}$ bushel .. . . . . .	2,218
$\frac{1}{9}$ bushel .. . . . . .	$\frac{1}{9}$ bushel .. . . . . .	2,241
$\frac{1}{10}$ bushel .. . . . . .	$\frac{1}{10}$ bushel .. . . . . .	2,177

We see by the foregoing figures that the greatest number of pounds of grain per acre was produced from a mixture of one bushel of oats (34 lbs.) and one bushel of barley (48 lbs.) per acre, or by a total amount of 82 pounds of the mixed seed per acre.

A MIXTURE OF OATS AND BARLEY WITH AND WITHOUT SOME OTHER GRAIN FOR SEED PURPOSES. In 1902, in 1903, and again in 1904, an experiment was conducted in duplicate in order to ascertain whether the seed mixture of one bushel of oats and one and a half bushels of barley per acre could be improved by the addition of a small quantity of some other kind of seed. In addition to the standard mixture of oats and barley, one-half bushel of grain was used in each mixture. The following yields per acre show the average results of the two tests for each of the three years as follows :

Standard Mixture .. . . . . .	lbs.
" " and 30 lbs. Wild Goose Spring Wheat .. . . . . .	2,500
" " " 22 pounds of Emmer .. . . . . .	2,480
" " " 28 " Flax .. . . . . .	2,500
" " " 30 " Black Hulless Barley .. . . . . .	2,511
	2,468

The average results of this experiment for three years seem to indicate that it is very difficult to surpass the standard mixture of barley : of oats in yield per acre by adding small quantities of other kinds of seed. If only one bushel of barley had been used instead of one and a half bushels for the standard mixture, possibly the other seed might have exerted an influence slightly more marked than is seen in the results of this experiment. A mixture of oats, barley, and flax has given very good satisfaction.

TWELVE KINDS OF GRAIN GROWN IN COMBINATION. In the spring of 1902, an experiment was started in growing twelve kinds of grain in different combinations. One of the principal objects of this experiment was to ascertain the relative value of different kinds of grain when grown in combination in comparison with the same grains when grown separately. The different grains used for this mixture were as

follows: Mandscheuri barley, Black Hulless barley, Spring rye, Early Alaska oats, field peas, Joannette Black oats, White Hulless barley, Emmer. Grass peas, Wild Goose spring wheat, vetches, and flax. The mixtures were made up in two different ways—first, by using the same amount of seed of each variety which is usually sown when the grains are grown separately, and second, by using equal quantities of seed of all the varieties. Each of the mixtures here described was sown at the rate of 56, 84, 112, 140, and 168 pounds of seed per acre. Each part of the experiment was conducted in duplicate. It will therefore be seen that there were four tests made with these different mixtures in each of the four years, and that sixty plots have been used for the test during the years 1902, 1903, and 1904. The average results for the three years show that 112 pounds of the mixture of seed per acre produced a greater yield of grain than either of the two lighter or the two heavier seedings.

The crop produced by the mixture of twelve kinds of grain and sown at the rate of 112 pounds per acre was carefully analysed in order to ascertain the percentage of yield of each of the separate crops. Those varieties which had the largest average percentage of seed in the crops produced were as follows: Mandscheuri barley, Black Hulless barley, Spring rye, Joannette Black oats, and Early Alaska oats. These five varieties furnished about two-thirds of the entire crop; while the other third was produced by the White Hulless barley, field peas, Grass peas, Emmer, Wild Goose spring wheat, Common Spring vetches, and flax. The Mandscheuri barley had the largest and the flax the smallest percentage in the crop produced from the mixture of the twelve varieties. This experiment goes to confirm other experiments, and to show that it is very difficult to make a mixture which will produce a heavier yield of grain per acre than one made of barley and oats.

VARIETIES OF OATS AND BARLEY FOR GROWING IN COMBINATION. If oats and barley are grown in combination, it is, of course, important to secure those varieties which will mature at about the same time. In order to do this, it is necessary to use a very early variety of oats with an ordinary ripening barley, or a very late variety of barley to use with an oat which matures at an average date. Of all the varieties which we have used in combination, we have found that the Early Daubeney oats and the Mandscheuri barley make a very excellent combination. Another mixture which has given good satisfaction is the Siberian or Banner oats and the Chevalier two-rowed barley. It is, however, difficult to secure true seed of the Chevalier barley in Ontario at the present time. Taking everything into consideration, the first mixture here mentioned is one of the most satisfactory to use at the present time.

#### MANGELS.

The number of acres used for the mangel crop in Ontario has been greatly increased within the past twelve years. According to the

report of the Bureau of Industries, we learn that from 1882 to 1903 an annual average area of 37,993 acres was used for the growing of mangels. In 1893 there were only 21,510, in 1894, 27,670, and in 1895, 34,383 acres. From that time forward there has been a gradual increase in the acreage used for mangels up to 1903, when no less than 80,918 acres were used for this important crop in Ontario. In 1904, however, the acreage dropped to 71,344 acres, owing, no doubt, to the unfavorable weather at that time in the spring when the farmers were ready to sow their mangel crop. The average yield of mangels per acre for Ontario for the past twenty-three years has been 459 bushels, or about 13.8 tons.

**VARIETIES.** Twenty-three varieties of mangels have been carefully tested in our experimental grounds for five years in succession. The seeding has usually taken place near the first of May. There have been three rows of each variety, each row being four rods in length. Three and a third links (26 2-5 inches) were allowed between the rows, and ten inches between the mangels in the rows. The same distance was allowed between the different varieties as between the rows of the same variety. Level cultivation was practised throughout. The average results for the five years in yield of tops and in yield of roots per acre as follows :

Varieties.	Average results for five years.	
	Yield of tops per acre.	Yield of roots per acre.
	Tons.	Tons.
1. Yellow Leviathan .....	5.44	34.16
2. Mammoth Golden Giant .....	5.90	33.76
3. Sutton's Mammoth Long Red .....	5.82	33.30
4. Oblong Giant Yellow or Giant Yellow Inter .....	5.26	33.20
5. Steele, Briggs Giant Yellow Inter....	5.66	33.12
6. Carter's Mammoth Prize Long Red ....	6.15	32.66
7. Evans' Improved Mammoth Sawlog..	6.53	32.40
8. Northan Giant .....	6.02	31.62
9. Simmers' Improved Mammoth Long Red .....	6.62	31.77
10. Steele's Long Red Selected .....	6.06	31.13
11. Cornish Giant Yellow Globe .....	2.30	31.06
12. English Prize .....	6.52	30.64
13. Giant Yellow Half Long .....	5.03	30.61
14. Long White .....	5.79	30.67
15. Buckbee's Mastadon .....	6.79	30.07
16. Rennie's Perfection Mammoth Long Red .....	5.85	29.63
17. Carter's Windsor Prize Taker Yellow Globe .....	2.24	29.60
18. Daniels' Improved Gate Post .....	3.32	29.39
19. Carter's Elephant Yellow Globe .....	2.61	29.61
20. Taber's Gate Post Yellow Inter .....	3.45	29.78
21. Rivershall Giant Yellow Globe .....	2.57	29.24
22. Red Globe .....	4.30	27.55
23. Mammoth Red Intermediate .....	3.39	26.11

The Yellow Leviathan, which stands at the head of the list in yield of roots per acre, is a yellow intermediate variety which has given very

excellent satisfaction. In connection with the co-operative experimental work throughout Ontario in 1904, the Yellow Leviathan also gave the greatest yield of roots per acre, and, of the three varieties distributed, it was the most popular among the experimenters. The seed of this variety was obtained from D. M. Ferry, Windsor, Ontario. Within the past fifteen years, we have grown upwards of twenty-five different strains of the long red mangel, all of which have been surpassed by Yellow Leviathan intermediate variety.

In 1904, thirty-two varieties of mangels were under test. Among the better kinds, the following produced the greatest yield per acre: Griewener, 29.9 tons; Giant Eckendorf, 28.1 tons; and Rennie's Golden Giant, 24.6 tons.

**SOAKING SEED BEFORE PLANTING.** For three years, an experiment has been conducted in which mangel seed has been soaked twelve, twenty-four, and thirty-six hours before sowing in comparison with mangel seed which was sown without being soaked. The average results of the three years' tests show that the mangel seed which was soaked twelve hours gave the highest yield of roots per acre, the average being 22.9 tons, as compared with 20.1 tons produced from the unsoaked seed. It is quite probable that the condition of the land at the time of sowing has much to do with the comparative results from soaked and unsoaked seed.

### SUGAR BEETS.

The total area devoted to the growing of sugar beets in Ontario is still quite limited. A considerable amount of interest, however, has been taken in this crop during the past few years, both for feeding purposes and for the manufacture of sugar. Usually those varieties which give a large yield per acre, are easily harvested, and contain an average of about ten per cent. of sugar, are the ones used for feeding purposes; and those varieties which grow mostly underground and furnish about 15 per cent. of sugar are the ones sown for sugar production.

**VARIETIES.** In our experimental work, we have made a comparative test of thirty-two varieties of sugar beets within the past five years. These include some of the leading varieties as grown for feeding purposes, and also some of the leading kinds which have been specially bred in Germany for many years for the production of sugar. In 1900 and in 1901, the sugar beet seed was planted in rows 26 inches apart, and the plants were thinned to a distance of 7.9 inches apart in the rows. In 1902, 1903, and again in 1904, however, all the varieties were planted in rows 21 inches apart, and a distance of seven inches was left between the plants. The thinning took place when the plants were quite small. Level cultivation was practised throughout. The following table gives the average yield per acre of duplicate experiments conducted with nineteen varieties in 1900, twenty-one

varieties in 1901, thirty varieties in 1902, and thirty-two varieties in 1903 and again in 1904, as well as the average for the number of years that each variety was grown.

Varieties.	Yield of roots per acre.					Average Tons.
	1900. Tons.	1901. Tons.	1902. Tons.	1903. Tons.	1904. Tons.	
1. Giant White Feeding .....	14.05	17.22	25.38	31.53	38.44	25.32
2. Royal Giant.....	14.95	19.29	29.63	26.55	33.14	24.71
3. New Danish Improved .....	19.10	18.60	27.88	27.44	29.08	24.42
4. Red Top.....	24.25	19.63	26.81	20.83	30.38	24.38
5. Giant Rose Feeding .....	14.50	17.67	25.38	31.11	32.84	24.30
6. Red Skinned .....	21.55	20.60	22.38	22.36	28.39	23.06
7. White French.....	17.35	14.39	29.06	26.08	26.63	22.70
8. Green Top White .....	18.35	18.91	26.56	20.47	25.73	22.00
9. White Silesian.....	21.45	18.15	25.94	21.23	22.28	21.81
10. Lane's Improved .....	20.45	16.28	22.75	22.08	24.30	21.17
11. Carter's Nursery .....	13.35	14.93	29.38	27.02	20.78	21.09
12. Queen of the Danes .....	11.65	12.63	20.00	29.27	25.91	21.09
13. Jersey .....	13.70	14.63	20.69	23.06	30.31	20.48
14. Champion.....	19.25	17.18	22.38	21.00	20.28	20.02
15. Kleinwanzlebener.....	14.38	16.81	23.06	20.97	24.89	20.02
16. Pitzscheke's Elite .....	14.85	14.61	20.63	30.70	21.20	18.40
17. Imperial Grey Top .....	11.85	15.87	21.81	22.39	19.59	16.30
18. French Yellow .....	13.15	15.14	23.19	19.48	19.25	18.04
19. Improved Imperial .....	14.00	14.22	21.32	19.88	16.66	17.20
20. Mangel Sugar Beet .....		13.01	20.50	21.27	19.08	18.47
21. Vilmorin's French Sugar .....		13.22	19.44	21.45	16.38	17.62
22. Ideal .....			30.13	31.69	32.16	31.32
23. Tankard Cream .....			28.56	28.75	34.31	30.54
24. Rennie's Giant Sugar .....			33.00	26.50	29.14	29.55
25. Rubensamen (Rimpau) .....			21.06	19.67	21.02	20.56
26. Kleinwanzlebener (Mette) .....			21.50	22.44	17.22	20.39
27. Jaensch's Victrix .....			21.44	21.23	17.83	20.17
28. Dieckman No. 3 .....			20.44	19.86	19.52	19.94
29. Dieckman No. 1 .....			19.63	19.33	19.94	19.63
30. Dieckman No. 2 .....			19.13	18.52	18.58	18.74
31. Hybrid Sugar Beet Mangel .....				25.23	24.22	24.73
32. Imperial Giant Half Sugar .....				25.02	21.06	23.04

In the average results for five years, the Giant White Feeding variety now occupies the highest place in yield of sugar beets per acre. The yield of this variety in 1904 was very large, being 38.4 tons per acre. The Royal Giant variety, which stood third in average yield of roots per acre in the average results for the last year, now occupies second place. The Kleinwanzlebener variety, which is so extensively used in the United States and Canada for sugar production, has given an average of 20 tons per acre for five years. This is considerably larger than is usually obtained in general practice, 15 tons being considered a satisfactory crop in general field cultivation. Among the newer varieties, the Ideal stands very high, giving an average of 31.3 tons per acre for three years. This is a special variety which has been bred up by Mr. A. Kirsche, of Germany, for stock feeding purposes. Several of the varieties near the end of the list, which have been grown for three years, were obtained from different sugar beet breeders in Germany who have made a specialty of selecting beets for years in order to obtain a high percentage of sugar. For the results of the



chemical analyses of these beets, the reader is referred to the report of the Chemical Department, written by Prof. Harcourt, in the Report portion of this bulletin.

Some of the varieties of sugar beets have been grown at the College in uniform tests for eleven years in succession, the average results of the tests for the eleven years give us the following yields per acre for the different varieties: Red Top, 20.7 tons; Lane's Improved, 20 tons; White Silesia, 19.7 tons; White French, 19.1 tons; Champion, 18.9 tons; Red Skinned, 18 tons; Kleinwanzlebener, 17.5 tons; and Improved Imperial, 15 tons. In the average results for nine years, three other varieties have given the following average yields per acre: New Danish Improved, 22.6 tons; Jersey, 20.3 tons; and French Yellow, 18.1 tons.

**PLANTING SUGAR BEETS AT DIFFERENT DISTANCES BETWEEN THE DRILLS.** For three years in succession, an interesting experiment has been conducted in planting sugar beets at different distances in the rows. A comparison of nine different distances between the rows was made. Seven rows were sown at each distance apart. At the time of harvest, however, the two outside rows of each plot were discarded, and only the five inner rows were used in determining the comparative yields. The plants were thinned when very young, and were allowed to remain seven inches apart in the rows. Flat cultivation was used throughout. The experiment was conducted in duplicate, the Kleinwanzlebener variety being used in each of the tests. The average results of three years' tests in average weight per root, yield of tops per acre, and yield of roots per acre, are here presented:

No.	Distances.	Average of six tests.		
		Average weight per root, 1902-3-4.	Yield of tops per acre, 1902-3-4.	Yield of roots per acre, 1902-3-4.
1	Rows 12 inches apart.....	Lbs.	Tons.	Tons.
2	" 14 ".....	.71	11.37	23.02
3	" 16 ".....	.74	8.92	21.43
4	" 18 ".....	.80	9.22	20.66
5	" 20 ".....	.87	9.39	20.25
6	" 22 ".....	.96	9.28	20.23
7	" 24 ".....	1.01	9.47	19.74
8	" 26 ".....	1.07	8.96	19.38
9	" 28 ".....	1.14	8.92	19.09
		1.20	8.69	17.83

It will be observed that the average results show regularity throughout. As the distance between the rows increased, there was a gradual increase in the comparative size of the individual roots, but a decrease in the yield of roots per acre. The roots which were placed in rows 18 inches apart, which is usually the distance recommended for the growing of beets for sugar production, produced an average of 20½ tons of roots per acre. Some people think that larger yields can be obtained by having the rows of sugar beets 28 to 30 inches apart.

The average results of the six tests conducted within the past three years, however, have given us about 2 1-2 tons per acre more from the sugar beets grown in rows 18 inches apart as compared with those grown in rows 28 inches apart. Samples from the various parts of this experiment were taken to the chemical laboratory and were analyzed by Prof. Harcourt, in order to ascertain the percentage of sugar from beets grown in rows at different distances apart. For the results of these analyses, the reader is referred to the report of the Chemical department, to be found in the Report of the College for 1904.

**THINNING SUGAR BEETS AT DIFFERENT DISTANCES IN THE DRILLS.** For two years in succession, an experiment has been conducted with sugar beets by thinning the plants to two, four, six, eight, and ten inches apart in the rows. Each plot consisted of six rows, fifty links (2 rods) in length, and eighteen inches apart. The experiment was conducted in duplicate in each of the two years, the Kleinwanzlebener variety being used throughout. The average results of the four tests made in the two years are as follows :

Distance Between Plants.	Average weight per root.	Average yield of roots per acre.
	Pounds.	Tons.
2 inches .....	.52	19.7
4 inches .....	.87	18.7
6 inches .....	1.02	18.2
8 inches .....	1.21	15.1
10 inches .....	1.47	14.9

The results of this experiment seem to indicate that as the distance between the sugar beets in the rows increases, the average size of the individual roots also increases, but the yield of roots per acre decreases.

**FLAT AND RIDGED CULTIVATION.** Sugar beets have been grown on the flat and on ridges in an experimental way in each of three years. The experiment in each year was conducted in duplicate. Each plot consisted of six rows, each row being fifty links (2 rods) in length. The Kleinwanzlebener variety was used throughout. The average results for the six tests conducted in the three years gave 18.82 tons per acre from the flat cultivation, and 18.17 tons per acre from the ridged cultivation. These results, therefore, show that for the three past years, about two-thirds of a ton more of sugar beets per acre have been obtained from the flat as compared with the ridged cultivation.

**THINNING PLANTS AT DIFFERENT STAGES.** In each of the years 1903 and 1904, sugar beet plants were thinned when they were one-half inch, two inches, five inches, and eight inches in height. The experiment was conducted in duplicate each year, and the Kleinwanzlebener variety of sugar beets was used. The highest average yield per acre

of the four tests conducted in the two years was obtained from the thinning which took place when the plants were two inches in height, the yield being fully one ton per acre more than for any of the other thinnings.

**SOAKING SUGAR BEET SEED BEFORE PLANTING.** An experiment has been conducted for two years in succession by soaking sugar beet seed for twelve, twenty-four and thirty-six hours, and then sowing this seed as well as unsoaked seed in order to ascertain the comparative results of the different treatments. The experiment was conducted in duplicate each year. In each of the two years, the unsoaked seed gave the lowest yield of roots per acre. The results show us the greatest yield of roots per acre was obtained from the seed which was soaked for twelve hours in 1903, and from that which was soaked for twenty-four hours in 1904.

#### FIELD CARROTS.

In 1904, twenty-five varieties, and for each of the past five years, twenty varieties of field carrots have been grown in our experimental grounds. The carrot seed was sown on the level with a root drill in rows three and one-third links (26 2-5 inches) apart, and, when the plants were still quite small, they were thinned to an average distance of four inches apart in the rows. Three rows, each four rods in length, were used for each variety, thus making the plots exactly one one-hundredth of an acre in size. The average results for five years in weight per root, yield of tops per acre, and yield of roots per acre, are as follows:

Variety	Average results for five years.		
	Weight per root.	Yield of tops per acre.	Yield of roots per acre.
1. Mastadon White Intermediate	Lbs. 1.04	Tons. 6.68	Tons. 31.18
2. Mammoth Intermediate Smooth White	1.06	6.81	31.10
3. Steele's Improved Short White	1.01	6.76	30.08
4. Iverson's Champion White Intermediate	1.00	6.25	29.98
5. Sutton's Matchless White	.98	7.09	29.44
6. Carter's Hundred Ton	.96	6.06	29.17
7. Simmer's Short White Vosges	.96	6.56	28.03
8. Large White Belgian	.93	6.55	27.75
9. Long Yellow Stump Rooted	.87	5.32	26.57
10. Large White Vosges	.90	5.95	26.50
11. Pearee's Improved Half Long White	.87	7.72	25.90
12. Daniel's Giant Yellow Intermediate	.83	6.60	25.05
13. Sutton's Yellow Intermediate	.84	6.61	25.02
14. Carter's Gate Post Orange Long	.82	6.96	24.95
15. Rubicon Half Long Red	.83	5.45	24.83
16. Victoria Long Red	.81	6.58	24.04
17. Guerande	.78	4.86	23.55
18. Chantenay Short Red	.78	5.21	23.46
19. Danver's Orange	.79	5.90	21.73
20. Half Long Stump Rooted	.63	3.42	18.95

There are several varieties of intermediate white carrots, which are represented by different names and are obtained from different sources, which are quite similar in character of growth and in appear-

ance, and which present results having variations that are not extreme. For instance, we observe from the table here presented that the Mastadon White Intermediate, the Mammoth Intermediate Smooth White, the Steele's Improved Short White, the Iverson's Champion White Intermediate, the Sutton's Matchless White, and the Carter's Hundred Ton, which are all intermediate white varieties, have a variation of about two tons per acre in the average results for five years. In comparison with this, however, we notice that the Half Lon~ Stump Rooted gave a yield of only 18.7 tons of roots per acre.

Of the newer varieties, not included in the table here presented, the White Griewener, the American Beauty, the Carter's Orange Giant, and the Sutton's Magnum Bonum are among the most promising varieties.

#### SWEDE TURNIPS.

Although the acreage sown to Swede turnips in Ontario at the present time is not much greater than the average for the past twenty-three years, we notice that there is yet nearly one-half as much more land devoted to the growing of this crop than to the cultivation of mangels and carrots combined. According to the report of the Bureau of Industries for Ontario, the average yield of turnips per acre for the past twenty-three years is 434 bushels, or about 13 tons per acre. The average yield of turnips throughout Ontario is 25 bushels, or three-quarters of a ton per acre less than that of mangels.

**VARIETIES.** Upwards of eighty varieties of Swede turnips have been under experiment at the College within the past fifteen years. Those varieties which produced the poorest results have been dropped from the list from time to time and only the leading varieties continued in the experiments. The following gives the names of leading varieties, with their average yield of roots per acre for the past five years: Sutton's Magnum Bonum, 23 tons; Buckbee's Giant, 21.9 tons; Kangaroo, 21.5 tons; Hall's Westbury, 20.9 tons; and Hartley's Bronze Top, 20.7 tons. In the co-operative experiments throughout Ontario, the Sutton's Magnum Bonum has given the highest yield of roots per acre in each of the years 1902, 1903, and 1904.

**SELECTION OF SEED.** For five years in succession, experiments have been conducted with the object of securing information regarding the comparative value of different selections of turnip seed. Each year some of the best commercial seed of a leading variety of Swede turnips was purchased for this experiment. With the aid of sieves, the seed was carefully graded into large, medium, and small. The seed of each selection was then carefully hand-picked in order that nothing but apparently sound and perfect seed was used. The experiment was conducted in duplicate each year. The average results for the five years show the following yields of roots per acre: Large seed, 17.1 tons; medium-sized seed, 15.2 tons; and small seed, 8.7 tons.

## FALL TURNIPS.

Although fall turnips, soft turnips, or, as they are sometimes called, yellow and white flesh turnips, yield heavily per acre, they are not grown very extensively throughout Ontario, owing, no doubt, to the fact that they do not keep very late into the winter, but are more specially suited for feeding in the autumn of the year.

**VARIETIES.** Sixteen varieties were under test in 1904, and the results show that the highest yields per acre were produced by the Red Top White Globe, 44 tons; White Egg, 38 tons; Early American Red Top, 37 tons; Sutton's Imperial Green Globe, 37 tons; Sutton's Purple Top Mammoth, 37 tons; Carter's Commonwealth, 35 tons; and Carter's Purple King, 35 tons.

In some seasons, this class of turnips is considerably damaged by what is commonly called the "turnip rot." This disease attacks the turnips during the growing season, and sometimes causes the root to become either partially or wholly decayed before they have been harvested. We have counted the number of sound roots, and also the number of decayed roots of each of the varieties grown in our experimental grounds for several years in succession. The crops grown in 1899, 1900, 1902, and 1903 were almost free from rot; while those grown in 1897 had 51 per cent; in 1898, 30 per cent; in 1901, 15 per cent; and in 1904, 2 per cent of rot. We submit herewith a table giving the names of the varieties and the percentage of the crop which was diseased in each of the years 1897, 1898, and 1901, with the average percentage of diseased roots for the three years.

Varieties.	Per cent. of crop diseased.			
	1897.	1898.	1901.	Average 3 years.
1. Cow Horn .....	2	7	5	5
2. Early American Purple Top .....	8	6	1	5
3. Yellow Stone .....	8	5	12	8
4. White Egg .....	16	13	1	10
5. Jersey Navet .....	28	2	..	10
6. Red Top Strap Leaf .....	29	7	5	14
7. Yellow Montgomery .....	14	31	2	16
8. Jersey Lily .....	27	4	20	17
9. Purple Top Mammoth .....	23	26	5	18
10. Milk Globe .....	26	27	7	20
11. Greystone Improved .....	46	14	3	21
12. White Lily .....	50	16	2	23
13. Green barrel .....	37	24	10	24
14. White Six-weeks .....	32	32	8	24
15. Red Top White Globe .....	19	58	4	27
16. White Stone .....	62	6	13	27
17. Sutton's Imperial Green Globe .....	39	34	9	27
18. Early White Model .....	35	21	27	28
19. Large White Norfolk .....	42	35	7	28
20. Early La Crosse .....	84	1	3	30
21. Purple Top Hybrid .....	59	12	26	32
22. Red Globe Norfolk .....	81	9	16	35
23. Jarman's Selected Green Globe .....	47	53	11	37

Varieties.	Per cent. of crop diseased.			
	1897.	1898.	1901.	Average 3 years.
24. Yellow Finland .....	71	35	7	38
25. Long Tankard .....	66	43	6	38
26. White Flat Dutch Strap Leaf .....	54	59	3	39
27. Imperial Green Globe .....	43	27	48	39
28. Orange Sweet .....	77	36	11	41
29. Early Purple Top Munich .....	63	42	21	42
30. Sutton's Purple Top Scotch .....	78	42	7	42
31. Pomeranian White Globe .....	88	22	20	43
32. Orange Jelly .....	80	9	48	46
33. Sutton's Perfection Green Top .....	57	78	5	47
34. Sutton's Favorite Purple Top Yellow Hybrid .....	65	61	15	47
35. Rennie's Selected White Globe .....	79	65	4	49
36. Yellow Aberdeen Green Top .....	77	21	52	50
37. Yellow Aberdeen Purple Top .....	83	19	64	55
38. All Gold .....	69	55	43	56
39. Extra Early Milan .....	75	70	23	56
40. Yellow Globe .....	83	65	31	60
<b>Average</b> .....	51	30	15	32

Evidently the information given by Prof. F. C. Harrison on pages 27 and 28 of the College Bulletin 137, under the heading of "Susceptibility of Varieties," and on pages 16 and 17 of bulletin 136, under the headings of "Susceptibility of Varieties," and "The Planting of Immune Varieties," was based entirely on the notes taken by the Experimental Department in 1901. In bulletin 137, page 28, "Jersey Navet" should read "Jersey Navet"; "Warly La Crosse" should read "Early La Crosse"; "Lutton's Imperial Green Globe" should read "Sutton's Imperial Green Globe"; "Early Purple Top Murrich" should read "Early Purple Top Munich"; and in bulletin No. 136, page 17, "Red Top" should read "Red Top White Globe."

From the results here presented in tabulated form, it will be seen that none of the varieties were immune from the rot in the average of the three years' tests, but that three varieties, viz., the Cow Horn, the Early American Purple Top, and the Yellow Stone, had less than 10 per cent. of diseased roots. Those varieties having 10 and under 20 per cent. of decayed turnips were the White Egg, Jersey Navet, Red Top Strap Leaf, Yellow Montgomery, Jersey Lily, and Purple Top Mammoth.

In averaging the results for the five years during which the fall turnips were practically free from rot, we find the yield of each of five varieties to be as follows:

Varieties.	Yield of tops per acre.	Average weight per root.	Yield of roots per acre.
	tons.	lbs.	tons.
Red Top White Globe	4.2	2.28	26.5
White Egg .....	5.2	2.00	23.0
Early American Purple Top	4.8	1.84	21.0
Cow Horn .....	6.2	1.79	16.6
Jersey Navet .....	6.9	1.64	16.9

From these results, we learn that the Early American Purple Top and the White Egg varieties are not only among the freest from rot, but they are also heavy yielding varieties. The Jersey Navet turnip, which formerly gave very good yields, has given unsatisfactory returns during the past few seasons; so much so that we have dropped it from our lists entirely in our experiments with fall turnips in 1904.

**SELECTION OF SEED.** Large, medium, and small sized turnip seed has been sown on separate plots in each of four years. The experiment was conducted in duplicate each year, so that we now have average results of eight separate tests. The seed used on the different plots was of the same variety and of practically the same quality, except in size. The average yields produced from the different selections for the four years are as follows: Large seed, 25.4 tons; medium-sized seed, 21.7 tons; and small seed, 16.2 tons per acre.

#### PARSNIPS.

Parsnips have not been grown very generally as a farm crop in Ontario. Enquiries have been received occasionally, however, asking about the yields of parsnips as compared with other classes of roots for cultivation as a stock food. Four varieties have now been grown for five years, the average yield of roots per acre being as follows: Buckbee's New Sugar, 11.5 tons; New Ideal Hollow Crown, 11 tons; Improved Half Long, 10.3 tons; and Improved Long Smooth, 10.1 tons. The Sutton's Cattle variety, which has been grown for four years in succession has given an average of 10.2 tons of roots per acre. It will be observed that the parsnips have yielded considerably less per acre than the leading varieties of mangels, sugar beets, turnips, or carrots.

#### KOHL RABI.

This crop is sometimes grown for food for stock in some of the older countries. The root of the kohlrabi is somewhat like that of cabbage; while the leaves resemble those of Swede turnips. The valuable part of the plant, however, grows about three inches above the level of the ground in the form of a bulb. Kohlrabi makes a very nice food for domestic use, and is prepared for culinary purposes in much the same way as Swede turnips. The seed of kohlrabi resembles very closely that of Swede and fall turnips, and the crop is grown in much the same manner as turnips.

The following is the average yield in tons per acre of each of two varieties of kohlrabi grown in the experimental grounds for six years: Early White Vienna, 20.7 tons and Earliest Erfurt, 18.2 tons. The Goliath Purple variety, which has been grown for three years, gave an average of 16.7 tons per acre. In the crop of 1904, the yields were very high, being as follows: Early White Vienna, 27.1-2 tons; Earliest Erfurt, 26.9 tons; and Goliath Purple, 18.3 tons per acre. It will be seen from these results that the Early White Vienna gave the largest yield per acre in 1904, and also in the average of six years.

## POTATOES.

According to the reports of the Bureau of Industries, the potatoes grown in Ontario within the past twenty years have given a greater market value per acre than any other farm crop grown throughout the Province, being slightly in advance of that of field carrots, turnips, or mangels, and about three times as great as wheat, oats, barley, or peas.

VARIETIES. One hundred and four varieties of potatoes were grown in the Experimental department in 1904, on what might be termed an average clay loam. Three rows each four rods in length and three and a third (26 2-5 inches) apart were used for each variety. Owing to the unfavorable weather during the latter part of May and the early part of June, the potatoes were not planted in 1904 until the tenth day of June. Furrows were made with a double mould board plow, and fifteen pounds of each variety were planted and covered to a depth of about four inches. Level cultivation was used throughout the season. *Bus Death*, which is claimed to be an insecticide and also a fungicide, was sprayed on the tops of all the varieties on July 13th, July 25th, and August 3rd. When the potatoes were dug in the autumn, careful determinations were made regarding the exact percentage of rotten potatoes, the yield of sound potatoes per acre, and the percentage of potatoes which were of the proper size to be marketable. As the rot both at the College and throughout Ontario was very bad in 1904 as well as in 1903, it is thought wise to present the results of all the varieties which were under experiment during both of these years. A table is therefore presented, giving the average number of days to reach maturity, the yield of sound potatoes per acre, and the percentage of rotten potatoes of each of the eighty-two varieties grown in 1903 1904.

Varieties.	Average results for two years, 1903-04.		
	Number of days in reaching maturity.	Yield of sound potatoes per acre.	Percentage of potatoes rotten.
1. Holborn's Abundance .....	111	Bus. 294.2	3.4
2. Robertson's Champion .....	110	221.0	3.7
3. Skerries .....	111	119.8	3.7
4. Up-to-date .....	110	242.8	3.8
5. Stray Beauty .....	87	196.5	4.6
6. Sensation .....	109	187.2	5.1
7. Tremendous .....	108	171.5	5.3
8. Factor .....	110	206.1	5.3
9. Early Pinkeye .....	81	259.0	5.4
10. Green Bay .....	81	200.4	6.5
11. Seedling No. 230 .....	93	290.1	7.0
12. Main Crop .....	112	241.0	8.3
13. Bliss Triumph .....	92	245.8	9.5
14. Gemmeil's seedling .....	106	117.7	11.3
15. Salzer's Earliest .....	90	279.8	12.1
16. Irish Cups .....	103	267.5	13.9
17. Always .....	97	294.2	14.6
18. Howe's Premium .....	102	255.2	20.1
19. Carman No. 2 .....	100	172.3	21.4



Varieties.	Average results for two years, 1903-04.		
	Number of days in reaching maturity.	Yield of sound potatoes per acre.	Percentage of potatoes rotten.
20. Dewey .....	101	Bus. 200.4	21.6
21. Carter's Royalty .....	101	106.7	23.4
22. White Giant .....	98	134.4	25.0
23. Early Short Top .....	93	106.0	26.1
24. Lightning Express .....	91	200.4	26.0
25. Burbank's Seedling .....	102	195.0	26.0
26. Sir Walter Raleigh .....	99	165.6	26.2
27. Empire State .....	105	232.5	26.6
28. Jersey Snowdrop .....	98	147.1	28.1
29. Snowflake .....	94	161.1	31.3
30. Early Michigan .....	90	164.0	31.6
31. Rural Blush .....	105	196.5	32.7
32. Carman No. 1 .....	109	170.4	33.3
33. American Wonder .....	103	218.1	34.4
34. Dempsey's Seedling .....	102	218.5	34.8
35. Rural New Yorker No. 2 .....	103	178.5	35.1
36. Uncle Sam .....	101	148.1	35.5
37. North Pole .....	95	156.7	35.6
38. Pearl of Savoy .....	103	223.8	35.7
39. Celtic Beauty .....	101	144.6	35.8
40. King of Michigan .....	97	157.1	35.6
41. Steele's Earliest of All .....	96	192.4	36.0
42. Canadian Beauty .....	91	158.5	36.7
43. Early Dawn .....	89	174.0	36.6
44. New White Beauty .....	102	135.6	36.9
45. Adirondac .....	107	165.6	37.4
46. Bovee .....	93	163.1	37.6
47. Early Ohio .....	89	158.1	38.1
48. Todd's White Monarch .....	106	174.0	38.4
49. Sunlit Star .....	102	165.0	39.3
50. Early Thoroughbred .....	99	155.6	39.5
51. Early Rose .....	102	138.8	39.9
52. Six Weeks .....	90	145.5	40.3
53. Woodhull .....	102	194.6	40.3
53. Early Fortune .....	89	153.1	41.2
55. Early Andes .....	89	165.4	41.8
56. Early Market .....	93	156.7	41.7
57. Crown Jewel .....	102	196.9	41.9
58. Burpee's Extra Early .....	99	137.5	42.1
59. White Elephant .....	102	198.9	42.8
60. Dublin Prize .....	99	126.3	43.8
61. Rose of Quebec .....	102	150.4	44.3
62. Dobson's Early .....	96	102.9	44.5
63. Rose's New Invincible .....	102	161.0	44.5
64. Democrat .....	101	145.8	44.9
65. Burnaby Mammoth .....	102	163.6	45.5
66. The Daisy .....	100	167.1	46.0
67. Gem of the Hebrons .....	102	164.4	47.5
68. Acme .....	91	123.8	48.2
69. Leamington .....	102	141.9	48.6
70. Rose of the North .....	98	159.4	48.6
71. Wonder of the World .....	98	136.3	48.8
72. Brown's Prolific .....	102	145.2	50.3
73. Morning Star .....	105	147.1	50.3
74. New Queen .....	102	130.6	50.4
75. Lady Finger .....	99	106.9	50.6
76. Surprise .....	102	134.4	51.1
77. Hanlan Beauty .....	102	129.6	52.6
78. Early Dominion .....	95	122.7	53.3
79. White Pinkeye .....	102	104.8	54.2
80. Beauty of Hebron .....	102	153.3	56.2
81. Weld's Orange .....	99	103.3	56.8
82. Montana Bluff .....	105	144.2	56.3
Average .....	100	171.8	33.0

As the varieties presented in the table are arranged in the order of the percentage of rotten tubers, starting with the smallest and finishing with the greatest percentage of rot, the results regarding the percentage of disease are shown quite clearly. It will be seen that the Holborn Abundance, Robertson's Champion, Skerries, Up-to-date, and Stray Beauty varieties each had less than five per cent. of rot in comparison with the Beauty of Hebron, Weld's Orange, and Montana Bluff, each of which had upwards of fifty-five per cent. of rot.

It is claimed by some that early potatoes, and by others that late potatoes, are the freest from the attacks of this disease. According to the reports of the last two years, the average results of ten early, ten medium, and ten late varieties of potatoes are as follows:

Classes According to Maturity.	Number of days in reaching maturity.	Percentage of rotten potatoes.
Ten early varieties .....	88	25.8
Ten medium varieties .....	100	33.8
Ten late varieties .....	110	10.9

From these results, it appears that of all the varieties grown in the Experimental Department in each of the past two years, the late varieties, as a whole, were the freest from rot.

Those varieties which had the largest percentage of rot did not yield as many sound potatoes as the varieties having the least percentage of rot, as will be seen by the following figures:

Amount of Rot.	Bushels of sound potatoes per acre.	Percentage of rotten potatoes.
Twelve varieties having the least rot.....	219.2	5.2
Twelve varieties having the most rot .....	129.9	52.9

This gives us some idea of the great loss caused by means of the rot on the potato crop of the past two years. The November Crop Bulletin for 1904 had the following regarding the condition of the potato crop: "The extent of the loss from rot is variously estimated at from twenty to fifty per cent." This will show the importance of planting those varieties which produce large yields of potatoes of good quality and which are less subject to rot than other varieties.

In averaging the yields per acre produced by each of forty-six varieties of potatoes grown in the experimental grounds for the past five years in succession, the greatest number of bushels of sound potatoes were produced by the following: Empire State, 269; Seedling No. 230, 256; Dempsey's Seedling, 252; Pearl of Savoy, 251; White Elephant, 251; American Wonder, 247; Holborn Abundance, 247; The Daisy, 243; Rural New Yorker No. 2, 243; and Rural Blush, 240.

About twenty new varieties of potatoes were grown in the experimental plots in 1904 for the first time; some of them being grown in very limited quantities, as only a small amount of seed could be obtained. A few potatoes of each of a number of new varieties were sent out by Mr. Kyle, Ontario Special Farm Labor Agent, from the Old Country, and were transferred to the Experimental Department by Prof. C. C. James, Deputy Minister of Agriculture. The varieties were as follows: Davies' Foundling, Davies' King Loth, Davies' Warrior, Davies' Dunion, and Scottish Triumph. As these varieties were planted in such small quantities, no record can here be made regarding the yield per acre for 1904. Of the Davies' Warrior there were in all twenty hills, and no rotten potatoes were found in the crop. The Davies' Dunion had only thirteen hills, and there was only one rotten potato at the time that the crop was harvested. It is unsafe, however, to say, from these results, that the Davies' Warrior is immune from this disease, as similar areas of land on which a few of other varieties were grown also gave no rot in 1904, but when a larger area was taken into consideration a few rotten potatoes were found.

In order to obtain fuller information regarding the comparative yield of very early potatoes, six rows of each of nine varieties have been planted in the spring of each of the years 1902, 1903, and 1904. Two rows of each variety were dug at the end of nine weeks, two rows at the end of twelve weeks, and the two remaining rows at the end of fifteen weeks after the planting took place. In the average for three years, the greatest yields produced at nine weeks after planting were by the following varieties: Early Andes, Early Dominion, Six Weeks, Early Fortune, and Early Dawn. The Stray Beauty variety, which gave excellent results in a similar experiment conducted for several years previous to 1902, has produced low yields per acre during the last two or three years. This is true not only in the experiments at the College, but also in the co-operative experiments throughout Ontario. Evidently this variety has passed its best period of life and is now deteriorating.

**BORDEAUX MIXTURE FOR THE POTATO BLIGHT.** Until the last two years, the potatoes grown in the Experimental Department have been comparatively free from blight, although in some parts of the Province the rot has proven very troublesome in some seasons. In those sections where the blight has been serious, some farmers have had excellent results from the use of the Bordeaux mixture, along with Paris green, the first spraying being done when the plants were about six inches in height, and the second and third sprayings at intervals of ten to fifteen days. In some cases, five or six sprayings of Bordeaux mixture have been made in the same season. In 1903, and again in 1904, an experiment was conducted in our experimental plots by spraying two varieties of potatoes with Paris green and Bordeaux mixture; and also

the same varieties of potatoes with Paris green alone. The potatoes for this experiment were planted in 1903 on June 10th, and the sprayings took place on July 11th, July 23rd, and August 6th; and those in 1904 were planted on June 11th, and the sprayings took place on July 16th, July 29th, and August 4th. The Bordeaux mixture was made in the same way and in the same proportions as described in the College Bulletin No. 122, copies of which may be obtained from the Department of Agriculture Toronto, Ontario. The results show that there was less rot on the potatoes on which the Bordeaux mixture and the Paris green were used than on those on which the Paris green was applied alone. In the case of both varieties of potatoes on which the Bordeaux mixture was used, the tops kept greener to a later date than those which did not receive this treatment.

#### DIFFERENT METHODS OF TREATMENT FOR THE POTATO BEETLE.

Owing to the severe ravages of the Potato Beetle in Ontario, an experiment has been conducted in duplicate in each of nine years by using different methods for destroying the insect. The experiment consisted in spraying the potatoes with Paris green and water, Paris green and plaster, and Potato Bug Finish. The test was conducted in duplicate each year. As a rule, three applications were made on each crop. For the sake of comparison, one plot was allowed to remain untreated.

In 1902, in 1903, and again in 1904, six lots of each of two varieties of potatoes were carefully selected and planted on separate plots. After the potatoes had made sufficient growth and the potato beetles (bugs) had made their appearance, five plots of each variety were treated in different ways to destroy the beetle, and one plot of each variety was left untreated as a basis of comparison. The five treatments made in each of the years were as follows: (1) Paris green and water, using one pound of Paris green and 96 gallons of water per acre; (2) Paris green and plaster, using one pound of Paris green and thirty-eight pounds of plaster per acre and applying the mixture to the potatoes in the dry condition; (3) Potato Bug Finish, which was applied dry at the rate of twenty pounds per acre; (4) Bug Death and water, using on an average thirty-two pounds of Bug Death and 96 gallons of water per acre; and (5) Bug Death used in the same proportion as No. 1, but in the dry condition. Three applications of each of the five treatments were made in both cases. In the autumn, the potatoes from each of the twelve plots were dug and weighed. The following are the average results of the smaller experiment conducted for nine years, and of the larger experiment conducted for three years:

Treatments.	Average number of bushels of potatoes per acre.	
	9 years.	3 years.
Nothing .....	81.8	83.6
Potato Bug Finish .....	123.2	126.0
Paris green and plaster .....	132.3	146.9
Paris green and water .....	140.4	151.5
Bug Death (dry) .....	.....	175.3
Bug Death and water .....	.....	175.5

In seven out of the nine years, those potatoes which were sprayed with Paris green and water surpassed those which were sprayed with Paris green and plaster, in yield of crop per acre. It is also quite noticeable that in each of the nine years the untreated potatoes gave decidedly the lowest yield of tubers per acre. The Bug Death, which has only been tested in our trial grounds for the past three years, is manufactured at St. Stephen, N.B., and has been used to a limited extent throughout Ontario during the last two or three years. The potato tops on which Bug Death was applied were more vigorous in growth and greener in appearance throughout each of the seasons than those on which the other applications were made. In this respect, the Bug Death exerted an influence about equal to a combination of Paris green and Bordeaux mixture in each of the past two years. The usual prices of these insecticides, when bought in quantity, are about as follows: Paris green, 20 cents; Bug Death, 7 cents; and Potato Bug Finish, 1 2-3 cents per pound. The cost, therefore, for the material used in the experiments conducted in 1902, 1903, and 1904, was about as follows: Paris green and water, 60 cents; Paris green and plaster, 88 1-2 cents; Bug Death, \$6.72; and Potato Bug Finish, \$1.00 per acre.

**TREATMENT OF POTATOES TO DESTROY THE SCAB.** An experiment was again conducted in 1904 by immersing scabby potatoes in a solution of corrosive sublimate for one and a half hours, after which they were spread out to dry; they were then cut and planted in the usual way. The treatment was made with each of two varieties. Both the treated and untreated potatoes were planted at the same time and in the usual manner. The corrosive sublimate solution was made by dissolving corrosive sublimate in hot water in the proportion of 2½ ozs. of the former and two gallons of the latter. The solution was allowed to stand twelve hours, after which it was diluted with 13 gallons of water. As the corrosive sublimate is very poisonous, the material itself should be looked after very carefully and no potatoes which have been treated should be left unplanted. As none of the potatoes had more than one-half of one per cent. of scab in the crop of 1904, the results of this experiment do not furnish much information for this season. Taking the average of four years' results, the potatoes which were treated with corrosive sublimate gave about 7 bushels per acre more than those on which the corrosive sublimate was not used. This treatment has been used with good satisfaction in some places where there is usually a considerable amount of scabby potatoes.

**PLANTING DIFFERENT SIZED PIECES AT DIFFERENT DISTANCES APART IN THE ROWS.** For three years in succession, an experiment has been conducted by planting one, one and a half, and two ounce pieces of potatoes. The potatoes of each of these sizes were planted twelve, eighteen, and twenty-four inches apart in the row. The average results show that the yield per acre increased in the order of the increase

of the size of the pieces and of the decrease in the distance between the pieces in the row; thus, the highest average yield (177.6 bus.) was produced by the two ounce pieces planted one foot apart in the row, and the lowest yield per acre (107.3 bus.) was produced by the one ounce pieces planted two feet apart in the row.

**SELECTION OF SEED.** For ten years in succession, large, medium-sized, small, and very small potatoes have been selected continuously and planted from season to season. The crop of 1904 shows, that as the seed decreased in size not only was there a decrease in the yield of potatoes per acre, but there was an increase in the percentage of small tubers.

**PLANTING ONE, TWO, AND FOUR POTATO SETS PER HILL.** For five years in succession, an experiment has been conducted by planting one, two, and four pieces of potatoes per hill, using the same amount of seed throughout. The average results for the five years are as follows: One two-ounce piece in a hill, 195.2 bushels; two one-ounce pieces in a hill, 182.9 bushels; and four one-half ounce pieces in a hill, 162.4 bushels per acre. The cutting of a potato tends to increase the number of stems produced, and when from two to four potato sets are planted in one place there is a greater number of stems produced than where one large piece is used. Evidently a few large, vigorous stems give better results than a large number of small, weakly stems, which are almost sure to grow where more than one piece is planted in each hill.

**METHODS OF PLANTING POTATOES.** Some farmers favor planting potatoes in rows 25 to 30 inches apart; while others favor planting in squares, or hills, from 30 to 40 inches apart both ways. An experiment has been conducted in our experimental grounds for seven years in succession, in order to compare the results of planting potatoes in rows three and a third links (26 2-5 inches) apart and having the potato sets one foot apart in the row in comparison with planting the potato sets in squares 33 inches apart both ways. The same amount of seed was used in each method, and the experiment was conducted in duplicate each year. The average results for seven years show, that the potatoes which were planted in rows gave 179.6 bushels, and those planted in squares gave 152.3 bushels per acre.

#### CORN FOR FODDER AND FOR THE SILO.

There has not been much variation in the area devoted to fodder and silage corn in Ontario within the last few years. The average for the last two years, however, is about nineteen per cent. greater than for the past twenty-three years.

**VARIETIES.** It should be quite evident to a person familiar with the growth of fodder and silage corn throughout Ontario that no one variety is equally suited to all parts of the Province. It is also a fact that some of the varieties which give the best results in the middle

States of the American Union are entirely unsuited for cultivation in Ontario, owing to the shorter season of growth in Ontario as compared with that in some of the central States. Hence, the importance of testing a large number of varieties under similar conditions to ascertain not only the total yield of crop per acre but also the yield of ears or grain and the comparative earliness or lateness of the different varieties. In securing a suitable corn for the silo or for use as green or dry fodder, it is important to select a variety that produces a large total yield per acre and also gives a large yield of grain, and reaches a fair stage of maturity before the first nipping frosts occur in the locality where it is grown. Keeping these three points in view in experiments which have been conducted with a large number of varieties of corn for several years in succession, we have found that the Mammoth Cuban, Mastadon Dent, and Leaming are varieties which generally give good satisfaction on the warm soils of the southern part of Ontario, where large varieties of corn can be grown successfully; that the Wisconsin Earliest White Dent and the White Cap Yellow Dent give a good yield of total crop per acre which is of excellent quality, both of these varieties producing large yields of ears, and being specially suited to the central part of the Province where the frosts are not too severe; and that the King Phillip, Salzer's North Dakota, and Compton's Early varieties generally give good satisfaction in those parts of Ontario where the frosts are apt to occur at an early date. Of the one hundred and three varieties grown in the Experimental Department in 1904, the largest yields of ears per acre were produced by the following kinds: Early Windsor Sweet, 5.2 tons; Kendal's Early Giant Sweet, 5.2 tons; Ringleader Sweet, 5.0 tons; and Winconsin Beauty Sweet, 4.9 tons per acre. It will therefore be seen that the four varieties which have produced the greatest yields of ears per acre in 1904 were all sweet corns. These varieties are suitable for fodder purposes, but are not considered as valuable for silage as some of the Dent corns.

**METHODS OF CULTIVATION.** In 1902, 1903, and again in 1904, an experiment was conducted by cultivating corn in four different ways. The North Star Yellow Dent variety of corn was used in the experiment in 1902 and in 1903, and the White Cap Yellow Dent and King Phillip varieties in 1904. Each test consisted of four plots. The experiment was conducted in duplicate each year. The average results of the six tests conducted within the last three years are as follows: (1) Deep cultivation at first gradually getting shallower as the season advanced, 21.9 tons; (2) Shallow cultivation throughout the season, 21.2 tons; (3) Deep cultivation throughout the season, 20.8 tons; and (4) Shallow cultivation at first gradually getting deeper as the season advanced, 20.5 tons per acre. From these results, it will be seen that, in seasons such as we have had in the past three years, corn which was cultivated deeply immediately after it was planted and in which the cultivation was made shallower as the season advanced produced the

greatest yield; while that which was cultivated shallow at first and deeper as the season passed by produced a lighter yield by fully one ton per acre.

#### SORGHUM FOR FODDER.

Eighteen varieties of sorghum were grown in the experimental grounds in 1904. These included different varieties of sugar cane, broom corn, kaffir corn, millo maize, etc. The greatest yields in the past season were produced by the following varieties: Orange Sugar Cane, 20.5 tons; Earliest Black Sugar Cane, 18.8 tons; Kenney's Improved Amber Sugar Cane, 18.1 tons; Folger Cane, 16.3 tons; and Early Minnesota Sugar Cane, 15.4 tons per acre. The greatest yields of heads in 1904 were produced by the Australian Broom Corn, 1.7 tons; California Golden Broom Corn, 1.6 tons; Dwarf Broom Corn, 1.6 tons; and Kenney's Improved Amber Sugar Cane, 1.5 tons per acre. In the average of eleven varieties grown for six years in succession, the highest yields of total crop per acre were produced by the Early Minnesota Sugar Cane, 16.6 tons; Orange Sugar Cane, 16.4 tons; Fodder Cane, 13.5 tons; Early Amber Sugar Cane, 13.3 tons; and Kaffir Corn, 11.2 tons per acre.

#### SUNFLOWERS FOR FODDER.

As considerable has been said regarding the practice of growing sunflowers and using the heads for cutting with corn for the silo, and as some farmers are growing sunflowers for this purpose, experiments have been conducted with several varieties within the past ten or twelve years in order to glean fuller information regarding the comparative value of the different varieties. Two varieties have now been under uniform tests for ten years in succession and have produced the following averages in tons of whole crop and of heads per acre: Black Giant, 19.8 and 5.8; and Mammoth Russian, 16.1 and 5.4, respectively. The White Beauty, which has been grown for seven years in succession, has produced an average of 16 tons of total crop and 5.8 tons of heads per acre. The results for 1904 were very high, showing a record for the Black Giant of 31.9 tons of total crop and 8.5 tons of heads per acre.

#### MILLET FOR GREEN FODDER AND FOR HAY.

Twenty-five varieties of millet were grown in the Experimental Department in 1904, and determinations were made regarding the relative yields of green fodder and of hay. The results show us that the greatest yields of green crop were produced by the Japanese Panicke, 12.2 tons; East India Pearl, 10.7 tons; Early Harvest, 9.3 tons; Steel Trust, 9.2 tons; and Japanese Barnyard, 8.4 tons per acre. In comparison with these, the Hungarian Grass produced 8.2 tons of



green crop. The Pencilaria produced 10.5 tons per acre, but no mention was made of this when giving the different varieties, as it is simply another name of the East India Pearl Millet. The greatest yields of hay in 1904 were produced by the Japanese Panicle, 4.5, and the Japanese Barnyard, 3.7 tons per acre.

As twelve of the varieties of millet have been grown for ten years in succession, the experiments cover a great variety of seasons. Those varieties producing large yields of green crop and of hay per acre are as follows: Golden Wonder, 11.2 tons of green crop and 4.5 tons of hay; Holy Terror Gold Mine, 10.8 tons of green crop and 4.5 tons of hay; Japanese Panicle, 10.1 tons of green crop and 4.5 tons of hay; Magic, 9.9 tons of green crop and 4.2 tons of hay; and Japanese Barnyard, 9.5 tons of green crop and 4 tons of hay per acre.

#### RAPE, KALE, CABBAGE, ETC.

Although rape is known more or less throughout Ontario, neither cabbage or kale has been grown as a field crop on many of our farms for the purpose of furnishing food for farm stock. All these crops are grown more extensively in Great Britain than they are in Canada. Experiments have now been conducted in each of the past six years with fifteen varieties of rape, kale, cabbage, etc., in order to glean some information regarding the comparative yields of these varieties when grown under uniform conditions in Ontario. The seed has been sown in rows about 26 inches apart, and the land has been cultivated in much the same way as that containing a crop of turnips. Only about one pound of seed per acre is required when sown in rows and the land cultivated. The seeding has usually been done in June, and the crop harvested the latter part of September or in October. The following table gives the names of the varieties, the yield per acre in 1904, and the average yield per acre for six years of each of fifteen varieties:

Varieties.	Yield per acre in 1904.	Average yield per acre for 6 years.
	Tons.	Tons.
Sutton's Earliest Drumhead Cabbage .....	24.5	19.9
Dwarf Essex Rape .....	14.9	17.4
Thousand Headed Kale .....	19.0	17.1
Dwarf Victoria Rape .....	12.3	17.0
Marrow Stem Kale .....	21.0	16.9
Purple Sprouting Broccoli .....	18.5	16.6
Sutton's Earliest Sheepfold Cabbage .....	25.0	16.2
Marrow Collards .....	22.7	15.7
Hardy Curled Kale .....	15.2	15.6
Sutton's Best of All Savoy Cabbage .....	18.3	14.9
Jersey Kale .....	15.4	14.6
Sutton's Latest Drumhead Cabbage .....	18.0	12.2
Tall Green Curled Scotch Kale .....	12.5	12.1
Brussels Sprouts .....	15.2	11.6
Tall Jersey Cabbage .....	2.9	7.6

It will be noticed that the two varieties of rape gave exceptionally low results in 1904. Among eighteen varieties of rape, kale, cabbage, etc., which have been grown for less than six years, the greatest yields in 1904 were as follows: Sutton's Giant Drumhead Cabbage, 24.4 tons; Large Seeded Common Rape, 20.8 tons; Large Seeded Umbrella Rape, 20.6 tons; Hammond's English Rape, 20 tons; Garton's Improved Thousand Headed Kale, 19.3 tons; and Buckbee's Wonderful Dwarf Bonanza Rape, 18.5 tons per acre. For a free donation of seed of several new varieties of rape, we are indebted to Mr. Dicks, of the Cooper-Taber Seed Growers, England.

#### GREEN FODDER CROPS.

Fifteen varieties of leguminous crops, including vetches, Soy beans, Cow peas, etc., have been grown in the experimental plots for four years in succession. As much interest has been taken in recent years in some of these crops, a table, giving the results of all the different crops which were grown under similar conditions, furnishes both interesting and valuable information.

Varieties.	Average for 4 years.	
	Length of plants.	Yield of green crop per acre.
	Inches.	Tons.
Medium Green Soy Beans .....	32.0	11.0
Hairy Vetches .....	33.5	10.2
Common Vetches .....	.....	8.7
Early Yellow Soy Beans .....	27.0	8.5
Grass Peas .....	34.5	7.9
Horse Beans .....	31.0	6.7
American Coffee Berry .....	22.0	6.4
Wonderful Cow Peas .....	16.8	5.2
Extra Early Blackeye Cow Peas .....	16.8	5.0
Taylor Cow Peas .....	13.5	4.9
Whip-poor-will Cow Peas .....	14.3	4.4
New Era Cow Peas .....	13.5	4.4
Warren's Extra Early Cow Peas .....	13.0	3.7
Extra Early Dwarf Soy Beans .....	19.0	2.6
Velvet Beans .....	14.8	1.8

The Medium Green Soy beans, which stood first in the accompanying table in yield per acre, are an exceptionally fine variety, and, we believe, will be grown more and more for the production of fodder for feeding in the autumn or for mixing with corn when filling the silo, in order to increase the quality of the silage. If the Medium Green Soy beans are sown in rows 30 inches apart with the beans 8 inches apart in the row, at the time when the corn is planted, the crop will usually be ready for mixing with the corn for putting in the silo when the corn is in the best condition. The Hairy Vetches, as a rule, produce fully 4 tons per acre more than the Common Vetches, as shown by the results of these varieties which have been grown side by side for eight

years in succession. The Grass peas have given very good results as a green crop in each of the past three years, but, owing to the peculiar conditions of the weather during the summers of 1902, 1903, and 1904, the Grass peas have not ripened as satisfactorily as they did in previous years. The varieties of Cow peas are not, as a rule, suitable for the production of either grain or fodder when grown in Ontario.

No less than twenty-seven different varieties of leguminous crops were tested under similar conditions in 1904. The greatest yields during the past season were obtained from the following varieties: Grass peas, 10.2 tons; Medium Green Soy beans, 9.5 tons; Ito San Soy beans, 8 tons; and Early Yellow Soy beans, 7.8 tons per acre.

#### WINTER SOWING OF WINTER RYE, HAIRY VETCHES, AND CRIMSON CLOVER, FOR FODDER PRODUCTION.

In the autumn of 1903, plots were sown with Winter Rye, Hairy Vetches, and Crimson Clover, with the object of ascertaining the comparative yields of green fodder produced from these crops in the following season. The Crimson Clover, however, was completely winter killed. Both the Winter Rye and the Hairy Vetches survived the winter in fairly good condition. Each crop was cut in 1904 when in its best condition as green fodder, the Winter Rye producing 15.2 and the Hairy Vetches, 12.1 tons of green crop per acre.

#### THE WILD VETCH AS A FODDER CROP.

In the spring of 1902, Mr. F. W. Hodson, Live Stock Commissioner for Canada, forwarded some seed of the wild vetch, which is frequently observed growing in uncultivated land and especially along the railroads. The seed was sown in the spring of 1902, but the growth was exceedingly small in the following season. In 1903 the crop was also light, but in 1904 it took complete possession of the land, forming a network of roots and producing 7.6 tons of green crop per acre. It is quite probable that this would form a bad weed if used in regular rotations, but it might prove serviceable for sowing on rough land where grass and clover do not thrive and where a permanent crop is desired.

#### ANNUAL CROPS FOR PASTURE PURPOSES.

An experiment was conducted in 1900 and repeated in 1901, 1902, and in 1904, with the object of finding out which one of a number of annual crops would give the best results when used for pasture in the same year in which it is sown. For this experiment, fourteen varieties have been used. In each of the years, the crops were sown in three separate sets, there being fourteen plots in each set, thus making in all a total of forty-two plots each season. All the plots were sown

each year on the same day and under similar conditions. The seed was sown in May in each of the four seasons. The three sets were handled in each year as follows :

Set 1. The crops on all the plots in Set 1 were cut at the end of six, nine, twelve, fifteen, and eighteen weeks after the seed was sown, thus making five cuttings for each crop. Each cutting was weighed in the green state, and also after it was dried in the form of hay.

Set 2. Each crop was cut when it was thought to contain the greatest bulk of best quality of green fodder. In order to ascertain the aftergrowth, another cutting was also made from each plot later in the season.

Set 3. A hurdle fence was placed around the set of eighteen plots, and cattle were turned on the plots daily until the pasture was all eaten. The first pasturing took place in the latter part of June and the early part of July. Careful notes were taken of the amount eaten of each crop each day. After the crops were pastured the first time, they were allowed to remain undisturbed until the autumn, when the cattle were again turned on, and the second growth was eaten off.

The average results for the four years, representing the yield of pasture for each of the five cuttings for the various crops under experiment, are here presented :

Crops.	Tons of green pasture per acre at each of five cuttings per annum. Average of four years.					Total number of tons per acre per annum in five cuttings.
	1st cutting.	2nd cutting.	3rd cutting.	4th cutting.	5th cutting.	
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1. Hairy Vetches .....	1.20	3.28	1.35	1.25	.85	7.93
2. Common Red Clover.....	.06	1.91	2.09	1.69	1.61	7.36
3. Siberian Oats.....	3.45	1.76	1.32	.40	.38	7.31
4. Crimson Clover.....	.05	2.64	1.76	.97	1.79	7.21
5. Early Amber Sugar Cane .....	.14	2.04	2.63	.97	.91	8.69
6. Spring Rye.....	5.07	.55	.35	.09	.09	6.15
7. Common Vetches .....	1.73	1.97	1.10	.63	.62	6.05
8. Dwarf Essex Rape .....	.58	2.56	1.26	.65	.80	5.85
9. Mandscheuri Barley .....	3.65	.85	.59	.09	.28	5.36
10. Hungarian Grass.....	1.23	1.79	1.38	.68	.20	5.36
11. Compton's Early Corn.....	.95	2.46	1.04	.35	.01	4.81
12. Grass Peas .....	1.68	2.06	.83	.17	.03	4.77
13. Wild Goose Spring Wheat .....	2.23	1.03	.90	.15	.17	4.46
14. Soy Beans .....	.73	1.27	.63	.37	.21	3.21

As the result of experiments previous to 1904, six different mixtures were formed and sown on different plots in the spring of the present year. The experiment was conducted in duplicate. The average yield of pasture produced from the five cuttings of each of the duplicate sets of the six mixtures are as follows: (1) Crimson Clover, Hairy Vetches, and Siberian Oats:—8.2 tons; (2) Hairy Vetches, Siberian Oats, and Early Amber Sugar Cane:—8.0 tons; (3) Siberian Oats, Early Amber Sugar Cane, and Common Red Clover:—8.0 tons; (4)

Common Red Clover, Emmer, and Hungarian Grass :—5.9 tons; (5) Early Amber Sugar Cane, Common Red Clover, and Emmer :—5.7 tons; and (6) Emmer, Hungarian Grass, and Spring Rye :—5.2 tons per acre. From a study of the results under this heading, it will be seen that a mixture of annual crops is likely to give a more satisfactory pasture during the same year it is sown than any of the crops when sown by themselves.

### GRASSES AND CLOVERS.

Of all the farm crops grown in Ontario, we believe there are none so important as the grasses and clovers used for hay and for pasture. Nearly six million acres of Ontario land are devoted annually to the production of hay and pasture; hence, the great importance of the farmers in this Province giving close attention to the different varieties of grasses and clovers for growing singly and in various combinations for the production of either hay or pasture.

**VARIETIES OF GRASSES FOR THE PRODUCTION OF HAY.** Fifteen varieties of grasses, including some of our best native as well as some of the most noted European kinds, have been carefully tested in the Experimental department in each of seven different years. The grasses have usually been sown in the spring of the year with a light seeding of grain, as, for instance, one bushel of barley or a bushel and a peck of oats per acre. In the following and succeeding years, careful records have been made regarding the height of the different crops, the date at which they reached the proper condition to cut for hay, and the yield per acre of each cutting in each season. The following table gives the common and scientific names of the different varieties, the average date and height of the first cutting, and the total annual yield of hay per acre of each of fifteen varieties, these results being obtained from seven different years and from three separate seedings :

Common name.	Scientific name.	Date of first cutting, average 3 years.	Height of first cutting, average 7 years.	Total annual yield of hay per acre, average 7 years.
			Inches.	Tons.
1. Western Rye .....	<i>Agropyron tenerum</i> .....	July 12	31	4.36
2. Lyme Grass .....	<i>Elymus virginicus</i> .....	" 25	33	4.31
3. Fringed Brome.....	<i>Bromus ciliatus</i> .....	" 30	36	3.90
4. Timothy .....	<i>Phleum pratense</i> .....	" 7	35	3.47
5. Bearded Wheat .....	<i>Agropyron caninum</i> .....	" 26	35	3.27
3. Canadian Lyme .....	<i>Elymus canadensis</i> .....	" 27	32	3.25
7. Tall Oat .....	<i>Arrhenatherum avenaceum</i> ..	June 26	43	2.79
8. Orchard .....	<i>Dactylis glomerata</i> .....	" 27	34	2.55
9. Meadow Fescue .....	<i>Festuca pratensis</i> .....	July 1	32	2.23
10. Awnless Brome.....	<i>Bromus inermis</i> .....	" 7	26	2.19
11. Rhode Island Bent.....	<i>Agrostis canina</i> .....	" 13	25	1.97
12. Red Top .....	<i>Agrostis vulgaris</i> .....	" 9	23	1.79
13. Kentucky Blue.....	<i>Poa pratensis</i> .....	June 26	24	1.59
14. Meadow Foxtail .....	<i>Alopecurus pratensis</i> .....	" 22	31	1.55
15. Perennial Rye .....	<i>Lolium perenne</i> .....	" 29	20	1.25

The Western Rye, Lyme Grass, and Fringed Brome, which stand at the head of the list in yield of hay per acre, are all natives of Canada and have not yet been brought into field cultivation in Ontario. The Western Rye Grass which produced on an average nearly 4 1-2 tons of hay per acre is quite promising. Dr. Jas. Fletcher, Botanist at the Central Experimental Farm, Ottawa, in referring to the Western Rye Grass in his report for 1898, states that it has given most satisfactory results as a hay and pasture grass, and also states that Mr. S. A. Bedford, Superintendent of the Brandon Experimental Farm, who has grown the Western Rye Grass for many years, has always spoken of it in the highest terms. It is highly spoken of by Mr. Angus McKay of the Experimental Farm at Indian Head. In the report of the Dominion Experimental Farms for 1901, Dr. Fletcher states that "the Western Rye Grass, a native of the prairie regions, is a most valuable grass, and is now much cultivated for its rich and heavy crops of hay and seed." It will be seen from the table here presented that the varieties which are ready for cutting for hay production at the earliest dates are the Meadow Foxtail Grass, Tall Oat Grass, Kentucky Blue Grass, Orchard Grass, and Perennial Rye Grass, each of these varieties being usually cut in the latter part of June. The varieties here mentioned are from one to two weeks earlier than timothy; while the Lyme Grass, Fringed Brome Grass, Bearded Wheat, and Canadian Lyme are about three weeks later than timothy in reaching the proper stage for cutting as hay.

VARIETIES OF GRASSES FOR THE PRODUCTION OF PASTURE. It is indeed a difficult matter to make an exact comparison of a number of different kinds of grasses for pasture purposes. In experiments conducted for many years in England at Woburn in connection with the Royal Agricultural Society, as well as at other places, it is found unwise to attempt to compare different grass lands by having the crops pastured by sheep, unless at least three acres are used in each plot. If cattle were pastured on it, even larger plots than these would be necessary. It will therefore be seen that if a person wished to make a comparison of fifteen or twenty separate kinds of grasses for pasturing sheep or cattle, a very large amount of land would be necessary. It was thought, however, that some valuable information might be obtained by using smaller plots of land, and by cutting, weighing, and removing the crops from the land, instead of pasturing them with farm stock. An experiment has been conducted, therefore, for four years in succession, by cutting each of sixteen varieties of grasses at that time in the spring when the earliest varieties were ready for pasturing, and then cutting, weighing, and removing the crops produced by each of the varieties at each time during the summer when the more vigorous varieties had produced a sufficient growth for furnishing a good pasture crop. The following table gives the average of the four years'

results of sixteen varieties of grasses at each of six different cuttings, as well as the total number of tons of pasture per acre per annum :

Varieties.	Tons of green pasture per acre, at each of six cuttings per annum. Average of four years.						Total number of tons per acre per annum in six cuttings.
	1st cutting.	2nd cutting.	3rd cutting.	4th cutting.	5th cutting.	6th cutting.	
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1. Tall Oat .....	5.93	.83	1.59	1.23	1.33	.87	11.8
2. Orchard .....	4.34	1.71	.92	1.30	1.06	1.40	10.7
3. Western Rye .....	4.82	1.28	.93	1.58	.89	.64	10.1
4. Canadian Lyme .....	3.67	1.81	1.01	1.82	1.01	.73	10.1
5. Bearded Wheat .....	3.18	1.78	1.03	1.89	1.11	.79	9.8
6. Meadow Fescue .....	4.60	1.72	.69	1.09	.84	.61	9.8
7. Virginia Lyme .....	4.13	1.32	.87	1.65	.86	.62	9.5
8. Tall Fescue .....	4.70	1.75	.78	.87	.74	.59	9.4
9. Timothy .....	4.87	1.71	.58	1.11	.62	.49	9.4
10. Fringed Brome .....	4.27	.80	1.09	1.55	.98	.58	9.4
11. Awless Brome .....	4.53	.96	1.04	1.26	.63	.62	9.3
12. Perennial Rye .....	4.10	1.49	.61	.78	.90	.80	9.7
13. Meadow Foxtail .....	3.81	1.32	.72	.95	.53	.37	7.7
14. Kentucky Blue .....	3.76	1.04	.73	.78	.58	.58	7.5
15. Rhode Island Bent .....	3.17	1.17	.66	.91	.52	.40	6.9
16. Red Top .....	2.71	1.03	.62	.67	.44	.37	5.8

It will be seen that the Tall Oat Grass produced the greatest amount of pasture crop per acre, the average for the four years being nearly 12 tons per acre. It gave decidedly the largest yield at the first cutting, held out well in the middle of the summer, and furnished a fairly large amount of pasture crop in the autumn of the year. The Orchard Grass was especially strong in the autumn, producing the greatest quantity of pasture crop at the last cutting of the sixteen varieties of grasses under experiment. Although the Western Rye, Canadian Lyme, and Bearded Wheat have all given comparatively high results in yield of pasture crop per acre, a study of the experiment shows us that when these crops are cut six times during the season, the vitality of the plants becomes greatly exhausted and the crops are apt to be quite inferior in the following season. In the case of the Tall Oat, Orchard Grass, Meadow Fescue, and Tall Fescue, however, the vitality of the plants does not seem to be injured to any great extent by frequent cutting. The results of this experiment are very suggestive, and, we believe, furnish some valuable information regarding the special characteristics of different varieties of grasses when grown with the object of pasture. As a result of this experiment, we are obtaining valuable suggestions as to the most suitable combinations of grasses to use for permanent pastures.

VARIETIES OF CLOVERS FOR THE PRODUCTION OF HAY. A number of varieties of clover have been grown in the Experimental Department for the production of hay, but it has been difficult to get the results of a large number of varieties of clover under uniform conditions for a series of years. We are, however, presenting the average results of each of three varieties for a period of six years. The following table

gives the average date of the first cutting for four years, the average height of the first cutting for six years, and the total annual yield of hay per acre for the average of six years.

Varieties.	Date of first cutting, average 4 years.	Height of first cutting, average 6 years.	Total annual yield of Hay per acre, average 6 years.
Alsike .....	July 3	Inches. 20	Tons. 3.47
Mammoth Red .....	" 11	25	3.31
Common Red .....	June 27	22	2.95

It will be seen that in the average of four years' experiments the Common Red clover was ready to cut on the 27th of June, the Alsike clover on the 3rd of July, and the Mammoth Red clover on the 11th of July. According to this report, the first cutting of the Mammoth Red clover was exactly two weeks later than that of the Common Red variety. The Alsike clover, although producing the shortest plants in the first cutting, gave the largest average yield of hay per acre. It furnishes a close mat of growth. The Mammoth Red clover produces a large crop at the first cutting, but neither this variety nor the Alsike clover furnishes much of a second growth. In 1904 both the Alsike and the Mammoth Red varieties gave exceptionally high yields of hay per acre.

**VARIETIES OF CLOVER FOR THE PRODUCTION OF PASTURE** An experiment has been conducted for three years by cutting each of eight varieties of clover and similar crops at five different times during the growing season, in order to ascertain the amount of pasture crop produced by each variety throughout the summer. The first cutting was made as soon as the earliest varieties had made sufficient growth to furnish a good pasture. Each of the other five cuttings were made at such times as the most vigorous growing varieties had produced sufficient growth for pasture purposes. As each cutting was made, the crop was weighed immediately in order to ascertain the exact yield of pasture crop produced by each variety. The following table gives the average results for three years of each of the six cuttings per annum of each variety:

Varieties.	Tons of green pasture per acre, at each of six cuttings per annum. Average of three years.						Total number of tons per acre per annum in six cuttings.
	1st cutting.	2nd cutting.	3rd cutting.	4th cutting.	5th cutting.	6th cutting.	
1. Lucerns.....	Tons. 8.73	Tons. .06	Tons. 2.70	Tons. 3.62	Tons. 1.56	Tons. 1.27	Tons. 20.8
2. Common Red .....	10.88	.10	2.37	3.39	1.52	1.15	20.4
3. Mammoth Red .....	10.55	1.02	1.99	2.83	1.19	1.19	18.8
4. White or Dutch .....	7.35	2.35	1.95	1.91	2.08	1.63	17.3
5. Alsike.....	8.22	.28	3.66	1.41	2.56	.93	18.5
6. Yellow Trefoll .....	5.07	.19	2.59	2.18	2.10	1.02	13.2
7. Sainfoin .....	4.64	.67	1.78	2.73	1.19	.79	11.8
8. Bnrnet .....	2.64	1.39	1.05	1.52	.59	.41	7.8



According to the results here presented in tabulated form it will be seen that upwards of 20 tons per annum of green pasture crop per acre were produced by Lucerne and also by the Common Red clover. Each of these yields is about double that of Tall Oat grass and of Orchard grass previously reported. The White or Dutch clover made a high record, producing over 17 tons of green pasture crop per acre per annum. Although this clover does not produce a very large amount of hay, it will be seen that it furnishes a large amount of pasture, as it forms an exceedingly compact mass near the surface of the ground. The results which are here presented should be considered in connection with the results previously reported under the heading of "Varieties of Grasses for the Production of Pasture."

**MIXTURES OF HARDY GRASSES AND CLOVERS FOR THE PRODUCTION OF EITHER HAY OR PASTURE.** A large amount of experimental work has been done in testing varieties of grasses and clovers, both singly and in combination, within the past twenty-seven years. The grasses and clovers have been carefully studied, and much information has been gleaned in regard to their value, for hay and also for pasture. In 1885, Prof. Wm. Brown, who was then Farm Superintendent at the Ontario Agricultural College, recommended a mixture which he thought well adapted for permanent pasture. Only the most hardy varieties which had been tested up to that time were included in the mixture. In 1893, after eight years of additional experimental work, during which time the writer was closely connected with the work of the Experimental

Grasses and Clovers.	Varieties in mixtures.	Amount of seed per acre.	Average height of 1st cutting for 10 years.	Yield of hay per acre.	
				1904, 2 cuttings.	Average for 10 years, 23 cuttings.
		Lbs.	Inches.	Tons.	Tons.
1885.					
Grasses	Meadow Fescue	6	33.2	4.16	4.44
"	Meadow Foxtail	3			
"	English Rye	2			
"	Timothy	3			
"	Canadian Blue	4			
"	Orchard	3			
"	Red Top	2			
"	Yellow Oat	2			
Clovers	Lucerne	4			
"	White or Dutch	2			
"	Alsike	2			
"	Red	1			
"	Yellow or Trefoll	1			
		35			
1893.					
Grasses	Orchard	4	37.0	4.64	5.00
"	Meadow Fescue	4			
"	Tall Oat	3			
"	Timothy	2			
"	Meadow Foxtail	2			
Clovers	Lucerne	5			
"	Alsike	2			
"	White or Dutch	1			
"	Yellow or Trefoll	1			
		24			

Department, another mixture was recommended containing a smaller number of varieties and requiring a smaller amount of seed per acre. The grasses and clovers recommended in 1893 have proven themselves to be a valuable mixture. They are all hardy varieties, and when grown together give a large yield. An experiment was started in the spring of 1894 by sowing a plot of the mixture which was recommended in 1885, and a plot of the mixture which was recommended in 1893. The seed was sown with a light sowing of barley; and the germination of the seed of the grasses and clovers was quite satisfactory.

From two to three cuttings have been secured in each of the ten years from 1895 to 1904, inclusive. In 1904, which is the eleventh year since the plots were sown, two cuttings were taken from each plot. The total yield of hay produced from the two cuttings was 4.64 tons from the mixture recommended in 1893, and 4.16 tons from the mixture recommended in 1885. The figures represented in this report show the comparative yields of hay from the two mixtures; they also show that the grasses used for the mixtures are very suitable for an average soil in Ontario. These mixtures can be used for the production of either hay or pasture, but are more suitable for pasture purposes, owing to the unevenness in the maturity of the different varieties, which is a detriment to hay production but an advantage when the crop is used for pasture purposes. Without a single exception, the mixture which was recommended in 1893 has produced a larger yield per acre than that which was recommended in 1885. We have named all the varieties of grasses and clovers sown in each mixture, and also the quantity of seed per acre, in order to make the experiment as clear as possible, and also to furnish a guide for any person who wishes to know the quantity of seed per acre of the different varieties which are recommended as a permanent pasture mixture for an average Ontario soil. It will be observed that the mixture recommended in 1893 possessed none but very hardy grasses and clovers which have been tested at the College more or less for about twenty-six years. This mixture could, of course, be somewhat modified to suit different localities and different soils.

## CONTENTS.

Experimental Work at the Agricultural College.....	1
Results of Experiments.....	1
Conditions of the weather during the past Summer.....	2
Fluctuations in the Areas of Farm Crops in Ontario.....	3
Yields per acre of different classes of grain.....	4
Barley .....	6
Oats.....	11
Wheat.....	16
Rye.....	22
Buckwheat.....	22
Field Peas.....	23
Field Beans.....	25
Soy, Soja or Japanese Beans.....	26
Horse Beans.....	26
Grass Peas.....	26
Cow Peas.....	27
Hairy Vetches for Seed.....	27
Alfalfa for Seed Production.....	27
Corn for Grain.....	27
Sorghum for Seed.....	28
Millet for Seed.....	28
Sunflower Seed.....	28
Flax Seed.....	28
Sowing Spring Grains on Six Different Dates.....	29
Growing Grains in Mixtures for the Production of Grain and Straw.....	31
Mangels.....	33
Sugar Beets.....	35
Field Carrots.....	39
Swede Turnips.....	40
Fall Turnips.....	41
Parsnips.....	43
Kohl Rabi.....	43
Potatoes.....	44
Corn for Fodder and for the Silo.....	50
Sorghum for Fodder.....	52
Sunflowers for Fodder.....	52
Millet for Green Fodder and for Hay.....	52
Rape, Kale, Cabbage, etc.....	53
Green Fodder Crops.....	54
Winter Sowing of Winter Rye, Hairy Vetches and Crimson Clover for Fodder Production.....	55
The Wild Vetch as a Fodder Crop.....	55
Annual Crops for Pasture Purposes.....	55
Grasses and Clovers.....	57

