A STUDY OF THE RELATIVE FEEDING VALUE OF EARLY AND LATE MATURING CORN IN MANITOBA.

A THESIS

Submitted to the University of Manitoba
in partial fulfillment of the requirements
for the Degree of
MASTER OF SCIENCE

By

ROBERT WHITEMAN

April
1933.

Acknowledgements

The writer wishes to express his appreciation to Dr. G. F. McRostie of the Department of Agronomy, University of Manitoba, for his valuable assistance during the progress of this study.

His thanks are also due to Dr. Geddes, Chemistry Department, Manitoba Agricultural College, for the use of materials so kindly furnished and helpful criticisms offered and to Wm. Tildesley, Research Assistant, Agronomy Department, and Prof. A. T. Elders, Agronomy Department, for their helpful assistance in the analytical portion of this work.

C O N T E N T S.

A STUDY OF THE RELATIVE FEEDING VALUE OF EARLY AND LATE MATURING CORNS.

I N T R O D U C T I O N .

The increased demand for fodder crops in Manitoba, makes it imperative that a careful study be made of the composition of the various fodders, particularly corn. It has long been a controversial point among feeders as to whether the late corns improperly matured, with their heavy green weight yields have a higher feeding value per acre than the early maturing strains with lower gross yields. This investigation has been conducted with corns commonly grown in Manitoba, where even the late varieties will mature in favorable years. No attempt has been made to utilize Southern grown corns, therefore the terms "Early" and "Late" are applied in this case to those corns which will mature in approximately 100 days or well within the frost free season and those which require a somewhat longer period to ripen. Samples of both types were

obtained from four different points in the province viz. Morden Experimental Station, Brandon Experimental Farm, Manitoba Agricultural College and from Mr. Murray of Grayeville, Manitoba. The harvesting of these corns was done at the time the early varieties were in approximately the late dough stage or the usual time of harvesting. Four to five stalks of each variety, or one hill, were taken. The yields have been figured on the basis of ten thousand hills per acre.

REVIEW OF LITERATURE

Early investigators devoted practically all their efforts to the quality of the ear. This, no doubt, was due to the fact that corn is the cash crop in the areas where they carried on their work. Also in nearly every case only one variety was under test and this was usually a Dent. We, therefore, find (1) Babcock 1883, (19) Schweitzer 1889, (4) Failyer and Willard 1890, (12) Ladd 1890, (14) Smith 1898 and (11) Jones and Huston 1914, working on the composition of the corn plant at different stages of growth instead of making any attempt to segregate varieties as to their suitability for feeding purposes. The work of these men was very valuable from the standpoint of plant physiology but for the study under discussion has little significance. Smith (18) reviews several years' work on high and low protein and oil strains but all information and analysis is on the grain alone.

In 1914 Jones, Slate and Brown (15) published "The Effect of Early Planting on Yield and Composition of the Corn Crop". Four varieties in fifteen tests were used with the object of finding the effect of early planting on the composition and yield of corn. Results showed an increase in dry weight of 759 lbs. or about ten percent from early planting over the late. Comparison of the protein showed no marked difference in percentage but the average increase in total yield of protein was 9.2 percent for the four years

from 1914 - 1917. This increase was due mainly to greater maturity when harvested. Hume, Champlin and Loomis selected strains for high and low protein content. The yields of protein after four years' tests in pounds per acre are reported to be 439.5 for the high strain and 331.62 for low. The difference in average yield of protein is 12.83 percent and 11.22 percent. Only two years' results on oil content are given, the difference in one year being 6.103% and 5.66%. Difference in dates of harvesting: Average of composite sample of 40 ears, Aug. 15, 3.272%, Sept. 4, 4.982, Sept. 19, 5.523.

Day (2) speaking before the Ontario Corn Growers' Assn. in 1914, comparing early and late corns for silage says: "The Flints and Dents are practically equal in feeding value as are also the yellow and white corns". We all know that the large, late maturing varieties of corn will give a very much larger yield per acre than the earlier maturing varieties and the question is just where to draw the line, that is to say, should we select a very early maturing variety regardless of the fact that it is a light yielder, or should we sacrifice quality and take a very heavy yielding variety which will not mature under our conditions. In the year 1915, three varieties of corn were used: Mammoth Southern Sweet, White Cap Yellow Dent and Longfellow. Theses corns were put into silos to test their effect upon the milk yield of cows. The Mammoth Southern Sweet ears were badly formed. White Cap was in the medium milk stage and the Longfellow had reached the dough stage. The

silage from Mammoth Southern Sweet was very sour and the cows did not like it. The silage from the other two varieties was quite satisfactory. Lennox (13)1919, before the Ontario Corn Growers' Convention, made the following statement: "Silage growers some few years ago aimed to produce a large quantity of silage irrespective of quality, but growers are beginning to realize that a sweeter corn is produced when the kernels have hardened before the corn is cut for the silo. Rapid storage of high quality nutrients takes place in the latter stages of maturity".

Hills (8) found it uneconomical to grow late varieties of corn where they would not mature, the larger bulk of these late varieties consisting chiefly of water. It was found necessary to feed 60 to 65 percent more green weight when placed in the silo above the earlier maturing varieties. Analysis of corns grown at the Vermont station show a marked increase in feeding constituents where the corn was allowed to become glazed before harvesting.

Digestible Nutrients

	Dry Matter %	Crude Protein %	Crude Fibre %	N.Free Ext. %	Ether Ext. %	Tot. Carbo. %
Dent Corn Immature	14.3	1.1	3.8	8.5	0.3	13.0
Dent Corn Mature (glaz.)	18.1	1.1	3.8	11.5	0.7	16.7

At the Vermont station it was found that one acre of green corn fodder, including ears, reduced to silage was equal in feeding value to 1.26 acres of silage from stalks stripped of their ears and fed with the meal made by grinding the dry ear corn. Southworth (17)in "Improvement of Fodder Corn for Manitoba and Other Prairie Provinces:

Year 1920-21.
Man. Flint -- two years' results 21.120 lbs.
Nor. West. Dent " " 23.942 ".

In the above test it will be noted that at the Agricultural College during these years, North Western Dent, selected for earliness was coming down to nearly equal tonnage weights with the Manitoba Flint, an early corn. Southworth also introduced Manalta, a very early corn.

Hopper (7) published a very comprehensive bulletin entitled "Composition and Maturity of Corn". Eighteen selected varieties of corn were grown in 1930, and for purposes of comparison they were divided into four groups: Early, Medium, Late and Miscellaneous. The composition of the samples of ear and stover was calculated on the dry matter basis. The yields of constituents were calculated from the yield of dry matter and the composition of the dry matter. The yields of fodder (whole plant) were obtained by totalling the yield of the ear and stover. The composition of the fodder was calculated from the yields of the

various constituents in it. In calculating the yields 93.56 percent stand or 10,000 plants per acre was used as a basis. A perfect stand would have had 10,688 plants per acre. Taking an example from the analysis, comparing Gehu with Minnesota 13, S. D. seed, both cut 100 days after planting we find the following:

	Green Weight	Dry Weight	Ash	Crude Prot.	Ether Ext.	Crude Fibre	N.F.E.
Gehu glazed	21.420	3.024	312	521	145	1140	3806
Minn. 13	22.667	4.671	313	362	82	1227	2683

This indicates that the mature types of corn will produce more of the essential food elements per acre than those types which do not approach maturity at time of harvesting, notwithstanding the fact that the immature varieties often yield five to six tons more per acre.

In comparing Dents and Flints the percentage of ash and ether extract was higher in Flints and crude fibre lower than in Dents. In the dry matter of the stover of the Flints the percentage of the ash and crude protein were the higher and crude fibre lower than Dents. In the matter of the fodder of the Flints the percentage of ash, crude protein and ether extract was higher and crude fibre lower than in the Dents. The Dents averaged nine days longer to reach the glazed stage than the Flints. At 100 days after planting, the earlier the variety the greater was the yield of dry matter in the ear and the ratio of the dry matter in the ear to that of the stover. The earliness and the production of the plants in

general bore a relation to their relative heights. The smallest and earliest variety, Assiniboine, had reached the glazed stage while the latest, Late White Dent, was only half way between the tassel and milk stage. In feeding value, measured by terms of net energy per acre, the early varieties with short stalks were ahead of medium and late, due to development of ears. Flint varieties were earlier, produced more therms net energy than the Dents. Early varieties will produce more grain by an earlier date, and a better material from which to make silage. In conclusion Hopper states that at an early frost date, 100 days after planting, the early varieties though short in stature, were superior as they showed the largest development of the ear, the largest yield of ear and the largest feeding value as measured in therms of net energy. Also there appears to be a close relationship between the maturity and the dry matter content of the ear and fodder, particularly the ear.

In 1928 Elders (3) delivered a paper before the Manitoba Agronomists' Convention, held at the Manitoba Agricultural College, in which he commented on Hopper's work, drawing attention to the necessity of some work being done in Manitoba, to determine whether early corns capable of being harvested before danger of frost, contained more actual feeding value per acre than do the tall, rank growing, later varieties, which do not ordinarily mature under our conditions. As a result a Committee was appointed to do some investigation work along this line.

Finline (20) has been conducting feeding tests with immature and mature corn for silage. Two groups of cows with six in each group, were used for this test. The groups were uniform as to stage in lactation period, general condition and amount of milk produced by the cows. The ration was identically the same for all groups of cows with the exception of the different forms of silage. Records were kept of the amount of milk produced by cows in each group for each period. The cows were weighed at the beginning and at the end of each of three week periods.

Immature V. S. Mature Corn for Cows.

Period	Silage from Mature Corn	Silage from Immature C.	Increase in Favor of Sil. From Mature C.
No. of Cows	6	6	
Duration of Test	21 days	21 days	
Milk Produced	1,716 lbs.	1,502.5 lbs.	213.5
Gain or loss in body wgt. in 21 days	150 lbs. G.	-30 lbs loss	

Mr. Finline states "The results of this test indicate silage from mature corn to be superior to silage from immature corn". Representative samples of the two silages were taken and submitted to Dr. F. T. Shutt, Dom. Chemist, Ottawa. His report on the analysis is as follows:

Analysis of Mature and Immature Corn
At Brandon.

	Laboratory No. 96622 Mature corn silage W. H. Bent, Brandon	Laboratory No. 96623 Immature corn silage Leaming
	Percent	Percent
Moisture	69.10	82.60
Protein	2.77	1.71
Fat	0.61	0.91
Carbohydrates	16.63	7.74
Fibre	9.27	5.45
Ash	1.62	1.59
	100	100
Acidity	2.01	2.52

CO-OPERATION

The corn varieties used in this experiment were grown at the Manitoba Agricultural College, Morden Experimental Station, and Brandon Experimental Farm. Several lots of early and late corns were also forwarded to some few farmers. These, however, did not warrant working with, due to weather conditions, with the one exception of Mr. Alex. Murray, Grayesville, Manitoba.

MATERIALS

In the present study 22 varieties and strains of corn were used: (1)Quebec 28 from Brandon, (2)Quebec 28, Murray, Grayesville, (3)North Western Dent, Morden, (4)North Western Dent, Manitoba Agricultural College, (5)North Western Dent, Brandon, (6)Manitoba Flint, Brandon, (7)Manitoba Flint, Murray, (8)Gehu, Morden, (9)Gehu, Manitoba Agricultural College, (10)Extra Early White Flint, M.A.C., (11)Extra Early Squaw, M.A.C., (12)Minnesota 13, M.A.C. (13) Minnesota, Morden, (14)Canadian Leaming, Brandon, (15)Can. Leaming, Brandon, (16)Early Abundant, M.A.C., (17)Kings Cross, M.A.C., (18)90 Day Disco, Morden, (19)Extra Early White Prince, M.A.C., (20)Pioneer White Dent, M.A.C., (21)Extra Early Rustler, M.A.C., (22)Golden Glow, Morden.

METHODS

The twenty-two varieties and strains were grown in 1931. At each station the corn was planted on the same date and at time of harvest the cutting was done the same day. Date of harvesting was set at the time the early varieties and strains had cobs in the late dough stage or at the time of danger from the average first fall frost. For purposes of comparison the

terms "Early" and "Late" are used to designate first, the corn which had attained the late dough stage before approximately 100 days, which is about the average frost free period in Manitoba, and secondly, those corns which were still quite immature at 100 days. The average frost free period for South and Central Manitoba is approximately 110 days but the Northern areas drop to as low as 90 days. No attempt was made to introduce late or early corns as classified in the corn areas of the United States, because for the purpose of this study, this would not be practical. In some instances chemical analysis and green and dry weights are given for each station, in others the total green and dry weight only is given. The soil at the various stations ranges from a heavy clay to a sandy loam, therefore it is a fair average for the entire province. All samples were planted during May and each station harvested all varieties on the same date.

From four to five stalks of each variety or approximately one hill, was harvested from each variety and acre yields are figured at 10,000 hills per acre in every case. As soon as cut the stalks were carefully wrapped and forwarded to the Agricultural College, where the total green weight was noted. The material was run through a cutting box and two pound samples weighed out. This was placed in a drying oven for ten to twelve hours and dry weights obtained. The percentage of moisture was then figured out, also total green and dry acre yields obtained. The material was then ground finely and placed in air tight containers for analysis. The season of 1931 being one of low rainfall some of the station yields are low, also due to intense heat in July and August, the so called late varieties were much nearer

maturity than in normal years. However, for the purpose of comparison the later sorts still maintained their rank form of growth while the early varieties were much shorter.

TABLE 1.

GREEN AND DRY WEIGHTS OF CORN GROWN AT MORDEN

Harvested at Approximately 100 Days After Planting.

Pounds Per Acre on Basis of 1000 Plants.

Early Varieties	Green Wgt. Per Acre.	Dry Wgt. Per Acre.	Percent moisture
Nor. West Dent, Morden	10,840	4,119	62
Nor. West Dent, Brandon	9,100	3,148	65.4
Falconer	14,740	5,490	69.6
Minnesota 13	14,160	4,254	70
Gehu	12,640	2,806	77.8

Late Varieties	Green Wgt. Per Acre	Dry Wgt. Per Acre	Percent moisture
90 Day Disco	15,700	3,465	77.8
Longfellow	17,320	3,533	79.6
Giant Prolific	17,300	4,844	72
Can. Yellow Flint	18,380	4,411	76
Golden Glow	20,660	5,743	72.2

Table No. 1. represents corn grown at Morden, harvested at approximately 100 days after planting. The total green weights run much higher in the case of very late corns, with a total average higher moisture content. At Morden

considerable work in selection for earliness has been carried on, the result being that some varieties such as North West Dent, are now maturing fairly early and are classified as such. The corn represented by Table No. 1, was nearly all in the glazed stage.

TABLE 11.

GREEN AND DRY WEIGHTS OF CORN GROWN AT BRANDON

Harvested at Approximately 100 Days After Planting.

Pounds Per Acre on Basis of 10,000 Plants.

EARLY VARIETIES	Green Wgt. Per Acre	Dry Wgt. Per Acre	Percent Moisture
Manitoba Flint	9,658	2,993	69
Nor. West Dent, Brandon	20,676	7,097	66

Late Varieties	Green Wgt. Per Acre	Dry Wgt. Per Acre	Percent Moisture
Quebec No. 28	15,488	4,117	73.4
Leaming	16,082	4,602	72

Table No. 2, shows four varieties grown at Brandon Experimental Farm in 1931. Due to very hot, dry weather conditions prevailing in July and August all corns were hastened to maturity. This resulted in the late corns being in the dough stage at time of harvesting. It will be noted that N. W. Dent is classified as Early at Brandon, and shows the result of selection for earliness. The yield is shown as quite high and moisture content low due to advanced stage of maturity when harvested.

TABLE III

GREEN AND DRY WEIGHTS OF CORN GROWN AT WINNIPEG
Harvested at Approximately 100 Days After Planting.
Pounds Per Acre on Basis of 10,000 Plants.

Early Varieties	Green Wgt. Per Acre	Dry Wgt. Per Acre	Percent Moisture
Early White Flint	9,000	2,600	71.11
Early Squaw	9,500	3,410	64.1
Gehu	10,163	2,845	72

Late Varieties	Green Wgt. Per Acre	Dry Wgt. Per Acre	Percent Moisture
Canadian Leaming	16,000	4,328	72.95
Minnesota 13,(Haney)	18,000	4,206	76.63
Kings Cross	16,200	4,197	74.09
Early Abundant	15,000	3,375	77.5

Table No. 3, shows corn grown on plots at Manitoba Agricultural College. It will be noted that there is a startling difference between the early and late varieties as regards moisture content, the early corns yielding approximately one half as much green weight tonnage as compared to the late varieties.

TABLE IV

GREEN AND DRY WEIGHTS OF CORN GROWN AT GRAYSVILLE

Harvested at Approximately 100 Days After Planting.

Pounds Per Acre on Basis of 10,000 Plants.

Early Varieties	Green Wgt. Per Acre	Dry Wgt. Per Acre	Percent Moisture
Manitoba Flint	5,800	2,668	54

Late Varieties	Green Wgt. Per Acre	Dry Wgt. Per Acre	Percent Moisture
Quebec 28	3,700	1,369	63
Nor. West. Dent	6,000	2,220	63

Table no. 4, shows varieties of corn grown by Mr. A. Murray of Grayseville. Due to dry weather conditions prevailing at harvest time, all corns were somewhat wilted and the late varieties had suffered much more than the early sorts, giving them a greatly reduced yield. All varieties while classified as Early and Late ripen quite well in this district, therefore a much later corn such as Canadian Leaming would have made a better comparison.

TABLE V.

GREEN AND DRY WEIGHTS OF CORN GROWN AT WINNIPEG

Harvested at Approximately 100 Days After Planting

Pounds Per Acre on Basis of 10,000 Plants.

Early Varieties	Green Wgt. Per Acre	Dry Wgt. Per Acre	Percent Moisture
Extra Early Minnesota 13	10,035	3,176	68.4
N. W. Dent (Brandon)	11,864	4,211	64.5
Assiniboia Yellow	7,650	2,664	70.4
Gehu	10,165	3,893	61.7
Early White Flint	6,522	1,826	72
N. W. Dent Extra Early	14,077	4,462	68.3
Early Squaw	9,005	2,434	63
Medium Varieties	**Green Wgt. Per Acre**	**Dry Wgt. Per Acre**	**Percent Moisture**
Early Mixtures (Roberts)	10,036	3,171	68.4
Early Pioneer	13,123	3,055	69.1
Double Cross (N. King)	10,152	3,004	70.4
N. W. Dent (Crookston)	11,955	3,538	70.4
Late Varieties	**Green Wgt. Per Acre**	**Dry Wgt. Per Acre**	**Percent Moisture**
E. E. Rustler	12,093	3,700	69.4
Canadian Leaming	10,084	2,228	77.9
Kings Cross	14,777	4,617	67.4
Double Cross (Roberts)	10,036	3,171	68.4
Minnesota 13 (Haney)	11,448	3,251	71.6

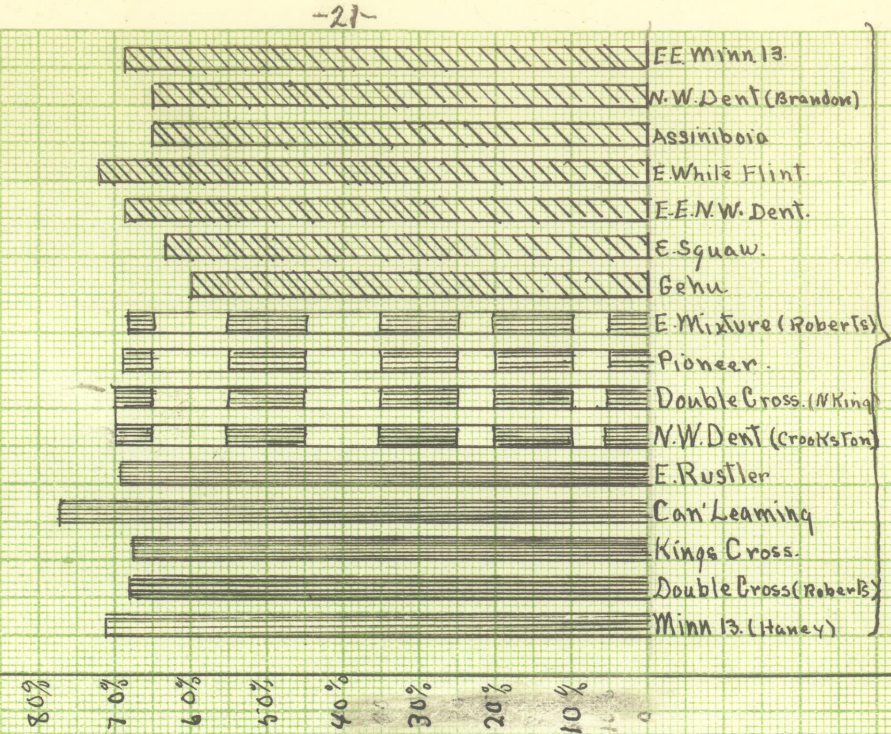
Table No. 5, taken from College corn harvested at approximately the same stage of maturity, the dough stage. This table shows that as the late maturing corns come to maturity the green weight tends to lessen and moisture percentage decreases but the dry weight increases. Under these conditions the late corns would, without doubt, be the varieties to grow. The question of length of growing season enters in and in most years it is impossible to bring most late varieties to a state of maturity. The problem then is to decide which is preferable to grow under Manitoba conditions.

In Southern Manitoba, North Western Dent, Quebec 28, and various intermediate types will mature with a fair margin of safety in most seasons, but in Northern Manitoba conditions are much different and we find these corns mature only in years of extremely open frost free falls. The variety to grow in these regions, then, must be a very early maturing sort such as Gehu, Manalto Early, Manitoba Flint, etc. The important factor here is to grow corn for fodder that has a chance of nearing maturity. Tonnage must be more or less a minor factor. The problem then, is selection of early corns with a view to increased growth of stem and leaf yet retaining their early habit. It will be noted that corn growing in Manitoba, presents a problem entirely different from the Northern and Central States, and late corns have no place whatever in our farming system.

Chart No.

Early
Medium
Late

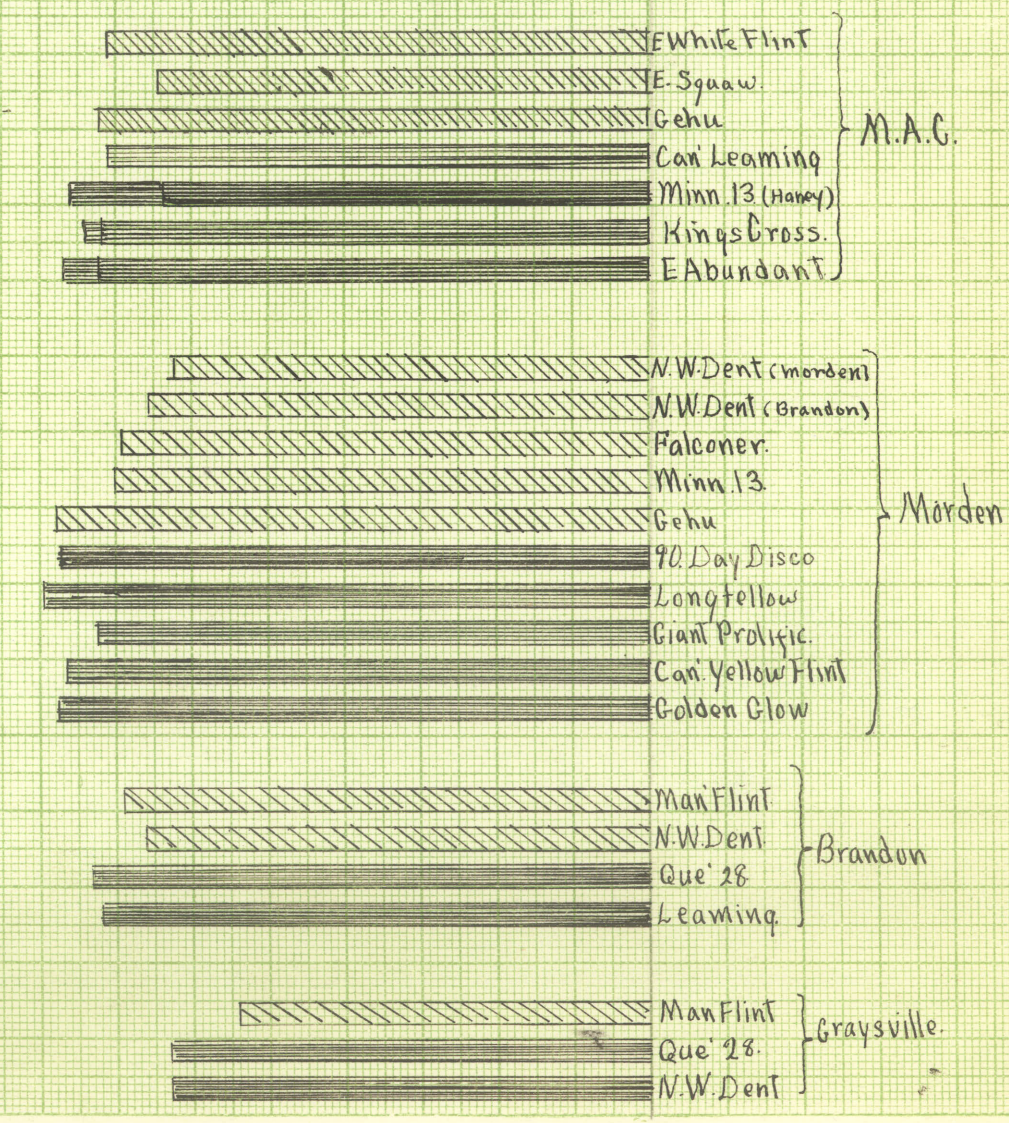
Harvested When Each Variety Was Mature.



Percentage Moisture in Corn.

Grown at Various Stations

Harvested at Approximately 100 Days After Planting.



ANALYSIS OF MATERIAL

The corn after being dried for ten to twelve hours in the drier and moisture content obtained, was run through the crusher and the material ground to a fine powder. It was then placed in an air tight container until such time as the analysis could be made. During the winter of 1932-33 the samples were taken to the chemical laboratory where thirty-six duplicate determinations were made. Moisture content was first obtained by weighing out two gram samples and placing them in oven for around six hours, at a temperature of 100°C. The samples were then cooled and weighed and the percentage of moisture obtained. Analysis was computed on dry weight basis.

The process of analysis was divided into five determinations: % Moisture, % Crude Protein, % Crude Fat, % Crude Fibre % Ash. Nitrogen Free Extract was obtained by subtracting the sum of the above from 100.

The work was hastened by equipment made by Mr. Binnington of the Chemistry Department, Manitoba Agricultural College. This was especially true in the determination of crude fibres. The glass filter was used instead of the old time method of filtering with a silk cloth. By means of this filter attached to a suction pump the washing was done directly inside of the Erlenmeyer flask. After the digestion process was finished crude fibre material was moved to Gooch crucibles arranged in series and connected with a suction pump. This allowed of six determinations being run at the same time.

TABLE VI.

PROXIMATE ANALYSIS OF CORN GROWN AT WINNIPEG

Harvested at Approximately 100 Days After Planting.

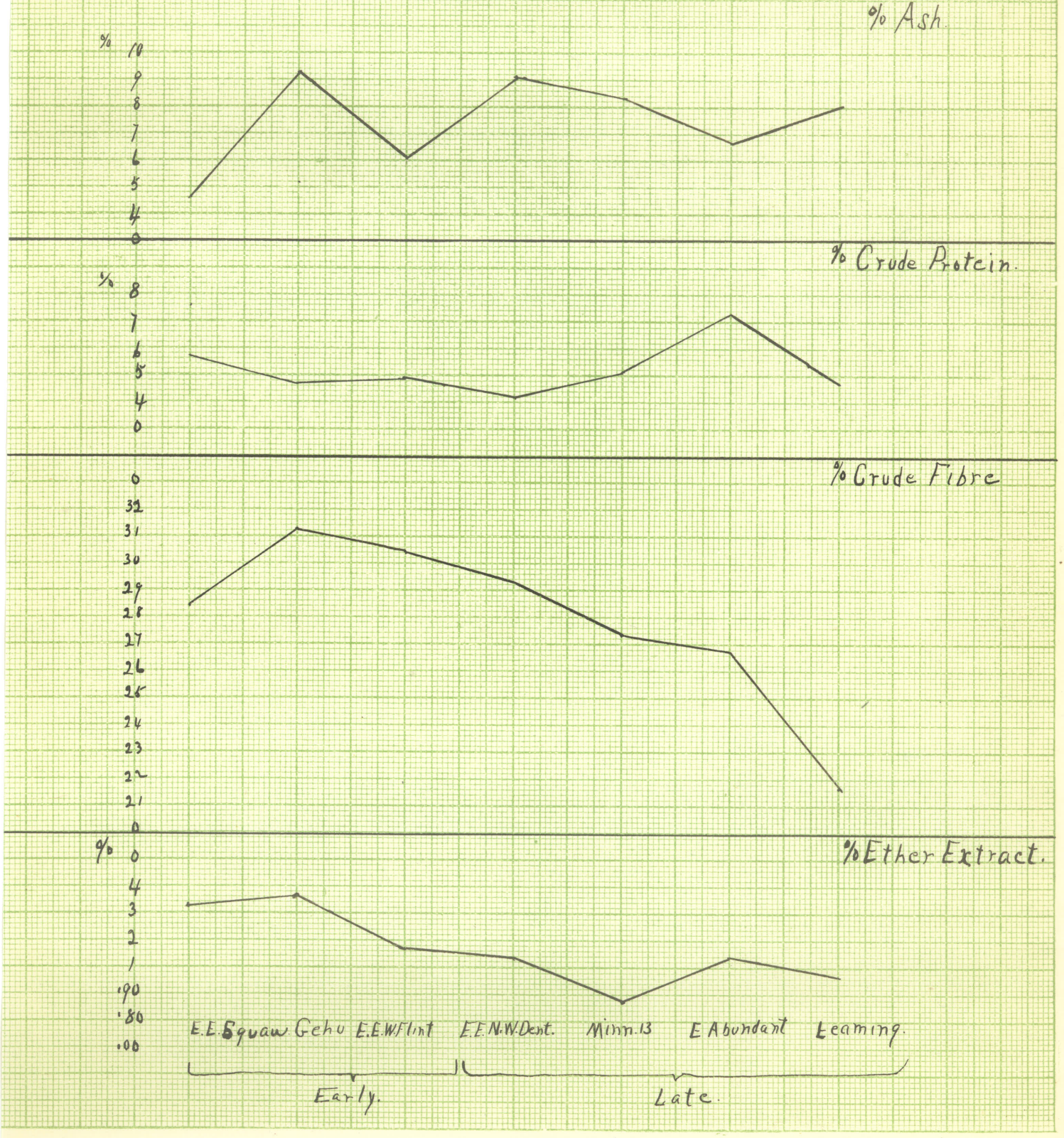
Dry Matter Basis.

Early Varieties	Crude Fat %	Crude Fibre %	Crude Protein (N X6.25) %	Ash %	N.F.E. By Diff. %
E. E. Squaw	3.38	28.54	5.78	4.76	57.54
Gehu	3.77	31.39	4.66	9.21	50.97
E. E. White Flint	1.75	30.25	4.89	6.18	56.95
E.E. N.W. Dent (Brandon)	1.22	29.24	4.15	9.08	56.31
Late Varieties					
Minn.13 (Haney)	.87	27.21	5.03	8.25	58.64
Can. Leaming	.96	21.78	4.68	8.03	64.55
E. Abundant	1.36	26.73	7.26	6.62	58.03
Kings Cross	1.97	21.28	5.36	6.40	64.99

Fat content averaged higher in the early varieties. Flints would appear to be higher in this constituent than Dents. Protein apparently remained constant once the plant had reached its maximum growth. The early varieties did not show any higher average than the late ourns.The mature plants show a higher percentage of crude fibre.

Chart No 3

Proximate Analysis of Early and Late Maturing Corns
Grown at Manitoba Agricultural College.
Harvested at Approximately 100 Days After Planting.
Dry Matter Basis.



No. 315 L — METRIC
HUGHES OWENS CO. LIMITED

TABLE VII

PROXIMATE ANALYSIS OF CORN GROWN AT MORDEN

Harvested at Approximately 100 Days After Planting.

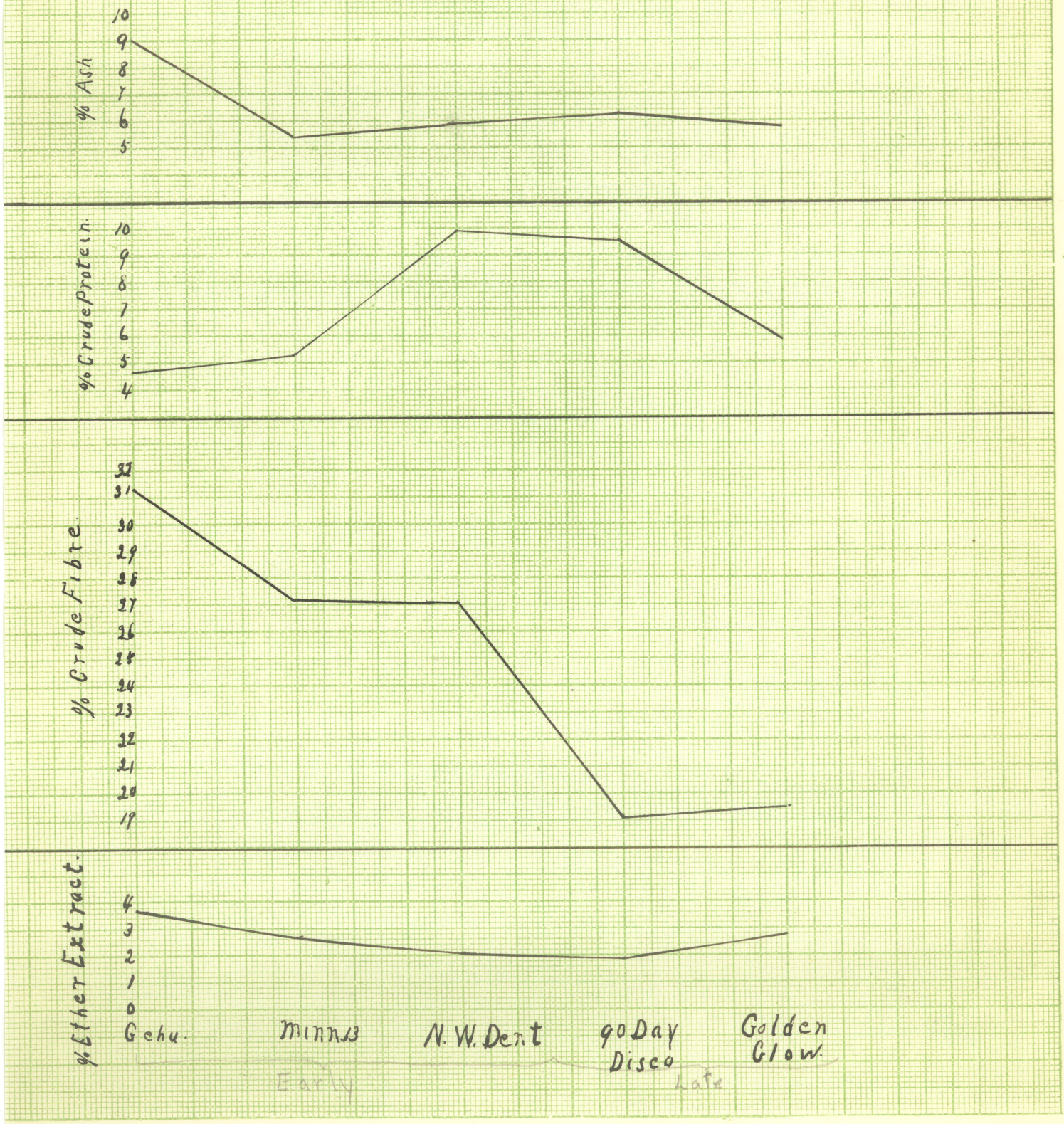
Dry Matter Basis

Early Varieties	Crude Fat %	Crude Fibre %	Crude Protein (N X 6.25) %	Ash %	N.F.E. By Diff. %
N. W. Dent, Morden	2.09	27.06	9.92	5.95	54.98
Gehu (C. Wills)	3.75	31.39	4.66	9.06	51.14
Minn. 13 (Haney)	2.89	27.19	5.73	5.44	58.75
Late Varieties					
90 Day Disco	1.98	19.02	9.55	6.12	63.33
Golden Glow	2.77	19.44	8.47	5.88	63.44

Fat content is much higher on the average in the early corn. Protein content is about equal in the case of North Western Dent (Early) and 90 day Disco (Late). Gehu and Minn. 13 are quite low in protein. The crude fibre runs quite nigh in the case of the early corns.

Chart No 4

Proximate Analysis of Early and Late Maturing Corns. Grown at Morden. Harvested at Approximately 100 Days After Planting.



No. 315 L — METRIC
HUGHES OWENS CO. LIMITED

TABLE VIII

PROXIMATE ANALYSIS OF CORN GROWN AT GRAYSVILLE

Harvested at Approximately 100 Days After Planting.

Dry Matter Basis.

Early Varieties	Crude Fat %	Crude Fibre %	Crude Protein (N.X6.25 %	Ash %	N.F.E. By Diff. %
Manitoba Flint	3.72	18.20	8.72	6.60	62.76
Late Varieties					
Quebec 28	2.59	23.71	9.27	4.90	59.54

Table No. 8, shows Manitoba Flint as having a much higher fat content while Quebec 28 is higher in protein. The Crude Fibre is higher in the late corn while the nitrogen free extract is higher in the early variety. This would appear to be a fairly constant factor when early and late corns are allowed to come to maturity. The tall, rank growing varieties have much higher fibre content while the early corns with their short habit of growth, yet having a better opportunity to mature, store more fat and contain more nitrogen free extract.

TABLE 1A.

PROXIMATE ANALYSIS OF CORN GROWN AT BRANDON

Harvested at Approximately 100 Days After Planting.

Dry Matter Basis

Early Varieties	Crude Fat %	Crude Fibre %	Crude Protein (N.X6.25) %	Ash %	N.F.E. By Diff. %
Manitoba Flint	2.86	18.49	12.01	8.30	58.35
E. E. White Flint	1.62	27.92	4.89	6.07	59.30
E. E. Dent	1.70	28.27	9.60	4.72	55.31
Late Varieties					
Canadian Leaming	.45	21.32	3.87	6.37	67.99
Quebec 28	1.67	22.63	11.33	8.86	55.31

This table shows very early corns such as Man. Flint and a very late corn, Canadian Leaming, with an intermediate type, Quebec 28, which while listed as a late corn, will under conditions at Brandon, ripen with comparative safety under average open falls. It is shown that the corn nearest to maturity contains a much higher percentage of fat and protein, while the very late variety, Canadian Leaming, shows that at time of harvesting the plants had not finished their food storage period.

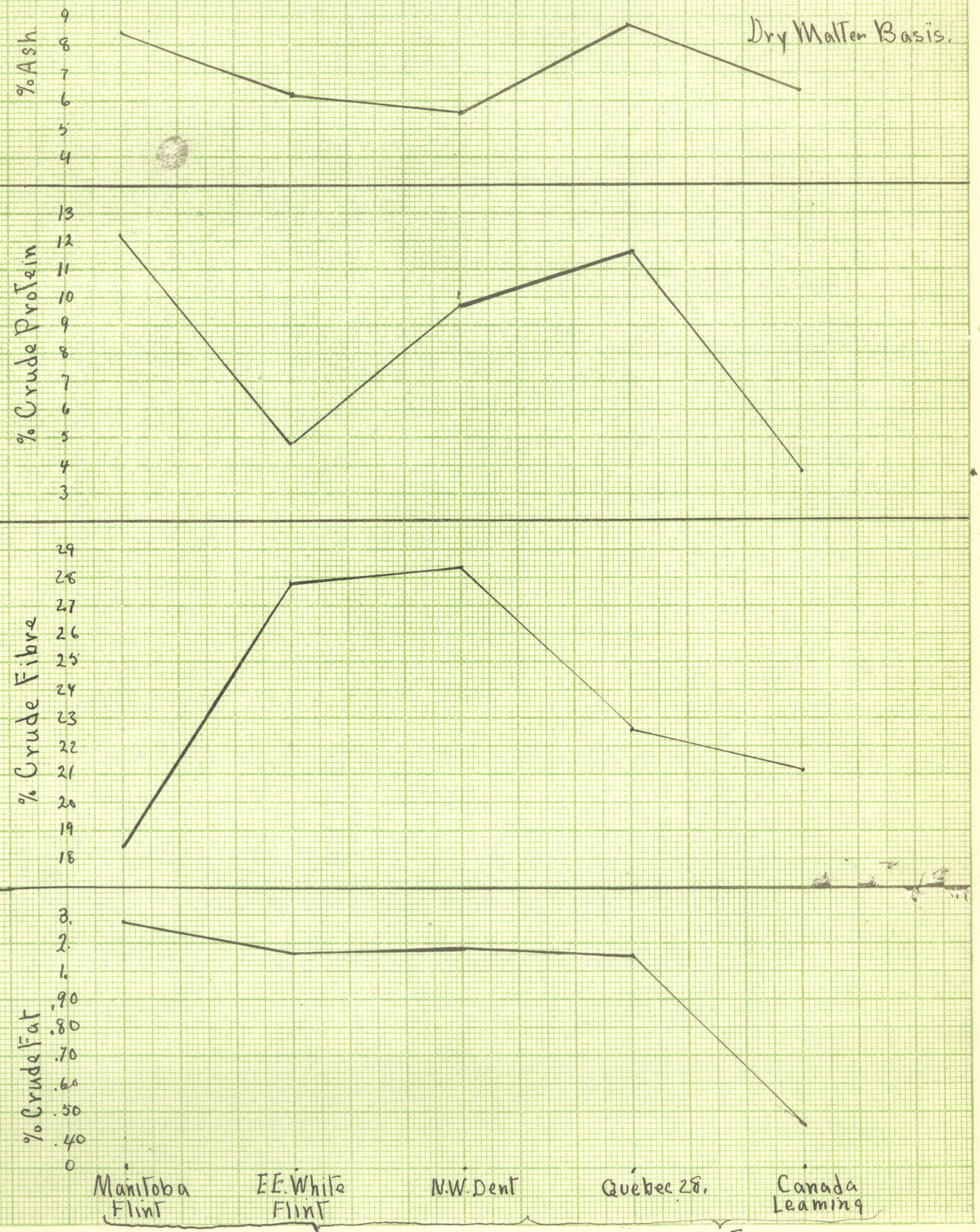
Chart 605

Proximate Analysis of Early and Late Maturing Corn

Grown at Brandon

Harvested at Approximately 100 Days after Planting

Dry Matter Basis.



No. 315 L — METRIC
HUGHES OWENS CO. LIMITED

TABLE X.

PROXIMATE ANALYSIS OF CORN GROWN AT WINNIPEG

Harvested When Mature

Dry Matter Basis.

Early Varieties	Crude Fat %	Crude Fibre %	Crude Protein (N.X6.25) %	Ash %	N.F.E. By Diff. %
Gehu (C. Mills)	3.51	31.39	4.66	8.56	51.88
Early Squaw	2.04	28.54	5.78	4.38	59.26
E. E. White Flint	1.60	30.25	4.89	5.62	57.64
Medium Varieties					
N. W. Dent (C.)	1.15	29.24	4.15	8.56	56.90
Pioneer	1.77	29.53	5.26	7.94	55.50
Late Varieties					
Minnesota 13	.81	27.21	5.03	7.66	59.29
Kings Cross	1.87	21.26	5.36	6.03	65.48
Can. Leaming	.89	21.78	4.68	7.49	65.16

Table No. 10, shows the proximate analysis of corn grown at Manitoba Agricultural College in 1931, harvested when each variety was allowed to come as near to maturity as possible without frost damage. The early varieties had cobs quite mature while the late varieties had cobs formed and in some few cases the earlier strains had cobs in the dough stage.

The early corns show an increase in crude fat with the exception of Early White Flint. The fibre content is high in the early varieties while the nitrogen free extract is about average for all varieties. This table shows that the real early corns when allowed to come to a perfect state of maturity tend to store the essential elements right up to complete ripening with the exception of protein, and that there is a steady gain of these materials until fully mature. The tall, rank growing varieties are low in fats and crude fibre while the protein would appear to remain fairly constant once the tassel has emerged.

Chart No 6

Proximate Analysis of Corn.

Grown at Manitoba Agricultural College

Harvested at Approximately the Same Stage of Maturity.

Dry Matter Basis.

HUGHES OWENS CO., LIMITED
315L—METRIC

The analysis of the foregoing tables substantiates the contention of live stock feeders, that the late, rank growing corns have not the actual feeding value per pound of air dried weight material which the early varieties contain. The fat and protein content is so low that even with increased tonnage they do not contain as much actual feed value as the early types when our short season is taken into consideration.

While no silage was made from the corns under test a study of the analysis of corn grown at a number of points throughout Canada, would indicate that the late corns contain far too much moisture and a too low chemical content to make really good silage. The work at Brandon confirms this, the acidity being high in the late, green varieties. most feeders contend that stock prefers the early corn silage and the nearer it is to the glazed stage the higher the feeding value. From a fodder standpoint as practised under our Western conditions, the analysis shows that the nearer the corn is to maturity the lower the moisture content and a higher percentage of those constituents which are required for the maintenance of animals.

TABLE XI

CORN GROWN AT WINNIPEG, 1931.

Weight of Constituents Based on Acre Yields 10,000 Plants

Early Varieties	Crude Fat lbs.	Crude Fibre lbs.	Crude Protein lbs.	Ash lbs.	N.F.E. lbs.	Dry Matter lbs.
Gehu (O.Wills)	87.69	730.03	103.39	214.22	1185.52	2325.85
Early Squaw	113.90	973.21	197.09	162.30	1962.00	3408.60
E.E.White Flint	60.60	1059.90	171.34	216.54	1994.45	3504.00
Late Varieties						
Minnesota 13	51.92	1623.80	300.10	492.36	3495.60	5962.00
Canada Leaming	57.09	1295.15	278.30	476.50	3838.78	5945.82
Kings Cross	112.11	1211.04	305.03	364.22	3698.56	5690.98

Manitoba Agricultural College results show that the dry weight of the late varieties is in some cases nearly double that of the early corns, yet the acre yield of fat in lbs.still remains much higher with the early varieties. Crude protein runs higher with the increased yield of dry weight. Results from all stations are comparable in this respect, showing that the storage of this material in the plant has reached its maximum at the time the plant is fully grown.

Table XII

Cold Shore Ac manor, 1931.

Weight of Constituents Based on Acre Yields 10,000 Plants.

Early Varieties	Crude Fat lbs.	Crude Fibre lbs.	Crude Protein lbs.	Ash lbs.	N.F.E. lbs.	Dry matter lbs.
S.S. Dent,(Norden	86.10	1114.87	408.70	245.15	2265.17	4179.89
Gehu (U.Ville)	164.60	1293.26	191.99	273.27	2106.96	4119.98
Sinn.13 (Nancy)	122.94	1166.66	243.75	231.41	2499.22	4263.98
Late Varieties						
90 Day Dieco	69.00	662.00	332.00	313.00	2208.00	3486.00
Golden Glow	135.00	983.00	416.00	288.00	3111.00	4902.00

At Norden we find conditions very favorable for corn production, therefore the varieties classified as late in the above table had attained their maximum growth. A point worthy of interest is that the early corns averaged more fat but that S. S. Dent is placed in the early class and is low in this respect. The result of tests on all stations would warrant the conclusion that Flints as a general rule, other things being equal, will produce a higher percentage of fat.

TABLE XIII

Corn Grown at Brandon, 1931

Weight of Constituents Based on Acre Yields 10,000 Plants

Early Varieties	Crude Fat lbs.	Crude Fibre lbs.	Crude protein lbs.	Ash lbs.	N.F.E. lbs.	Dry Matter lbs.
Man. Flint	85.00	553.50	359.40	248.00	1746.00	2992.90
Mer. W. Dent	120.65	2006.60	695.60	335.02	3940.00	7097.82
Late Varieties						
Quebec 28	60.77	931.90	474.60	364.85	2277.66	4117.98
Can. Leaming	20.25	959.82	174.22	286.77	3060.08	4501.14

At Brandon the comparison between Man. Flint and M. W. Dent shows what can be done by selection. M.W. Dent is considered an intermediate variety yet the strain produced here is early and shows a much higher acre yield of all constituents. The yield is nearly three times that of Man. Flint, therefore under conditions prevailing at Brandon and areas South and West, this variety would appear to be preferable. Can. Leaming is low in fat and protein indicating that at the time of harvest it had not attained its full growth and did not produce the quantity of constituents per acre in comparison with other varieties.

TABLE XIV

CORN GROWN AT GRAYSVILLE, 1931.

Weight of Constituents Based on Acre Yields 10,000 Plants

Early Varieties	Crude Fat lbs.	Crude Fibre lbs.	Crude Protein lbs.	Ash lbs.	N.F.E. lbs.	Dry Matter lbs.
Man. Flint	116.51	570.02	273.11	206.71	1965.64	3131.99
Late Varieties						
Quebec 28	35.45	324.58	126.90	67.08	814.96	1368.97

The above table shows Manitoba Flint with a greatly increased yield of dry weight. This is accounted for by the fact that the early corn was pretty well matured during the extremely hot weather of late July and the month of August. The Quebec 28 had not nearly finished its growing period and as a result suffered considerably more.

TABLE XV

PROXIMATE ANALYSIS OF FLINT AND DENT CORN

GROWN AT WINNIPEG

Flints	Crude Fat %	Crude Fibre %	Crude Protein (N.X6.25) %	Ash %	N.F.E. By Diff. %
Kings Cross	1.87	21.26	5.36	6.03	65.48
E.E.White Flint	1.60	30.25	4.89	5.62	57.64
Dents					
Minnesota 13	.81	27.21	5.03	7.66	59.29
N.W. Dent	1.15	29.24	4.15	8.56	56.90

Table No. 15, shows considerable difference in fat content between flints and dents, some of which can be accounted for by the state of maturity at time of harvesting. Protein is shown as running fairly uniform in both strains. Ash is high in the tall, rank growing corns. Nitrogen free extract averagee higher with early maturity.

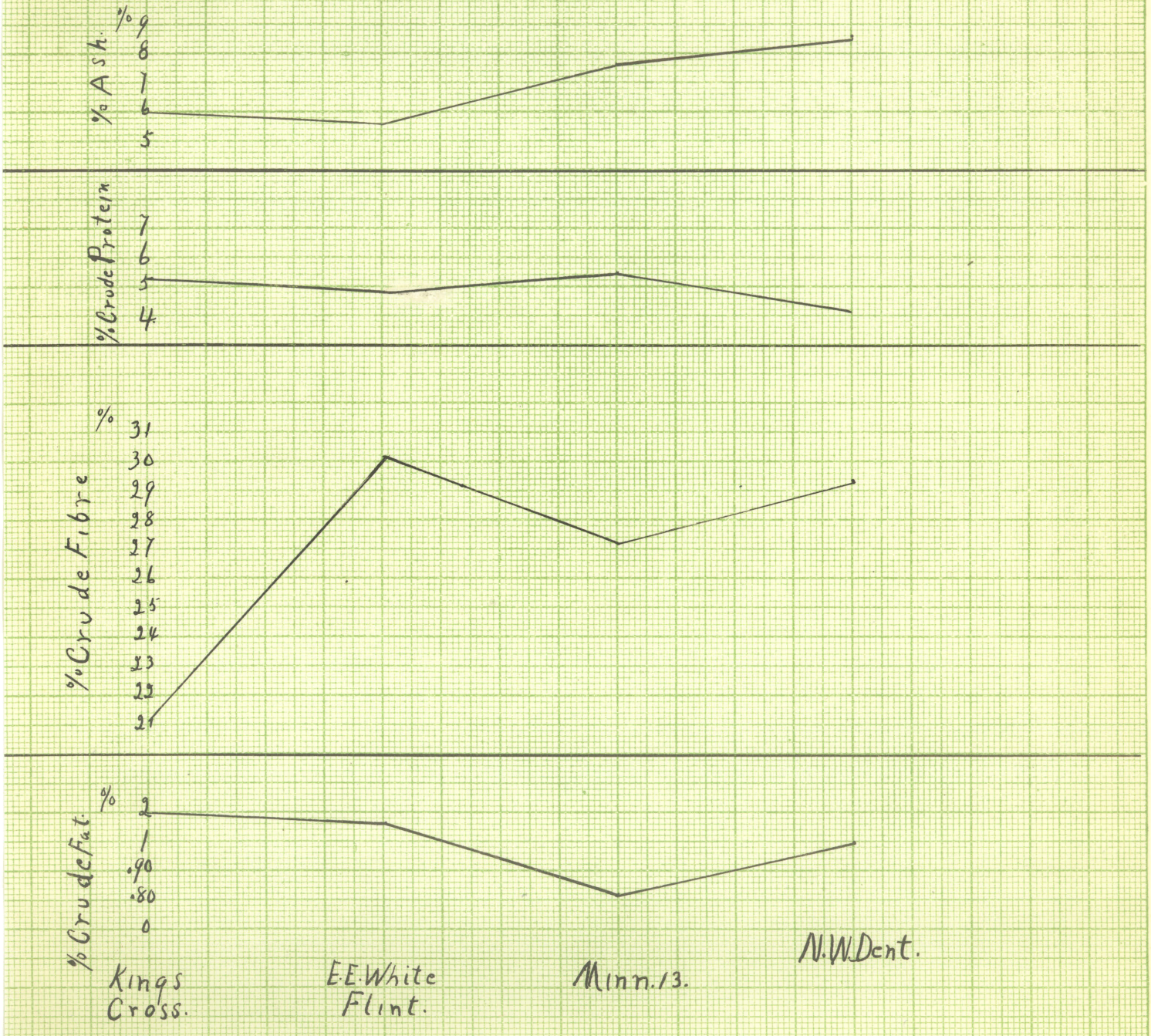
Under our conditions, apparently, the feeding value between flints and dents is very close, the whole question resolving itself into earliness of variety. Some few flints such as Manitoba, are reasonably tall growing and due to their extreme earliness must still be largely grown in Northern portions of Manitoba. The dents on the other hand, produce a higher yield of fodder under our conditions, and if selected for earliness have much to recommend them.

Proximate Analysis Flints and Dents.

Grown at Manitoba Agricultural College.

Harvested at The Same Stage of Maturity.

Dry Matter Basis.



No. 315 L — METRIC
HUGHES OWENS CO. LIMITED

TABLE XVI

PROXIMATE ANALYSIS OF NORTH WEST DENT GROWN AT WINNIPEG, MORDEN AND BRANDON

Dry Matter Basis.

N. W. Dent	Crude Fat %	Crude Fibre %	Crude Protein (N.X6.25) %	Ash %	N.F.E. By Diff. %
N. W. Dent M.A.C. (Crookston)	1.15	29.24	4.15	8.56	56.90
Brandon Selection	1.70	28.27	9.80	4.72	54.07
Morden Selection	1.97	27.06	9.92	5.61	55.44

Table No. 16, shows an analysis of North Western Dent corn grown at Manitoba Agricultural College, Morden Experimental Station and Brandon Experimental Farm. It will be noted that the fat content is low throughout. The crude fibre is very uniform. The ash shows an increase in Crookston corn while the nitrogen free extract shows a difference of approximately 1% at each station. For some unknown reason the protein content of N. W. Dent grown at M. A. C. was extremely low. Two duplicate samples of this material was made, to check this, with practically equal results. The only apparent reason for this is that this corn had not reached its full stage of growth at harvest time or the original sample was not properly mixed after grinding.

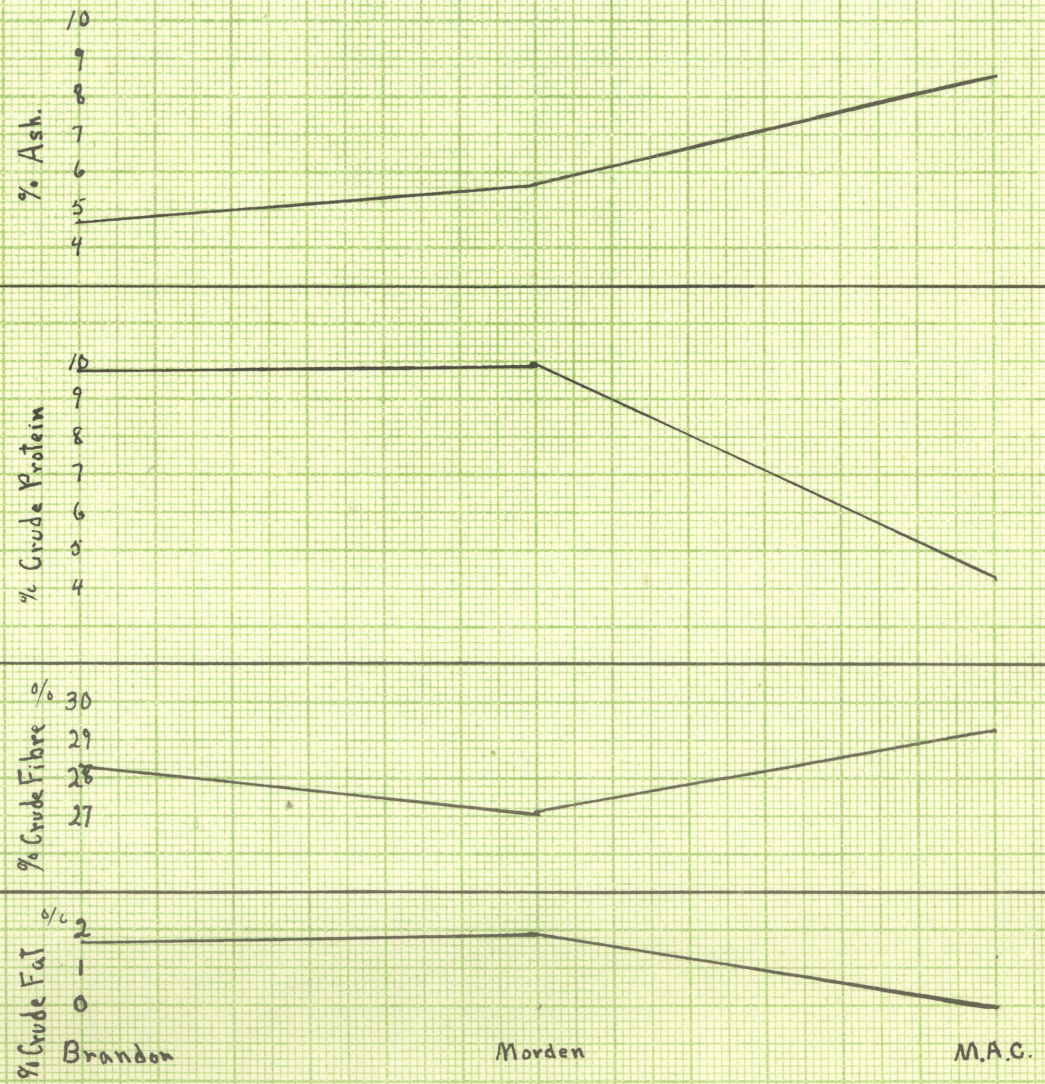
Chart No 7

Proximate Analysis. N.W Dent.

Grown at Manitoba Agricultural College, Morden, and Brandon.

Harvested at Approximately 100 Days After Planting.

Dry Matter Basis.



No. 315 L — METRIC
HUGHES OWENS CO. LIMITED

C O N C L U S I O N S.

(1) This study has been made with a view to determine the relative feeding value of Early and Late maturing corn in Manitoba.

(2) Four points in Manitoba contributed material for analysis: Morden, Graysville, Brandon and Winnipeg.

(3) Early corns are designated as those which will mature at approximately 100 days after planting.

(4) Under our climatic conditions it would appear that the medium early corns produce more dry matter as well as food constituents per acre.

(5) Among corns tested types such as North Western Dent, Minnesota 13, Quebec 28, Manitoba Flint and closely allied strains would appear to be most suitable for Manitoba conditions at the present time.

(6) The late corns have such a high moisture content that when dried weigh correspondingly little more than some of the taller, early varieties. This is important because excess moisture adds nothing to the feeding value of corn, but does add greatly to the cost of harvesting and storing.

(7) The protein content of corn appears to reach its maximum at the time the plant has reached its full growth with practically no gain from this period to maturity.

(8) Maturity causes a loss of moisture and a corresponding increase in crude fibre.

(9) Selection of a corn suitable to Manitoba conditions must be based largely on its ability to ripen well within the average date of the first fall frosts.

(10) No one variety or strain can be selected as a corn suitable to Manitoba. The Southern area can utilize a medium late variety, with its tall habit ofgrowth, medium moisture content and increased tonnage. The Northern districts must select those varieties which will mature with a reasonable margin of safety i. e. the early corns, preferably Flints, despite their lower yielding capacity.

B I B L I O G R A P H Y.

1. Babcock, 1893.

Annual Report, (N.Y.) Geneva Agri. Stn. 153.

2. Day, 1916.

Report of Ontario Corn Growers' Assn.

3. Elders, A. t. 1928.

Report San. Agronomists' Convention.

4. Failyer, and Willard, 1890.

Composition of Corn in Different Stages of Growth. Kansas Agri. Exp. Stn. Report 1890.

5. Fraps, G. S.

Texas Exp. Stn. Div. Chemistry, Bul. 422.

6. Hume, Champlin and Loomis, 1914.

Selecting and Breeding of Corn for Protein and Oil. S. D. Bul. 156.

7. Hopper, T. H. 1925.

Composition and Maturity of Corn. Agri. Exp. Stn. N.D. Agri. College.

8. Mills, J. I. 1915.

Commercial Feeding Stuffs Concerning the Corn Crop. Vermont Agri. Bul.189.

9. Mornberger, 1882.

Commercial Composition of the Corn Plant.

10. Ince, 1916.

Composition of the Corn Plant. N. D. Agri. Exp. Stn. Bul 117.

11. Jones and Huston, 1914.

Composition of Maize Plant at Different Stages of Growth. Ind. Exp. Stn. (Perdue) Bul. 175.

12. Jones, Slate and Brown, 1924.

Effect of Early Planting on Yields and Composition of the Corn Crop. Storrs Exp. Stn. Storrs, Conn.

13. Ladd, E. F. 1890.

Annual Report N. Y. (Geneva)Agri. Exp. Stn.

14. Lennox, 1919.

Annual Report Ontario Corn Growers' Assn.

15. Smith, C.D. 1898.

Some Experiments in Corn Raising. Michigan Exp. Stn. Bul. 154.

16. Southworth, W. 1922.

Improvement of Fodder Crops for Manitoba and Other Prairie Provinces, Man. Agri. College.

17. Smith, L. 1908.

U. S. Bul. 128.

18. Schweitzer, 1888.

A Study of the Life History of Corn at Different Stages of Growth. Mo. Agr. Exp. Stn. Bul. 9.

19. Tinline, M. T. 1929.

Dom. Exp. Farm Report, Brandon.
