

A STUDY OF  
VARIATIONS IN THE PANICLE OF SEVERAL  
OAT VARIETIES

3

A THESIS

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by

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## INTRODUCTION

The purity of variety of cereal crops eligible to produce Registered seed must be determined in the standing grain at or near maturity. In oats, as in other cereals, the head, or panicle, and its culm with typical and morphological characters must be taken as the unit for the identification of the variety. Heretofore nothing in the form of a reliable key, based on the morphological characters of the panicle and stem, has been worked out for use in positively identifying varieties of similar panicle structure. The following study was undertaken in the hope that one or more invariable morphological characters might be found to occur within the panicle of an individual variety, and thus be a means of identification of that particular variety.

By panicle type alone, oats may be divided into two general groups, namely, open or spreading-panicled and side-panicled. The side-panicled varieties are nearly all late in maturing, and therefore

are not much grown in this country. The open-panicled sorts are either early or medium-to-late maturing. All our standard varieties belong to the medium-to-late maturing class. The varieties used in this work were Gopher, Alaska, Abundance, Victory and Banner. The first two are early maturing varieties, ripening in about sixty days. The other three are medium maturing varieties, and take from ninety to one hundred days to ripen. The panicles of all these varieties are very similar when grown under field conditions, and it is practically impossible to identify them by general appearance alone.

I

WORK OF DIFFERENT INVESTIGATORS

Leighty (1914) published results obtained from a study of variation and correlation of several characters in oats. Included among them was the number of spikelets produced per plant and per culm. It is important to note his findings about this character, as it is one of the characters dealt with in the present study. He planted in hills as against drilling-in in the usual way, thus creating different environmental conditions as to room for growth. The results he obtained show that culms grown on plants in hills produced nearly twice as many spikelets as do culms on plants in drills. The relative variation for all trials was found to be about the same. Under the two conditions mentioned, the means for all the characters dealt with were greater in every case for the plants grown in hills than for those grown in drills.

Etheridge (1916) published a memoir on oats entitled "A Classification of the Varieties of Cultivated Oats". This is probably the most extensive classification made so far in North America. As a basis for his work he used the universally accepted botanical grouping of species founded on the morphological differences of the palea, rachilla, empty glumes, awns, basilar connection of grains - whether articulate or solidified, and panicles - whether

spreading or appressed. These groups, eight in number, are: *Avena nuda*; *A. sterilis*; *A. abyssinica*; *A. strigosa*; *A. brevis*; *A. fatua*; *A. sativa*; *A. sativa orientalis*. His classification of varieties within these groups cannot be considered of much value in Canada because with the exception of Banner, our Canadian varieties are not included. Further, his classifications were based on morphological and physiological characters, which are very susceptible to change under different environmental surroundings. The characters used were, color of straw, tillering capacity, color of grain, nerves on glumes, rachilla - glabrous or haired, panicles - widely spreading or compact, and other characters of the same nature.

Hunter (1924) published a monograph, "Oats - Their Varieties and Characteristics". He described varieties grown in England, Ireland and Scotland, many of which are now grown in this country. Among them are Banner, Victory, Gold Rain and Abundance. He used the same method of classification as did Etheridge (1916), namely, that all species of oats fall naturally into eight groups determined by the morphological characters mentioned above. He identified the varieties within the groups by means of both physiological and morphological characters in practically the same manner as Etheridge.

In a brief discussion on the spikelet of oats, Coffman (1925) describes the spikelet as being borne on the pedicle branch, each of which contains two or more florets, though one-flowered spikelets occur rarely. No oat varieties, he says, are known which produce one, two or three florets per spikelet exclusively.

Derick (1931) investigated several characters, including both morphological and physiological, in eight registered oat varieties. The characters used were: early growth, time of maturity, length and strength of straw, foliage - leaf width and pubescence, panicle - whether spreading or side, shape and veining of outer glume, size and shape of grain, color and awn development of lemma, and rachilla - long or short, and pubescent or glabrous. It was found that all of these characters varied more or less depending on the variety and its environment, and consequently cannot be taken as a means of positive identification of varieties of oats. None of the characters mentioned have been considered in the present work.

## II

### MATERIAL USED

Twenty-five panicles of each of the five varieties, Gopher, Alaska, Abundance, Victory and Banner, were selected at random from the pure strains grown on the

plots at the College Farm, Winnipeg, and twenty-five panicles from each of the same varieties grown on the Experimental Farm, Brandon, in the fall of 1931. It will be noted here that the panicle and not the entire plant, was the unit taken to represent the variety. The work was done in duplicate as a check on the results obtained, and also to see what effect, if any, the different environmental surroundings would have on the characters dealt with.

### III MORPHOLOGICAL CHARACTERS DEALT WITH

1. Number of whorls per panicle. The average was obtained for each variety at each point.
2. Number of branches per panicle. The average was obtained for each variety at each point.
3. Average number of branches per similar whorl.  
Obtained from the total branches in 25 similar whorls in the same variety grown at the same point: this done for each variety from each point.
4. Number of spikelets per panicle. The average was obtained for each variety at each point.
5. Number of spikelets per similar whorl. The average was obtained for each variety at each point.
6. Branch length for each variety at each point.
  - (a) Average total branch length per panicle.

(b) Average branch length per panicle.

#### IV

#### METEOROLOGICAL DATA

In order to know what the growing conditions were at both points, meteorological data were obtained showing the differences in temperature, rainfall and evaporation. Information was secured for the five growing months, namely, April, May, June, July and August of the same year in which the grain was grown. The evaporation record was not available for Winnipeg, as this has been discontinued since 1927.

The information is shown graphically on Charts 1, 2 and 3. It will be noted that practically the same daily temperatures prevailed throughout the growing season at both points. The total rainfall for Brandon for the period was 10.19 inches. The total for Winnipeg was 8.79 inches, or a difference of only 1.40 inches between the two locations. While the total moisture which fell at Winnipeg was less than at Brandon, it was more evenly distributed throughout the season. The figures are as follows:

|          | <u>April</u><br>inches | <u>May</u><br>inches | <u>June</u><br>inches | <u>July</u><br>inches | <u>August</u><br>inches |
|----------|------------------------|----------------------|-----------------------|-----------------------|-------------------------|
| Brandon  | .04                    | .42                  | 3.34                  | 3.97                  | 3.42                    |
| Winnipeg | .16                    | 1.27                 | 1.27                  | 3.26                  | 2.83                    |



It was found also that the precipitation at Winnipeg was distributed throughout each month more evenly than was the case at Brandon. For instance, the total at Brandon for June and July was 7.31 inches. Of this, 2.09 inches fell on June 30 and 3.08 inches on July 3, or 71 per cent of the total for the two months fell within 4 days. At Winnipeg it was found that the rainfall was fairly evenly scattered throughout each month. The figures for evaporation were not available for Winnipeg, but the temperature being about the same at both points throughout the season, it was assumed that the rate of evaporation would be similar. The conclusion arrived at from these figures is that more normal growing conditions prevailed at Winnipeg than at Brandon. On this account it would be expected that variable morphological characters in the oat panicles would be found to vary more extensively in the material secured from the plots at Winnipeg.



95  
90  
85  
80  
75  
70  
65  
60  
55  
50  
45  
40  
35  
30  
25  
20

Range in Temperature "F."

— Brandon.  
— Winnipeg.

← APRIL \* MAY \* JUNE \* JULY \* AUGUST →

Chart 1.  
Daily Temperatures  
at Brandon and Winnipeg  
April 1st to August 31st 1931.

— Brandon.  
— Winnipeg.

- 7 -

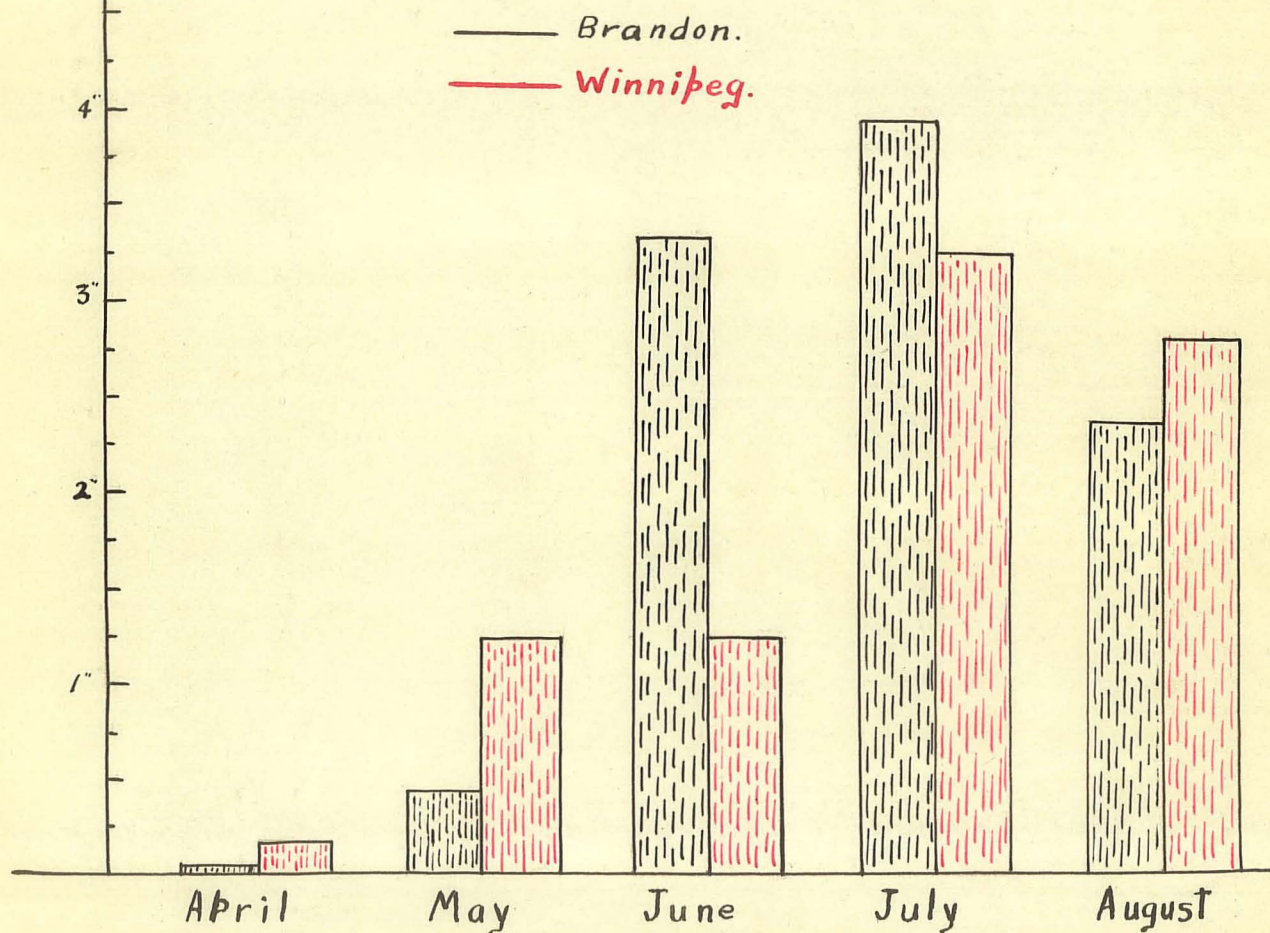
Rainfall in Inches at Brandon and Winnipeg  
April 1st to August 31st 1931.

|        |       |
|--------|-------|
| April  | 1.40" |
| May    | 1.75" |
| June   | 3.20" |
| July   | 3.20" |
| August | 2.40" |



Chart 2.

Rainfall in Inches at Brandon and Winnipeg  
April 1st. to August 31st. 1931.

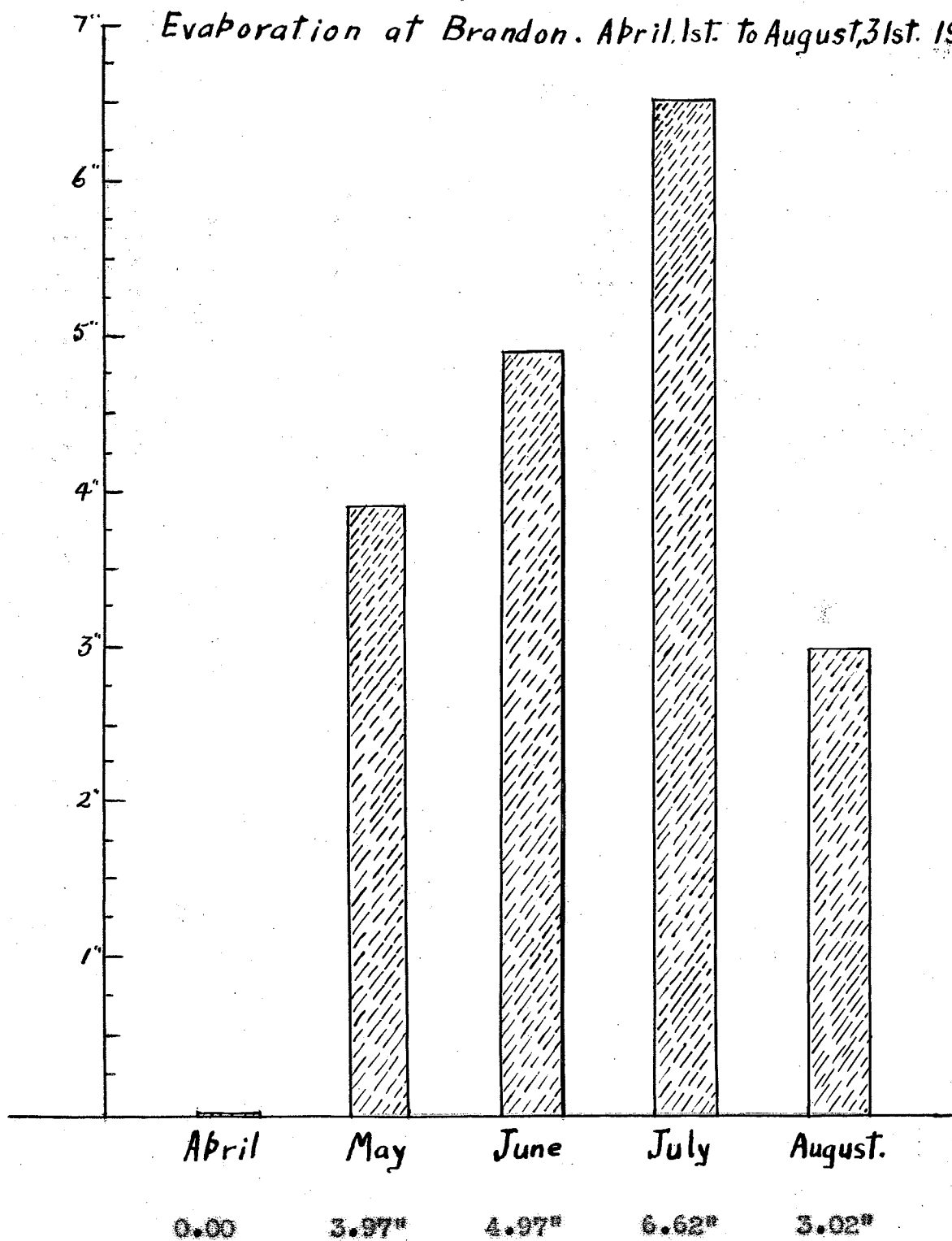


Brandon - April .04"  
May .42"  
June 3.34"  
July 3.97"  
August 2.42"

Winnipeg - April .16"  
May 1.27"  
June 1.27"  
July 3.26"  
August 2.83"

Chart 3.

*Evaporation at Brandon. April 1st. to August 31st. 1931.*



V

MATHEMATICAL PROCEDURE

All calculations were made to the second decimal place, that is, where the third place exceeded five the second place was increased by one.

SIGNIFICANCE OF DIFFERENCE

As usually interpreted, the significance of the probable errors may be explained on the following basis. In the comparison of two statistical results, the difference between the two results, compared to its probable error, is of great value. In general, we may take the probable error in a difference to be the square root of the sum of the squares of the probable errors of the two results. If the difference is found to be not more than three times the probable error obtained in this way, the difference is regarded as caused by random sampling. If the difference between the two results is over three times the probable error, the likelihood that it has been caused by random sampling is so small that we are correct in saying that the difference is significant.



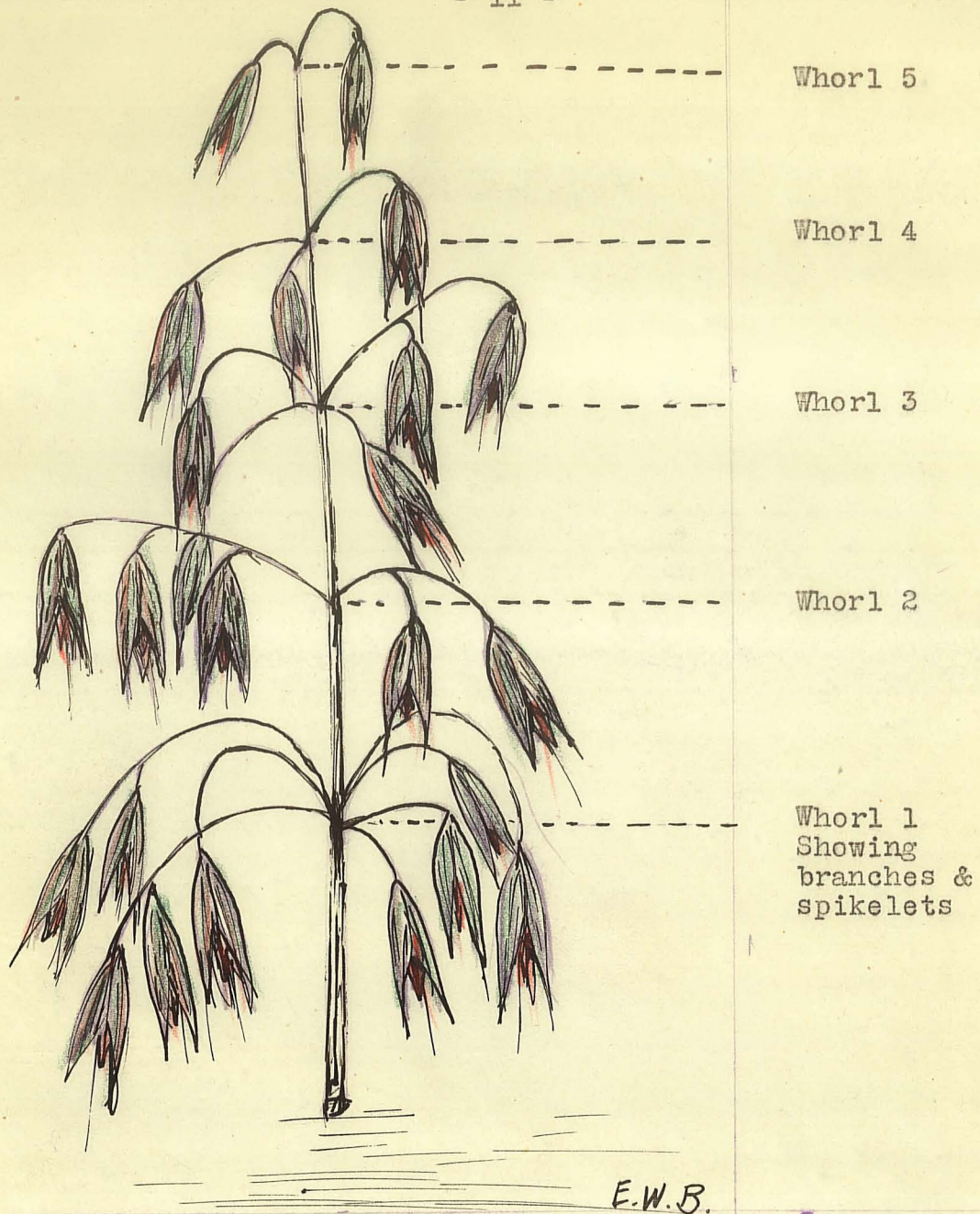


FIG. 4: Sketch of an oat panicle showing the characters dealt with, namely: whorls, branches and spikelets. The whorls are numbered in the order in which they appear in tables 1 to 10.

## VI

### METHOD OF WORK

Fig. 4 is a sketch of an oat panicle showing the whorls numbered in the order they appear in Tables 1 to 10 inclusive. The branches on each panicle were counted. Starting with the shortest and ending with the longest, each branch was cut off and measured individually with a rule graduated in millimeters and centimeters, and the measurement entered in the same order on the work sheets, A, B, C, etc. The length of the branch was considered as extending from the node of origin to the base of the apical spikelet.

Starting with the shortest branch and ending with the longest, the spikelets on each were counted and the numbers arranged in the same order. Where reference is made to "similar branches" in the various whorls, the term is intended to identify branches of similar length in each whorl. Comparison is thus made between all the shortest branches, in order of length, up to the longest within similar whorls.

The kernels per spikelet also were counted and the empty glumes measured for width and length. This phase of the investigation, however, was not brought to a conclusion as considerable work has already been done by Derick (1931) and Coffman (1925), who have shown these

characters to be more or less variable.

The results were summarized into 10 tables too large to be included as a whole in this study. The tables following, numbered 1 - 10, show in a condensed form the results obtained. Instead of showing the number of branches, spikelets and branch length per panicle for each of the 25 panicles used, the lowest and highest figures are given, thus indicating the range of variation of the characters dealt with. The total, average and standard deviation is also given for each character of the 25 panicles of the five varieties worked with.

VII      DISCUSSION OF RESULTS FOUND FOR ALL CHARACTERS  
STUDIED IN THE FIVE VARIETIES, TABLES 1 - 10

GOPHER OATS

Tables 1 and 2 show the results obtained in the variety Gopher at Brandon and Winnipeg respectively for all characters. Calculations for branches and spikelets were made with the standard deviation to the fourth whorl. In table 1, considering the branches first, for whorl 1 the number of the 25 panicles ranges from 5 to 10. The total number for all panicles is 173 with an average per whorl of 6.92, the standard deviation being 1.16. Whorls 2, 3 and 4 show a similar variation in number of branches for



all panicles. The totals per panicle range from 15 to 23, the total for all panicles being 457 with an average of 18.28 and the standard deviation 2.34.

The second part of the table shows the number of spikelets for all whorls, the standard deviation being figured from the first to the fourth inclusive. The range in whorl 1 is from 6 to 16, in whorl 2 from 4 to 10, whorl 3 from 2 to 5, and in whorl 4 from 1 to 3 spikelets per panicle. For the 25 panicles the range is from 18 to 34, with a total of 560, averaging 22.4. The standard deviation is 2.95. It will be noted, therefore, that there is a wide variation in the number of branches and spikelets in both whorls and panicles in this variety grown at Brandon.

It was found that a similar variation exists in the branch length as in the number of branches and spikelets. The total branch length per panicle ranges from 36.1 cms. to 56.6 cms. The total length for the 25 panicles is 1,111.20 cms., averaging 44.5 cms. with a standard deviation of 6.60 cms. The average branch length varied from 1.99 to 2.78 with an average of 2.44, the standard deviation being .22. It will be seen that the branch length shows a wide variation also, both in total and average length per panicle.

Table 2 gives the results for the same variety grown at Winnipeg. The range of difference for all characters is not as wide as found at Brandon except in the case of the average branch length which ranges from 2.17 cms. to 3.09 cms. as against 1.99 cms. to 2.78 cms. The standard deviation for both total and average branch length is practically the same for both locations. For Brandon the standard deviation is 6.60 and Winnipeg 6.10, and for average branch length .22 and .25 for Winnipeg. As at Brandon all characters vary widely.

TABLE 1

RANGE IN NUMBER OF BRANCHES, SPIKELETS AND WHORLS, AND IN  
BRANCH LENGTHS, WITH TOTALS AND AVERAGES, PER 25 PANICLES  
FOR GOPHER OATS GROWN AT BRANTON.

| Branches                | Range   | Total | Average | S.D. |
|-------------------------|---------|-------|---------|------|
| In whorl 1              | 5 - 10  | 173   | 6.92    | 1.16 |
| " " 2                   | 3 - 8   | 140   | 5.60    | 1.18 |
| " " 3                   | 2 - 4   | 66    | 2.64    | .62  |
| " " 4                   | 1 - 4   | 52    | 2.08    | .63  |
| " " 5                   | 0 - 2   | 26    | 1.04    | --   |
| Branches<br>per panicle | 11 - 28 | 457   | 18.28   | 2.34 |
| Whorls<br>per panicle   | 4 - 5   | 113   | 4.52    |      |

| Spikelets                | Range   | Total | Average | S.D. |
|--------------------------|---------|-------|---------|------|
| In whorl 1               | 6 - 16  | 244   | 9.75    | 2.40 |
| " " 2                    | 4 - 10  | 164   | 6.55    | 1.40 |
| " " 3                    | 2 - 5   | 72    | 2.88    | .69  |
| " " 4                    | 1 - 3   | 54    | 2.16    | .78  |
| " " 5                    | 0 - 2   | 26    | 1.04    | --   |
| Spikelets<br>per panicle | 18 - 36 | 560   | 22.4    | 2.95 |

|                                  |             |          |      |      |
|----------------------------------|-------------|----------|------|------|
| Branch<br>length in cms.         | 36.1 - 55.6 | 1,111.20 | 44.5 | 6.60 |
| Average branch<br>length in cms. | 1.99 - 2.78 | 60.95    | 2.44 | .22  |

TABLE 2

RANGE IN NUMBER OF BRANCHES, SPIKELETS AND WHORLS, AND IN  
BRANCH LENGTHS, WITH TOTALS AND AVERAGES, PER 25 PANICLES  
FOR GOPHER OATS GROWN AT WINNIPEG.

| <u>Branches</u>                       | <u>Range</u>   | <u>Total</u> | <u>Average</u> | <u>S.D.</u> |
|---------------------------------------|----------------|--------------|----------------|-------------|
| In whorl 1                            | 5 - 9          | 173          | 6.92           | 1.16        |
| " " 2                                 | 3 - 5          | 98           | 3.92           | .63         |
| " " 3                                 | 2 - 3          | 58           | 2.32           | .47         |
| " " 4                                 | 1 - 2          | 49           | 1.96           | .20         |
| " " 5                                 | 0 - 2          | 10           | .40            | --          |
| <u>Branches</u><br><u>per panicle</u> | <u>13 - 19</u> | <u>388</u>   | <u>15.52</u>   | <u>1.70</u> |
| <u>Whorls</u><br><u>per panicle</u>   | <u>4 - 5</u>   | <u>105</u>   | <u>4.20</u>    |             |

| <u>Spikelets</u>                       | <u>Range</u>   | <u>Total</u> | <u>Average</u> | <u>S.D.</u> |
|--|----------------|--------------|----------------|-------------|
| In whorl 1                             | 6 - 14         | 233          | 9.32           | 2.70        |
| " " 2                                  | 3 - 7          | 117          | 4.68           | .83         |
| " " 3                                  | 2 - 4          | 60           | 2.40           | .57         |
| " " 4                                  | 1 - 2          | 49           | 1.96           | .20         |
| " " 5                                  | 0 - 2          | 10           | .40            | --          |
| <u>Spikelets</u><br><u>per panicle</u> | <u>14 - 24</u> | <u>469</u>   | <u>18.76</u>   | <u>3.34</u> |

|  |                    |               |              |             |
|--|--------------------|---------------|--------------|-------------|
| <u>Branch</u><br><u>length in cms.</u>         | <u>28.4 - 48.5</u> | <u>980.70</u> | <u>39.23</u> | <u>6.10</u> |
| <u>Average branch</u><br><u>length in cms.</u> | <u>2.17 - 3.09</u> | <u>63.36</u>  | <u>2.53</u>  | <u>.25</u>  |

ALASKA OATS

Tables 3 and 4 give for the two locations, the range in all characters studied for Alaska variety. As with Gopher there is a similar wide diversity in all characters dealt with. Unlike Gopher, however, a greater range is shown for whorl 1 at Winnipeg than at Brandon. At Winnipeg the branches vary in number from 5 to 12, with a total of 177, averaging 7.08 with a standard deviation of 1.44. At Brandon the lowest number is 2 and the highest is 8, averaging 4.92 and a standard deviation of 1.49. For whorls 2, 3 and 4 the greater range, as with Gopher, is found in the panicles grown at Brandon. In total branches for the twenty-five panicles the range is a little greater at Winnipeg, being 12 to 22 as against 8 to 20, resulting in a larger average at Winnipeg.

The same wide variation in number of spikelets per whorl and panicles is found at both locations. Whorl 1 shows, as is found with branches, the greater number at Winnipeg. The total is 298 ranging from 8 to 23. The total for Brandon is 203, the lowest 4 and the highest 14. The same wide variation is found in whorls 2, 3 and 4 for both locations.

Branch length at Brandon ranges from 17.9 cms. to 62.7 cms. where, as at Winnipeg, the lowest total branch

length is 27.2 and the highest is 56.5 cms. Here again an extreme variation is found to exist, no two panicles even approximating the same branch length. For averages in branch length a similar variation is found.

TABLE 3

RANGE IN NUMBER OF BRANCHES, SPIKELETS AND WHORLS, AND IN  
BRANCH LENGTHS, WITH TOTALS AND AVERAGES, PER 25 PANICLES  
FOR ALASKA OATS GROWN AT BRANDON.

| <u>Branches</u>                       | <u>Range</u> | <u>Total</u> | <u>Average</u> | <u>S.D.</u> |
|---------------------------------------|--------------|--------------|----------------|-------------|
| In whorl 1                            | 2 - 8        | 123          | 4.92           | 1.49        |
| " " 2                                 | 2 - 7        | 89           | 3.56           | 1.02        |
| " " 3                                 | 1 - 6        | 63           | 2.52           | 1.10        |
| " " 4                                 | 1 - 3        | 50           | 2.00           | .45         |
| " " 5                                 | 1 - 3        | 30           | 1.20           | --          |
| <u>Branches</u><br><u>per panicle</u> | 8 - 20       | 355          | 14.02          | 3.71        |
| <u>Whorls</u><br><u>per panicle</u>   | 3 - 5        | 114          | 4.56           |             |

| <u>Spikelets</u>                       | <u>Range</u> | <u>Total</u> | <u>Average</u> | <u>S.D.</u> |
|--|--------------|--------------|----------------|-------------|
| In whorl 1                             | 4 - 14       | 203          | 8.12           | 2.21        |
| " " 2                                  | 2 - 9        | 121          | 4.84           | 1.41        |
| " " 3                                  | 1 - 8        | 76           | 3.04           | 1.58        |
| " " 4                                  | 1 - 3        | 51           | 2.04           | .45         |
| " " 5                                  | 1 - 3        | 30           | 1.20           | --          |
| <u>Spikelets</u><br><u>per panicle</u> | 9 - 30       | 482          | 19.28          | 7.48        |

|  |             |         |      |       |
|--|-------------|---------|------|-------|
| <u>Branch</u><br><u>length in cms.</u>         | 17.9 - 62.7 | 1,020.6 | 40.8 | 12.30 |
| <u>Average branch</u><br><u>length in cms.</u> | 2.24 - 3.57 | 71.8    | 2.87 | .56   |

TABLE 4

RANGE IN NUMBER OF BRANCHES, SPIKELETS AND WHORLS, AND IN  
BRANCH LENGTHS, WITH TOTALS AND AVERAGES, PER 25 PANICLES  
FOR ALASKA OATS GROWN AT WINNIPEG.

| Branches                | Range   | Total | Average | S.D. |
|-------------------------|---------|-------|---------|------|
| In whorl 1              | 5 - 12  | 177   | 7.08    | 1.44 |
| " " 2                   | 3 - 5   | 101   | 4.04    | .45  |
| " " 3                   | 1 - 3   | 59    | 2.36    | .63  |
| " " 4                   | 1 - 2   | 49    | 1.96    | .20  |
| " " 5                   | 0 - 2   | 12    | .48     | --   |
| Branches<br>per panicle | 12 - 22 | 398   | 15.92   | 5.59 |
| Whorls<br>per panicle   | 4 - 5   | 106   | 4.24    |      |

| Spikelets                | Range   | Total | Average | S.D. |
|--------------------------|---------|-------|---------|------|
| In whorl 1               | 8 - 23  | 298   | 11.92   | 3.40 |
| " " 2                    | 4 - 10  | 143   | 5.72    | 1.51 |
| " " 3                    | 1 - 4   | 61    | 2.44    | .75  |
| " " 4                    | 1 - 2   | 49    | 1.96    | .61  |
| " " 5                    | 0 - 2   | 12    | .48     | --   |
| Spikelets<br>per panicle | 17 - 36 | 563   | 22.52   | 5.23 |

|                                  |             |       |       |      |
|----------------------------------|-------------|-------|-------|------|
| Branch<br>length in cms.         | 27.2 - 56.5 | 943.5 | 37.74 | 7.03 |
| Average branch<br>length in cms. | 2.09 - 2.67 | 59.13 | 2.37  | .13  |



### ABUNDANCE OATS

In tables 5 and 6 the results obtained for Abundance are shown. Of all the varieties worked with, Abundance shows the greatest difference between the results found for all characters for the two locations. The largest number of branches, spikelets and greatest branch lengths are found in the panicles at Winnipeg. It may be noted here that, while this is the case, a larger number of branches and spikelets as well as greater branch length are found in the panicles grown at Winnipeg. The relative range of difference for all characters, however, is found to be about the same for the two points. This is shown by comparing the figures in the two tables. Taking first whorl 1 for Winnipeg, the range is 5 to 10 branches; at Brandon it is 3 to 8, or in both, the highest is practically double the number of the lowest. This is the case also with spikelets and branch length. The reason for the greater number found at Winnipeg is believed to be the more normal growing conditions which prevailed there during the growing season. Meteorological data indicate about equal rainfall at both locations, but show a more even distribution throughout the season at Winnipeg. This variety seems to be more susceptible to environmental changes.

TABLE 5

RANGE IN NUMBER OF BRANCHES, SPIKELETS AND WHORLS, AND IN BRANCH LENGTHS, WITH TOTALS AND AVERAGES, PER 25 PANICLES FOR ABUNDANCE OATS GROWN AT BRANTON.

| Branches                | Range   | Total | Average | S.D. |
|-------------------------|---------|-------|---------|------|
| In whorl 1              | 3 - 8   | 144   | 5.76    | 1.18 |
| " " 2                   | 3 - 7   | 128   | 5.12    | 1.27 |
| " " 3                   | 2 - 4   | 74    | 2.96    | .66  |
| " " 4                   | 1 - 3   | 46    | 1.84    | .46  |
| " " 5                   | 1 - 3   | 45    | 1.80    | --   |
| " " 6                   | 0 - 2   | 8     | .32     | --   |
| Branches<br>per panicle | 12 - 25 | 445   | 17.80   | 2.97 |
| Whorls<br>per panicle   | 5 - 6   | 129   | 5.16    |      |

| Spikelets                | Range   | Total | Average | S.D. |
|--------------------------|---------|-------|---------|------|
| In whorl 1               | 5 - 15  | 235   | 9.40    | 2.71 |
| " " 2                    | 3 - 12  | 159   | 6.36    | 1.90 |
| " " 3                    | 2 - 5   | 91    | 3.64    | .79  |
| " " 4                    | 1 - 3   | 46    | 1.84    | .44  |
| " " 5                    | 1 - 3   | 45    | 1.80    | --   |
| " " 6                    | 0 - 2   | 6     | .24     | --   |
| Spikelets<br>per panicle | 14 - 36 | 582   | 23.28   | 6.06 |

|                                  |             |          |       |       |
|----------------------------------|-------------|----------|-------|-------|
| Branch<br>length in cms.         | 30.1 - 68.7 | 11,119.0 | 47.96 | 10.10 |
| Average branch<br>length in cms. | 1.98 - 3.27 | 67.30    | 2.69  | .30   |

TABLE 6

RANGE IN NUMBER OF BRANCHES, SPIKELETS AND WHORLS, AND IN  
BRANCH LENGTHS, WITH TOTALS AND AVERAGES, PER 25 PANICLES  
FOR ABUNDANCE OATS GROWN AT WINNIPEG.

| Branches                | Range   | Total | Average | S.D. |
|-------------------------|---------|-------|---------|------|
| In whorl 1              | 5 - 10  | 184   | 7.36    | 1.13 |
| " " 2                   | 4 - 8   | 168   | 6.72    | 1.15 |
| " " 3                   | 3 - 4   | 91    | 3.64    | .48  |
| " " 4                   | 2 - 3   | 63    | 2.52    | .50  |
| " " 5                   | 1 - 3   | 46    | 1.84    | --   |
| " " 6                   | 0 - 2   | 12    | .48     | --   |
| Branches<br>per panicle | 17 - 27 | 564   | 22.56   | 2.27 |
| Whorls<br>per panicle   | 4 - 6   | 130   | 5.20    |      |

| Spikelets                | Range   | Total | Average | S.D. |
|--------------------------|---------|-------|---------|------|
| In whorl 1               | 10 - 27 | 389   | 15.56   | 3.60 |
| " " 2                    | 6 - 15  | 261   | 10.44   | 2.70 |
| " " 3                    | 3 - 8   | 124   | 4.96    | 1.60 |
| " " 4                    | 2 - 4   | 66    | 2.64    | .67  |
| " " 5                    | 1 - 3   | 46    | 1.84    | --   |
| " " 6                    | 0 - 2   | 12    | .48     | --   |
| Spikelets<br>per panicle | 24 - 52 | 898   | 35.92   | 6.65 |

|                                  |              |          |       |      |
|----------------------------------|--------------|----------|-------|------|
| Branch<br>length in cms.         | 54.5 - 112.8 | 1,937.30 | 77.50 | 12.8 |
| Average branch<br>length in cms. | 2.35 - 4.17  | 84.53    | 3.38  | .34  |

### VICTORY OATS

Tables 7 and 8 show the results for all characters in Victory at both locations. Here again, as with other varieties, a wide variation is found. A glance at the tables shows a considerable range in number of both branches and spikelets per whorl and per panicle. The branch numbers for the 25 panicles at Brandon range from 14 to 27, the average being 18.88 per panicle. Practically the same figures are found at Winnipeg, the total branches ranging from 14 to 24, with an average per panicle of 20.48.

The spikelets for both locations vary to about the same degree. The totals per panicle at Brandon range from 18 to 43, averaging 27.28. At Winnipeg the figures are 22 to 47, with an average of 34.80 per panicle. The higher average at Winnipeg indicates a greater percentage containing a higher number of spikelets than at Brandon.

Branch lengths per panicle for both locations show similar wide variation. The range for Brandon is from 24.8 cms. to 88.6 cms. per panicle as compared with Winnipeg where the range is from 35.4 cms. to 98.7 cms. As with the spikelets, the greatest variation is found at Winnipeg. The panicles for both locations, however, show extreme variation in all characters.

TABLE 7

RANGE IN NUMBER OF BRANCHES, SPIKELETS AND WHORLS, AND IN BRANCH LENGTHS, WITH TOTALS AND AVERAGES, PER 25 PANICLES FOR VICTORY OATS GROWN AT BRANDON.

| <u>Branches</u>                       | <u>Range</u>   | <u>Total</u> | <u>Average</u> | <u>S.D.</u> |
|---------------------------------------|----------------|--------------|----------------|-------------|
| In whorl 1                            | 3 - 9          | 140          | 5.60           | 1.50        |
| " " 2                                 | 3 - 8          | 130          | 5.20           | 1.40        |
| " " 3                                 | 3 - 4          | 78           | 3.12           | .29         |
| " " 4                                 | 1 - 3          | 52           | 2.08           | .85         |
| " " 5                                 | 1 - 2          | 44           | 1.76           | --          |
| " " 6                                 | 0 - 2          | 28           | 1.12           | --          |
| <u>Branches</u><br><u>per panicle</u> | <u>14 - 27</u> | <u>472</u>   | <u>18.88</u>   | <u>3.61</u> |
| <u>Whorls</u><br><u>per panicle</u>   | <u>5 - 6</u>   | <u>139</u>   | <u>5.56</u>    |             |

| <u>Spikelets</u>                       | <u>Range</u>   | <u>Total</u> | <u>Average</u> | <u>S.D.</u> |
|--|----------------|--------------|----------------|-------------|
| In whorl 1                             | 5 - 20         | 266          | 10.64          | 3.79        |
| " " 2                                  | 5 - 11         | 194          | 7.76           | 1.70        |
| " " 3                                  | 2 - 7          | 96           | 3.84           | .85         |
| " " 4                                  | 1 - 4          | 54           | 2.16           | .73         |
| " " 5                                  | 1 - 2          | 44           | 1.76           | --          |
| " " 6                                  | 0 - 2          | 28           | 1.12           | --          |
| <u>Spikelets</u><br><u>per panicle</u> | <u>18 - 42</u> | <u>682</u>   | <u>27.28</u>   | <u>6.68</u> |

|  |                    |                 |              |              |
|--|--------------------|-----------------|--------------|--------------|
| <u>Branch length</u><br><u>in cms.</u>         | <u>24.8 - 88.6</u> | <u>1,249.10</u> | <u>49.96</u> | <u>12.94</u> |
| <u>Average branch</u><br><u>length in cms.</u> | <u>1.55 - 3.28</u> | <u>66.38</u>    | <u>2.67</u>  | <u>.37</u>   |

TABLE 8

RANGE IN NUMBER OF BRANCHES, SPIKELETS AND WHORLS, AND IN BRANCH LENGTHS, WITH TOTALS AND AVERAGES, PER 25 PANICLES FOR VICTORY OATS GROWN AT WINNIPEG.

| Branches             | Range   | Total | Average | S.D. |
|----------------------|---------|-------|---------|------|
| In whorl 1           | 4 - 8   | 154   | 6.16    | 1.10 |
| " " 2                | 2 - 8   | 118   | 4.72    | 1.50 |
| " " 3                | 2 - 4   | 92    | 3.68    | .64  |
| " " 4                | 2 - 3   | 70    | 2.80    | .40  |
| " " 5                | 1 - 3   | 50    | 2.00    | --   |
| " " 6                | 2 - 2   | 28    | 1.12    | --   |
| Branches per panicle | 14 - 24 | 512   | 20.48   | 2.94 |
| Whorls per panicle   | 5 - 6   | 138   | 5.52    |      |

| Spikelets             | Range   | Total | Average | S.D. |
|-----------------------|---------|-------|---------|------|
| In whorl 1            | 8 - 22  | 327   | 13.08   | 3.19 |
| " " 2                 | 5 - 16  | 244   | 9.26    | 2.63 |
| " " 3                 | 3 - 8   | 142   | 5.68    | 1.35 |
| " " 4                 | 2 - 5   | 79    | 3.16    | .78  |
| " " 5                 | 1 - 3   | 50    | 2.00    | --   |
| " " 6                 | 2 - 3   | 28    | 1.12    | --   |
| Spikelets per panicle | 22 - 47 | 870   | 34.80   | 5.93 |

|                               |             |         |      |       |
|-------------------------------|-------------|---------|------|-------|
| Branch length in cms.         | 35.4 - 98.7 | 1,533.2 | 61.3 | 13.86 |
| Average branch length in cms. | 2.34 - 4.11 | 75.07   | 3.00 | .43   |

BANNER OATS

Tables 9 and 10 show the variations in all the characters studied in the panicles of the variety Banner for the two locations. Extreme variation is again apparent. A greater range is found at Winnipeg, indicating a larger number of branches, whorls and spikelets, and greater branch length at that point. Looking at the totals per panicles, Brandon has an average of 17.44 branches per panicle, the range being from 13 to 25 as compared with Winnipeg where the average is 21.92, the variation being between 13 and 30.

A greater number of spikelets per whorl and per panicle is found in the specimens from Winnipeg. The range is from 23 to 57 per panicle, while at Brandon it is from 17 to 49, resulting in a higher average at Winnipeg: 39.84 as against 25.24.

The branch length for this variety per panicle ranges from 41.8 cms. to 86.3 cms. at Brandon as against 44.8 cms. to 101.1 cms. at Winnipeg. Here, as with the branches and spikelets, greater variation is found in the panicles grown at Winnipeg.

TABLE 9

RANGE IN NUMBER OF BRANCHES, SPIKELETS AND WHORLS, AND IN BRANCH LENGTHS, WITH TOTALS AND AVERAGES, PER 25 PANICLES FOR BANNER OATS GROWN AT BRANDON.

| Branches                | Range   | Total | Average | S.D. |
|-------------------------|---------|-------|---------|------|
| In whorl 1              | 3 - 7   | 138   | 5.52    | 1.18 |
| " " 2                   | 3 - 9   | 126   | 5.04    | 1.56 |
| " " 3                   | 2 - 4   | 73    | 2.92    | .35  |
| " " 4                   | 1 - 3   | 52    | 2.08    | 1.23 |
| " " 5                   | 0 - 2   | 41    | 1.64    | --   |
| " " 6                   | 0 - 2   | 6     | .24     | --   |
| Branches<br>per panicle | 13 - 25 | 436   | 17.44   | 2.71 |
| Whorls<br>per panicle   | 4 - 6   | 124   | 4.96    |      |

| Spikelets                | Range   | Total | Average | S.D. |
|--------------------------|---------|-------|---------|------|
| In whorl 1               | 5 - 23  | 255   | 10.20   | 4.02 |
| " " 2                    | 4 - 14  | 189   | 7.56    | 2.39 |
| " " 3                    | 2 - 5   | 87    | 3.48    | .75  |
| " " 4                    | 1 - 4   | 53    | 2.12    | .54  |
| " " 5                    | 0 - 2   | 41    | 1.64    | --   |
| " " 6                    | 0 - 2   | 6     | .24     | --   |
| Spikelets<br>per panicle | 17 - 49 | 631   | 25.24   | 7.14 |

|                                  |             |          |       |       |
|----------------------------------|-------------|----------|-------|-------|
| Branch<br>length in cms.         | 41.8 - 56.3 | 1,309.10 | 52.36 | 10.81 |
| Average branch<br>length in cms. | 2.41 - 4.04 | 74.95    | 3.00  | .34   |



TABLE 10

RANGE IN NUMBER OF BRANCHES, SPIKELETS AND WHORLS, AND IN  
BRANCH LENGTHS, WITH TOTALS AND AVERAGES, PER 25 PANICLES  
FOR BANNER OATS GROWN AT WINNIPEG.

| Branches                | Range   | Total | Average | S.D. |
|-------------------------|---------|-------|---------|------|
| In whorl 1              | 4 - 10  | 177   | 7.08    | 1.70 |
| " " 2                   | 3 - 9   | 146   | 5.84    | 1.67 |
| " " 3                   | 3 - 6   | 96    | 3.84    | .67  |
| " " 4                   | 1 - 3   | 68    | 2.72    | .53  |
| " " 5                   | 2 - 3   | 51    | 2.04    | --   |
| " " 6                   | 2 - 2   | 10    | .04     | --   |
| Branches<br>per panicle | 13 - 30 | 548   | 21.92   | 4.27 |
| Whorls<br>per panicle   | 4 - 6   | 127   | 5.08    |      |

| Spikelets                | Range   | Total | Average | S.D. |
|--------------------------|---------|-------|---------|------|
| In whorl 1               | 9 - 30  | 414   | 16.56   | 4.83 |
| " " 2                    | 7 - 18  | 303   | 12.12   | 3.46 |
| " " 3                    | 3 - 12  | 144   | 5.76    | 2.03 |
| " " 4                    | 1 - 4   | 74    | 2.96    | .77  |
| " " 5                    | 2 - 3   | 51    | 2.04    | --   |
| " " 6                    | 2 - 2   | 10    | .40     | --   |
| Spikelets<br>per panicle | 23 - 57 | 996   | 39.84   | 9.02 |

|                                  |              |          |       |       |
|----------------------------------|--------------|----------|-------|-------|
| Branch<br>length in cms.         | 44.8 - 101.1 | 1,927.80 | 77.11 | 10.81 |
| Average branch<br>length in cms. | 3.04- 4.30   | 90.83    | 3.63  | .34   |

VIII

DISCUSSION OF THE DIFFERENCE FOUND BETWEEN  
THE SAME VARIETIES AT THE TWO LOCATIONS

While comparison has been made between the results obtained for the two locations, the important facts are, that all characters dealt with are shown to have extreme variations in numbers and measurements. The significance of the difference between the 25 panicles of the same variety from the two locations is indicated in the tables following, 11 - 16 inclusive. Tables 17 - 20 inclusive show the difference between the average number of spikelets per similar branch for the two locations for all varieties.

TABLE 11

THE DIFFERENCE, WITH PROBABLE ERROR, BETWEEN THE AVERAGE NUMBER OF WHORLS PER PANICLE FOR THE FIVE VARIETIES GROWN AT THE TWO LOCATIONS.

| Variety of Oats | Brandon        | Winnipeg       | Difference    |
|-----------------|----------------|----------------|---------------|
| Gopher          | 4.52 $\pm$ .34 | 4.20 $\pm$ .27 | .32 $\pm$ .46 |
| Alaska          | 4.56 $\pm$ .38 | 4.24 $\pm$ .29 | .32 $\pm$ .48 |
| Abundance       | 5.16 $\pm$ .23 | 5.20 $\pm$ .33 | .04 $\pm$ .40 |
| Victory         | 5.56 $\pm$ .34 | 5.52 $\pm$ .34 | .04 $\pm$ .48 |
| Banner          | 4.96 $\pm$ .36 | 5.08 $\pm$ .38 | .12 $\pm$ .52 |

As previously stated under heading "Mathematical Procedure", the significance of a difference between two results, is determined on the basis of the probable errors of the two results obtained. If the difference of the two results obtained is not more than three times greater than its probable error it is not considered significant. In table 11, for the number of whorls per panicle it is shown that the difference between the varieties for the two locations is not significant, as in no instance is the difference more than one and a half times its probable error. Comparing the results for the different varieties, it will be noticed that the two early varieties, Gopher and Alaska, have on the average, four whorls, and the later varieties, Abundance, Victory and Banner, have an average of five whorls per panicle.

TABLE 12

THE DIFFERENCE, WITH PROBABLE ERROR, BETWEEN THE AVERAGE  
NUMBER OF BRANCHES PER PANICLE, FOR THE FIVE VARIETIES  
GROWN AT THE TWO LOCATIONS.

| <u>Variety of Oats</u> | <u>Brandon</u>   | <u>Winnipeg</u>  | <u>Difference</u> |
|------------------------|------------------|------------------|-------------------|
| Gopher                 | 18.28 $\pm$ 1.59 | 15.52 $\pm$ 1.15 | 2.76 $\pm$ 1.96   |
| Alaska                 | 14.02 $\pm$ 1.48 | 15.92 $\pm$ 1.59 | 1.90 $\pm$ 2.17   |
| Abundance              | 17.80 $\pm$ 2.00 | 22.56 $\pm$ 1.53 | 4.76 $\pm$ 2.52   |
| Victory                | 18.88 $\pm$ 2.44 | 20.48 $\pm$ 1.98 | 1.60 $\pm$ 3.14   |
| Banner                 | 17.44 $\pm$ 1.83 | 21.92 $\pm$ 2.88 | 4.48 $\pm$ 3.41   |

The results obtained as shown in table 12 indicate very close similarity in number of branches per panicle in the same variety for both locations. The greatest difference is in the variety Abundance, where it is 4.76, the probable error being 2.52. This difference cannot be considered significant since it is not over three times its probable error. With the exception of Gopher, the larger number of branches is found in the panicles grown at Winnipeg. The difference in the Gopher variety is 2.76 in favor of Brandon. The probable error is 1.96.

TABLE 13

THE DIFFERENCE BETWEEN THE AVERAGE NUMBER OF BRANCHES PER  
SIMILAR WHORL - 1 TO 4 INCLUSIVE; FOR ALL VARIETIES AT BOTH  
LOCATIONS.

WHORL 1

| <u>Variety of Oats</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|------------------------|----------------|-----------------|-------------------|
| Gopher                 | 6.92 ± .78     | 6.92 ± .78      | 0.0 ± 1.10        |
| Alaska                 | 4.92 ± 1.00    | 7.08 ± .97      | 2.16 ± 1.39       |
| Abundance              | 5.76 ± .80     | 7.36 ± .76      | 1.60 ± 1.10       |
| Victory                | 5.60 ± 1.01    | 6.16 ± .74      | .56 ± 1.25        |
| Banner                 | 5.52 ± .80     | 7.08 ± 1.15     | 1.46 ± 1.40       |

WHORL 2

| <u>Variety of Oats</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|------------------------|----------------|-----------------|-------------------|
| Gopher                 | 5.60 ± .80     | 3.92 ± .42      | 1.68 ± .90        |
| Alaska                 | 3.56 ± .69     | 4.04 ± .29      | .48 ± .76         |
| Abundance              | 5.12 ± .86     | 6.72 ± .78      | 1.60 ± 1.16       |
| Victory                | 5.20 ± .94     | 4.72 ± 1.01     | .48 ± 1.37        |
| Banner                 | 5.04 ± 1.05    | 5.84 ± 1.13     | .80 ± 1.54        |

TABLE 13 (Continued)

WHORL 3

| <u>Variety of Oats</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|------------------------|----------------|-----------------|-------------------|
| Gopher                 | 2.64 $\pm$ .42 | 2.32 $\pm$ .32  | .32 $\pm$ .52     |
| Alaska                 | 2.52 $\pm$ .74 | 2.36 $\pm$ .42  | .16 $\pm$ .85     |
| Abundance              | 2.96 $\pm$ .44 | 3.64 $\pm$ .32  | .68 $\pm$ .54     |
| Victory                | 3.12 $\pm$ .19 | 3.68 $\pm$ .43  | .56 $\pm$ .47     |
| Banner                 | 2.92 $\pm$ .24 | 3.84 $\pm$ .45  | .92 $\pm$ .51     |

WHORL 4

| <u>Variety of Oats</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|------------------------|----------------|-----------------|-------------------|
| Gopher                 | 2.08 $\pm$ .42 | 1.96 $\pm$ .13  | .12 $\pm$ .43     |
| Alaska                 | 2.04 $\pm$ .29 | 1.96 $\pm$ .13  | .08 $\pm$ .31     |
| Abundance              | 1.84 $\pm$ .31 | 2.52 $\pm$ .34  | .68 $\pm$ .46     |
| Victory                | 2.08 $\pm$ .57 | 2.80 $\pm$ .27  | .72 $\pm$ .63     |
| Banner                 | 2.08 $\pm$ .82 | 2.72 $\pm$ .36  | .64 $\pm$ .90     |

In table 13 the differences in the number of branches per similar whorl are shown. In whorl 1 the greatest difference is between the variety Alaska grown at the two locations, the difference being 2.16, with a probable error of 1.39. In whorl 2 the variety Gopher shows the greatest difference, namely, 1.68, with a probable error of .90. Abundance shows the second greatest difference or 1.60, with a probable error of 1.16. As with whorls 1 and 2, the differences for whorls 3 and 4 for all varieties are well under their probable errors. It will be noted that the early varieties, Gopher and Alaska, show the greatest average at Brandon. With the late varieties the greatest average number is in the panicles grown at Winnipeg. In all whorls for all varieties between the two locations no significant difference is shown.

TABLE 14

THE DIFFERENCE, WITH PROBABLE ERROR, BETWEEN THE AVERAGE  
NUMBER OF SPIKELETS PER PANICLES FOR THE FIVE VARIETIES  
GROWN AT THE TWO LOCATIONS.

| <u>Variety of Oats</u> | <u>Brandon</u>   | <u>Winnipeg</u>  | <u>Difference</u> |
|------------------------|------------------|------------------|-------------------|
| Gopher                 | 22.40 $\pm$ 1.99 | 18.76 $\pm$ 2.25 | 3.64 $\pm$ 3.00   |
| Alaska                 | 19.28 $\pm$ 5.05 | 22.52 $\pm$ 3.56 | 3.24 $\pm$ 6.18   |
| Abundance              | 23.28 $\pm$ 4.09 | 35.92 $\pm$ 4.49 | 12.64 $\pm$ 6.07  |
| Victory                | 27.28 $\pm$ 4.51 | 34.38 $\pm$ 4.01 | 7.52 $\pm$ 6.03   |
| Banner                 | 25.24 $\pm$ 4.82 | 39.84 $\pm$ 6.08 | 14.60 $\pm$ 7.76  |

The greatest difference in the number of spikelets per panicle for the two locations is found to exist in Abundance and Banner. As shown in table 14, the difference for Abundance is 12.64 and for Banner 14.60. In neither case is the difference considered significant.



TABLE 15

THE DIFFERENCE, WITH PROBABLE ERROR, BETWEEN THE AVERAGE  
NUMBER OF SPIKELETS PER SIMILAR WHORL FOR THE FIVE  
VARIETIES GROWN AT THE TWO LOCATIONS.

WHORL 1

| <u>Variety of Oats</u> | <u>Brandon</u>   | <u>Winnipeg</u>  | <u>Difference</u> |
|------------------------|------------------|------------------|-------------------|
| Gopher                 | 9.76 $\pm$ 1.60  | 9.32 $\pm$ 1.80  | .44 $\pm$ 2.40    |
| Alaska                 | 8.12 $\pm$ 2.21  | 11.92 $\pm$ 2.30 | 3.80 $\pm$ 3.19   |
| Abundance              | 9.40 $\pm$ 1.83  | 15.56 $\pm$ 2.42 | 6.16 $\pm$ 3.03   |
| Victory                | 10.64 $\pm$ 2.56 | 13.08 $\pm$ 2.15 | 2.44 $\pm$ 3.34   |
| Banner                 | 10.20 $\pm$ 2.70 | 16.56 $\pm$ 3.26 | 6.36 $\pm$ 4.22   |

WHORL 2

| <u>Variety of Oats</u> | <u>Brandon</u>  | <u>Winnipeg</u>  | <u>Difference</u> |
|------------------------|-----------------|------------------|-------------------|
| Gopher                 | 6.56 $\pm$ .94  | 4.68 $\pm$ .56   | 1.88 $\pm$ 1.09   |
| Alaska                 | 4.84 $\pm$ 1.41 | 5.72 $\pm$ 1.01  | .88 $\pm$ 1.72    |
| Abundance              | 6.36 $\pm$ 1.28 | 10.44 $\pm$ 1.82 | 4.08 $\pm$ 2.20   |
| Victory                | 7.76 $\pm$ 1.15 | 9.76 $\pm$ 1.77  | 2.0 $\pm$ 2.11    |
| Banner                 | 7.56 $\pm$ 1.61 | 12.12 $\pm$ 2.33 | 4.56 $\pm$ 2.80   |

TABLE 15 (Continued)

WHORL 3

| <u>Variety of Oats</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|------------------------|----------------|-----------------|-------------------|
| Gopher                 | 2.88 ± .47     | 2.40 ± .38      | .48 ± .60         |
| Alaska                 | 3.04 ± 1.07    | 2.44 ± .51      | .60 ± 1.18        |
| Abundance              | 3.64 ± .53     | 4.96 ± 1.08     | 1.32 ± 1.20       |
| Victory                | 3.84 ± .57     | 5.68 ± .91      | 1.84 ± 1.07       |
| Banner                 | 3.48 ± .51     | 5.76 ± 1.37     | 2.28 ± 1.46       |

WHORL 4

| <u>Variety of Oats</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|------------------------|----------------|-----------------|-------------------|
| Gopher                 | 2.16 ± .53     | 1.96 ± .13      | .20 ± .54         |
| Alaska                 | 2.04 ± .30     | 1.96 ± .41      | .08 ± .51         |
| Abundance              | 1.84 ± .30     | 2.64 ± .50      | .80 ± .58         |
| Victory                | 2.16 ± .49     | 3.16 ± .53      | 1.0 ± .52         |
| Banner                 | 2.12 ± .36     | 2.96 ± .52      | .84 ± .63         |

Table 15 shows that the greatest difference for whorl 1 is in the variety Abundance. The average for Winnipeg is 15.56 spikelets as against 9.40 for Brandon, or a difference of 6.16, the probable error being 3.03. The difference, therefore, is obviously not significant. In whorl 2 Banner shows the greatest difference, which is 4.56, and Abundance next with 4.08. In both these varieties the difference is again small and consequently not significant. In whorls 3 and 4 the differences for all varieties at both locations are also less than three times their probable errors.

TABLE 16

THE DIFFERENCE, WITH PROBABLE ERROR, BETWEEN THE AVERAGE TOTAL BRANCH LENGTH PER PANICLE FOR THE FIVE VARIETIES GROWN AT THE TWO LOCATIONS.

(a)

| Variety of Oats | Brandon          | Winnipeg          | Difference        |
|-----------------|------------------|-------------------|-------------------|
| Gopher          | 44.50 $\pm$ 4.50 | 39.23 $\pm$ 4.10  | 5.27 $\pm$ 6.08   |
| Alaska          | 40.80 $\pm$ 8.30 | 37.74 $\pm$ 4.74  | 3.06 $\pm$ 9.60   |
| Abundance       | 47.96 $\pm$ 6.80 | 77.5 $\pm$ 8.63   | 29.54 $\pm$ 10.98 |
| Victory         | 49.96 $\pm$ 8.73 | 61.33 $\pm$ 9.35  | 11.37 $\pm$ 12.78 |
| Banner          | 52.36 $\pm$ 7.29 | 77.11 $\pm$ 10.51 | 24.75 $\pm$ 12.80 |

AVERAGE BRANCH LENGTH PER PANICLE WITH DIFFERENCE AND PROBABLE ERROR.

(b)

| Variety of Oats | Brandon        | Winnipeg       | Difference    |
|-----------------|----------------|----------------|---------------|
| Gopher          | 2.44 $\pm$ .15 | 2.53 $\pm$ .17 | .09 $\pm$ .22 |
| Alaska          | 2.87 $\pm$ .24 | 2.37 $\pm$ .12 | .50 $\pm$ .27 |
| Abundance       | 2.69 $\pm$ .20 | 3.38 $\pm$ .23 | .69 $\pm$ .30 |
| Victory         | 2.67 $\pm$ .25 | 3.00 $\pm$ .29 | .33 $\pm$ .38 |
| Banner          | 3.00 $\pm$ .23 | 3.63 $\pm$ .23 | .63 $\pm$ .32 |

As with the number of branches, the variety Abundance shows the greatest difference in average total branch length for all panicles, and also the highest average length per panicle. The difference in the averages for the total length per panicle is 29.54, or a little under three times its probable error, which is 10.98. It will be noted that a greater difference was found in the late maturing varieties than in the early varieties. The large difference in the variety Abundance for average total branch may be due, as was suggested before, to it being more easily influenced by changes in weather and soil conditions. The greatest average total length, which was 77.5, was to be expected at Winnipeg where the more ideal growing conditions prevailed.

TABLE 17

THE DIFFERENCE BETWEEN THE AVERAGE NUMBER OF SPIKELETS PER  
SIMILAR BRANCH IN WHORL 1 FOR THE FIVE VARIETIES AT THE TWO  
LOCATIONS.

| <u>Variety</u> | <u>Branch</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|----------------|---------------|----------------|-----------------|-------------------|
| Gopher         | a             | 1.00           | 1.00            | 0                 |
|                | b             | 1.00           | 1.00            | 0                 |
|                | c             | 1.08           | 1.08            | 0                 |
|                | d             | 1.18           | 1.20            | .04               |
|                | e             | 1.54           | 1.52            | .02               |
|                | f             | 1.95           | 1.61            | .34               |
|                | g             | 2.22           | 1.85            | .37               |
|                | h             | 2.14           | 2.13            | .01               |
| Alaska         | a             | 1.16           | 1.00            | .16               |
|                | b             | 1.28           | 1.00            | .28               |
|                | c             | 1.64           | 1.20            | .44               |
|                | d             | 1.82           | 1.60            | .22               |
|                | e             | 2.15           | 2.16            | .01               |
|                | f             | 2.75           | 2.00            | .75               |
|                | g             | 2.33           | 2.56            | .23               |
|                | h             | 2.50           | 2.70            | .20               |

WHORL 1 (Continued)

| <u>Variety</u> | <u>Branch</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|----------------|---------------|----------------|-----------------|-------------------|
| Abundance      | a             | 1.04           | 1.00            | .04               |
|                | b             | 1.12           | 1.04            | .08               |
|                | c             | 1.32           | 1.16            | .16               |
|                | d             | 1.83           | 1.84            | .01               |
|                | e             | 2.04           | 2.20            | .16               |
|                | f             | 2.62           | 3.21            | .59               |
|                | g             | 2.29           | 3.62            | 1.33              |
|                | h             | 4.00           | 3.55            | .45               |

|         |   |      |      |      |
|---------|---|------|------|------|
| Victory | a | 1.08 | 1.00 | .08  |
|         | b | 1.20 | 1.20 | .00  |
|         | c | 1.52 | 1.50 | .02  |
|         | d | 2.00 | 2.08 | .08  |
|         | e | 2.58 | 1.52 | .06  |
|         | f | 3.09 | 2.56 | .53  |
|         | g | 3.50 | 1.88 | 1.62 |
|         | h | 3.50 | 4.00 | .50  |

WHOHL 1 (Continued)

| <u>Variety</u> | <u>Branch</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|----------------|---------------|----------------|-----------------|-------------------|
| Banner         | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.16           | 1.16            | .00               |
|                | c             | 1.52           | 1.52            | .00               |
|                | d             | 2.04           | 2.04            | .00               |
|                | e             | 2.55           | 2.45            | .10               |
|                | f             | 3.20           | 3.30            | .10               |
|                | g             | 3.40           | 3.68            | .28               |



TABLE 18

WHORL 2

| <u>Variety</u> | <u>Branch</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|----------------|---------------|----------------|-----------------|-------------------|
| Gopher         | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.00           | 1.00            | .00               |
|                | c             | 1.12           | 1.28            | .16               |
|                | d             | 1.24           | 1.66            | .42               |
|                | e             | 1.04           | 1.25            | .21               |
| <hr/>          |               |                |                 |                   |
| Alaska         | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.12           | 1.04            | .08               |
|                | c             | 1.43           | 1.24            | .19               |
|                | d             | 2.31           | 1.96            | .45               |
|                | e             | 1.66           | 4.00            | 2.34              |
| <hr/>          |               |                |                 |                   |
| Abundance      | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.00           | 1.00            | .00               |
|                | c             | 1.12           | 1.80            | .68               |
|                | d             | 1.36           | 1.40            | .04               |
|                | e             | 1.60           | 1.78            | .18               |
|                | f             | 1.77           | 1.95            | .18               |
|                | g             | 2.00           | 3.00            | 1.00              |

WHORL 2 (Continued)

| <u>Variety</u> | <u>Branch</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|----------------|---------------|----------------|-----------------|-------------------|
| Victory        | a             | 1.00           | 1.12            | .12               |
|                | b             | 1.12           | 1.28            | .16               |
|                | c             | 1.40           | 2.13            | .73               |
|                | d             | 1.95           | 2.90            | .95               |
|                | e             | 1.94           | 3.00            | 1.06              |
|                | f             | 1.88           | 3.28            | 1.40              |
|                | g             | 2.00           | 4.00            | 2.00              |
|                | h             | 2.00           | 3.50            | 1.50              |

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|        |   |      |      |      |
|--------|---|------|------|------|
| Banner | a | 1.04 | 1.00 | .04  |
|        | b | 1.12 | 1.16 | .04  |
|        | c | 1.44 | 1.60 | .16  |
|        | d | 2.18 | 2.93 | .75  |
|        | e | 1.36 | 3.25 | 1.89 |
|        | f | 1.60 | 3.15 | 1.55 |
|        | g | 2.60 | 3.37 | .77  |
|        | h | 2.00 | 3.80 | 1.80 |
|        | i | 4.00 | 4.00 | .00  |

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TABLE 19

WHORL 3

| <u>Variety</u> | <u>Branch</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|----------------|---------------|----------------|-----------------|-------------------|
| Gopher         | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.00           | 1.04            | .04               |
|                | c             | 1.43           | 1.13            | .30               |
|                | d             | 1.00           | .00             | 1.00              |
| Alaska         | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.05           | 1.00            | .05               |
|                | c             | 1.64           | 1.18            | .46               |
|                | d             | 1.50           | .00             | 1.50              |
|                | e             | 2.00           | .00             | 2.00              |
|                | f             | 2.00           | .00             | 2.00              |
| Abundance      | a             | 1.04           | 1.00            | .04               |
|                | b             | 1.04           | 1.00            | .04               |
|                | c             | 1.26           | 1.24            | .02               |
|                | d             | 1.30           | 2.68            | 1.38              |
|                | e             | 1.00           | .00             | 1.00              |

WHOLE 3 (Continued)

| <u>Variety</u> | <u>Branch</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|----------------|---------------|----------------|-----------------|-------------------|
| Victory        | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.00           | 1.08            | .08               |
|                | c             | 1.68           | 1.71            | .03               |
|                | d             | 2.66           | 3.06            | .40               |
| <hr/>          |               |                |                 |                   |
| Banner         | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.00           | 1.00            | .00               |
|                | c             | 1.68           | 1.52            | .16               |
|                | d             | 2.00           | 1.84            | .16               |
| <hr/>          |               |                |                 |                   |

TABLE 20

WHORL 4

| <u>Variety</u> | <u>Branch</u> | <u>Brandon</u> | <u>Winnipeg</u> | <u>Difference</u> |
|----------------|---------------|----------------|-----------------|-------------------|
| Copher         | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.40           | 0.96            | .44               |
|                | c             | 1.00           | .00             | 1.00              |
|                | d             | 2.00           | .00             | 2.00              |
| <hr/>          |               |                |                 |                   |
| Alaska         | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.00           | 1.00            | .00               |
|                | c             | 1.00           | .00             | 1.00              |
| <hr/>          |               |                |                 |                   |
| Abundance      | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.00           | 1.00            | .00               |
|                | c             | 1.00           | 1.23            | .23               |
| <hr/>          |               |                |                 |                   |
| Victory        | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.00           | 1.00            | .00               |
|                | c             | 1.40           | 1.02            | .38               |
| <hr/>          |               |                |                 |                   |
| Banner         | a             | 1.00           | 1.00            | .00               |
|                | b             | 1.00           | 1.00            | .00               |
|                | c             | 1.33           | 1.31            | .02               |
| <hr/>          |               |                |                 |                   |

IX      DIFFERENCE IN AVERAGE NUMBER OF SPIKELETS  
ON SIMILAR BRANCHES FOR ALL VARIETIES.  
(RESULTS FOUND IN TABLES 17 - 20 INCLUSIVE)

Tables 17 - 20 inclusive show the difference in the average number of spikelets per similar branch in whorls 1, 2, 3 and 4 for all varieties at both locations. With few exceptions the difference is very small.

X

## SUMMARY

### NATURE OF THE PROBLEM

The objective was to find, if possible, one or more morphological characters within the panicles of the varieties of oats used, which, if constant, would be a means for identification of the varieties to which they belonged.

### MATERIAL

Twenty-five panicles of each of five varieties were used. Selection was made at random from pure strains growing at the College Farm, Winnipeg, and the Experimental Farm, Brandon. The varieties were: Gopher, Alaska, Abundance, Victory and Banner.

### CHARACTERS DEALT WITH

The characters dealt with were as follows:

- (a) Number of branches per similar whorl.
- (b) " " " " " panicle.
- (c) " " whorls " " "
- (d) " " spikelets per similar whorl.
- (e) " " " " " panicle.

- (f) Average total branch length per panicle.
- (g) Average branch length per panicle.

#### METHOD OF WORK

The branches were counted, and measured, and tabulated according to length, and designated on the work sheets, a, b, c, etc. Starting with the shortest and ending with the longest all branches were measured and counted for each whorl separately. The spikelets were counted and listed in the same order as the branches. The work sheets, 250 in all, were summarized into 10 tables showing complete data for all the panicles of the five varieties. These tables were further condensed in tables 1 to 10 as outlined in this study, on the basis of averages and range of variation in the characters dealt with.

#### METEOROLOGICAL DATA

In order to know what the growing conditions were at both locations where the varieties were grown, meteorological data were obtained showing the differences in temperature, rainfall and evaporation for April to August inclusive.



### COMPARISON OF RESULTS FROM BOTH LOCATIONS

The significance of the difference of the results between the two locations for the same variety is shown in tables 11 to 16 inclusive. The significance is determined on the basis of the probable errors of the two results obtained.

### RESULTS OBTAINED

All characters studied were found widely variable. The most extreme variation was found in the number of branches and spikelets and in branch length. The number of whorls appeared to vary less than the other characters dealt with.

Some difference was found between all characters in the same variety for the two locations. As shown in the foregoing tables 11 to 16, the differences were not significant and are therefore considered to be due to random sampling and unlike environments. There do not appear to be any outstanding differences between the different varieties growing at the same location.

XI

CONCLUSION

Considering the many morphological and physiological characters studied by investigators, all of which appear to be variable, as is the case with characters dealt with in this study, it seems highly improbable that any characters will be found constant and therefore valuable for variety identification.

The identification of varieties similar in panicle structure, will likely continue to depend, to a very great extent, on knowledge regarding the pure strains of elite stock from which they are derived.

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