4. "A Note on Rice Breeding." Chas. E. Chambliss, Department of Agriculture, Washington, D. C.

5. "Field Methods in Wheat Breeding." M. A. Carleton, Department of Agriculture, Washington, D. C.

Respectfully submitted,

C. A. ZAVITZ, *Chairman.*

FOUNDATION STOCK IN PLANT BREEDING.

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Dr. Hugo DeVries of Holland, after visiting Luther Burbank in California, wrote an account of his observations, in which the following statements were made:

"Hybrids do not present, as a rule, any new simple qualities, only new combinations of already existing properties. As a general rule, it holds true that the results of crossing depend primarily on the selection of varieties used for that purpose. These indicate the list of possibilities from which the choice of the combinations have later to be made."

It is undoubtedly true that if we can expect to get the best results from work in hybridization, we must take the greatest of care in securing our foundation stock. It seems to me that one of the very first things which needs to be studied in connection with plant improvement, whether it be conducted on the farm or at an experiment station, is the study of existing varieties of nearly all classes of crops, many of which vary considerably in different characteristics. After carefully watching the crop production of the Province of Ontario and closely observing the experimental work at the Ontario Agricultural College for the last twenty-three years, where we have carefully tested each of two thousand varieties of farm crops for at least five years, the writer is thoroughly convinced that the selection of proper varieties is a question of great importance in the improvement of farm crops, whether of a scientific or of a practical nature. Some varieties are particularly desirable, owing to the fact that they usually produce very heavy yields per acre, while others are desirable, owing to the fact that they are exceptionally early in maturing. Some varieties of grain produce long straw, while other varieties produce straw which is very short in its growth. Certain varieties seem very susceptible to the attacks of smut or rust, while others are almost immune. There are also great variations in the quality of the grain, in the strength of straw, and in many other respects.

DIFFERENCES OF VARIETIES IN YIELD OF GRAIN.

In order, for instance, to show more clearly some of the differences in varieties in regard to yield of grain per acre, the average results from growing a few different kinds of grain throughout long periods, varying from thirteen to nineteen years, are here presented.

CLASSES.	NUMBER OF YEARS.	VARIETIES.	AVERAGE YIELD PER ACRE. (Bushels.)
Oats	19	Joanette	87.7
		Siberian	87.3
		Egyptian	75.6
		Black Tartarian	71.8
Barley	19	Mandscheuri	71.2
		Oderbrucker	64.6
		Mensury	60.0
		New Zealand Chevalier	58.3
Winter Wheat	13	Dawson's Golden Chaff	55.4
		Imperial Amber	51.2
		Turkey Red	45.5
		Treadwell	44.8
Spring Wheat (Flour)	19	Saxonka	31.0
		Red Fife	30.7
		Colorado	27.9
Spring Wheat (Durum or macaroni)	16	Wild Goose	38.4
		Medeah	34.3
		Ontario	23.5
Potatoes	19	Empire State	225.5
		White Elephant	203.6
		Rural New Yorker No. 2	203.4
		Stray Beauty	161.5

It will be seen from the results here presented that there is a marked difference in the average results of the different varieties. As it has always been our policy to drop the poorest varieties after they have been tested for a period of five years, it will be understood that the differences given in the table here presented are not nearly as great as many of those secured by the longer lists of varieties which have been grown for a shorter period of time. The figures here presented, however, show quite clearly that some varieties are apt to produce much more heavily than others, when grown under similar conditions from year to year. For instance, there is an average annual increase in yield per acre of 15½ bushels from the Siberian over the Black Tartarian variety of oats, of

11.1 bushels from the Mandscheuri over the Mensury variety of six-rowed barley, of 10.6 bushels from the Dawson's Golden Chaff over the Treadwell variety of winter wheat, of 3.1 bushels of the Saxonka over the Colorado variety of spring rye, of 14.9 bushels of the Wild Goose over the Ontario variety of durum wheat, and of 64 bushels from the Empire State over the Stray Beauty variety of potatoes.

It is important to note, that although the different varieties of oats, barley, wheat, and potatoes have been grown in the Experimental Department at the College for from thirteen to nineteen years in succession, the average yield per acre for the last few years is considerably greater than the average yield per acre for the first few years of the whole period in case of each of the varieties under experiment. As there was no change of seed from one farm to another during this length of time, it shows that it is quite possible to grow these crops for a considerable length of time without the introduction of fresh seed from other localities, providing proper care is exercised each year in the quality of the seed used.

DIFFERENCES OF VARIETIES IN THEIR SUSCEPTIBILITY TO SMUT.

At one time, the writer considered that variety exerted but slight influence in regard to the amount of injury caused by the loose smut in oats or the stinking smut in wheat. From recent observations, however, it seems very evident that some varieties are decidedly more susceptible than others to the attacks of smut. During the year 1902, 1903, 1904 and 1905, we did not treat our varieties of oats for smut, but carefully picked out all smutted heads each year and kept an accurate record of the amounts of smut produced in the different varieties. The results are very striking. The following gives the number of smutted heads taken from a plot 10 links wide and 100 links long from different varieties of oats in each of the years mentioned above.

VARIETY.	1902.	1903.	1904.	1905.
Early Ripe	—	—	3	—
Joanette	20	9	10	18
Siberian	32	43	78	20
American Banner	116	303	317	22
Black Tartarian	332	608	369	62
Early Champion	634	380	1244	166

The foregoing table shows a wonderful influence in the comparative amounts of smut produced by the different varieties of oats. It is

quite probable that the Early Ripe is entirely immune to the attacks of this fungus. It is true that there were three smut heads found in the plot in 1904, but when it is considered that about 17,000 grains of oats were sown in each plot, it is quite likely that the three smutted heads were all from one plant produced from a seed of some other variety, which, by means of manure or in some other way, got into the plot. Taking advantage of the apparent immunity of the Early Ripe oats to the attacks to smut, we have now about one hundred and eighty crosses between this variety and the American Banner. The Early Ripe variety is the earliest oat amongst some two hundred and fifty varieties which we have grown in the experimental grounds, but the grain is long and slender, giving a light weight per measured bushel. If we can secure a hybrid possessing the good qualities of the American Banner with the earliness and immunity to smut of the Early Ripe, it will prove of exceedingly great value.

DIFFERENCES IN THE PERCENTAGES OF HULLS IN OATS.

The percentages of the hulls of oats of different varieties are much greater and more constant than we often realize. As the comparative amount of hull has a very marked influence on the quality of the grain of oats, it forms a subject for careful consideration from a breeder's standpoint, as well as that of the farmers. The figures which follow represent the percentage of hull of each of four different varieties of oats in each of six years and illustrate these variations to which reference has been made.

Varieties	1902	1903	1904	1905	1906	1907	Average 6 Years
Joanette	22.5	23.1	22.5	24.0	25.2	23.4	23.5
Daubeney	26.1	25.1	23.0	26.3	26.3	24.7	25.3
Early Dawson	32.6	33.7	32.4	36.0	38.1	33.7	34.4
Pioneer	48.1	36.8	36.9	36.8	42.8	38.8	40.0

From these results it will be seen that there is an average difference in percentage of hull of 16.5 per cent. between the Joanette and the Pioneer varieties of oats. It will also be observed that in every year the difference in the percentage of hull was large.

Much more could be said regarding other characteristics of different varieties of cereals, but enough has already been presented to show the very great importance of making a most thorough and comprehensive study of existing varieties of cereals as a basis for work in the improvement of plants through systematic selection and throgh cross-fertilization.

With our increased knowledge in plant breeding through the labors of Gregor Mendel, Dr. DeVries, Dr. Nilsson, Professor Bateson, and many others, there may be a danger of too great a desire to get results in the shortest possible time without a proper knowledge of the material already at hand, and of the needs of the agricultural constituents for whom we are laboring. I firmly believe that there was never a time in which the outlook for the work in plant breeding was as promising as it is at present. It is to be hoped that the committee on cereal breeding may draw particular attention to the foundation material of the work, as well as to the scientific principles relating to heredity and its influence on future generations.

PROGRESS IN CEREAL BREEDING AT THE OHIO EXPERIMENT STATION.

C. G. WILLIAMS, *Wooster, Ohio.*

In my report of progress I shall confine my remarks to two field crops, viz: corn and wheat.

Taking up corn first, let me call your attention to an ear-row test of 25 ears of a variety of yellow dent corn, known as Clarage, made in the year 1905.

This test was conducted in duplicate, with check rows every sixth row, in the manner described in the annual report of the American Breeders' Association, Vol. III, page 111. The usual variation in yield was found and is indicated by the comparative height of the columns on Chart I (see Chart I, upper series). Only one-half of the ears tested are represented on the chart, but these include the extremes, in so far as yield is concerned. You will note that ears 9, 13, 11 and 7, in the order given, are the highest yielding ears of this test.

In our corn breeding work we retain a portion of each ear tested that we may later use those ears which demonstrate their superiority free from admixture with the less valuable ears of the test. Accordingly, the following year (1906) crosses were made in an isolated breeding plot of ear 9 upon ears 13, 11 and 7, planting the ear used as sire (9) upon alternate rows throughout the small plot. The ears 13, 11 and 7 were planted separately, an ear to a row, alternating with the sire rows. No plants being allowed to mature pollen save those grown from ear 9, we were thus able to grow four distinct strains in one breeding plot, viz: 13 by 9, 11 by 9, 7 by 9, and an inbred strain 9 by 9 on the sire rows.

In 1907 these pedigreed strains descended from the best ears of the