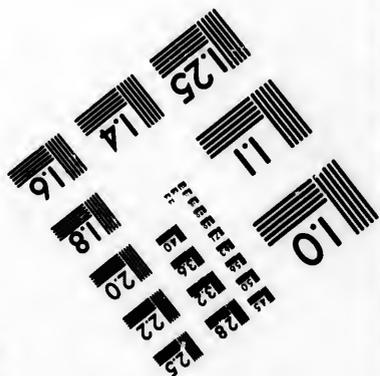
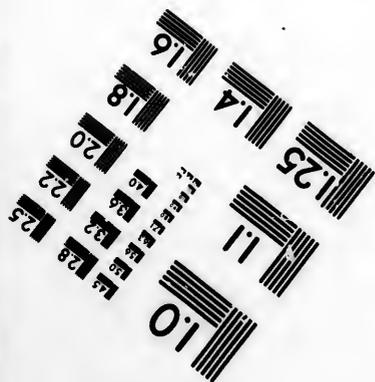
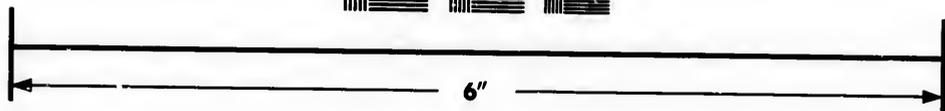
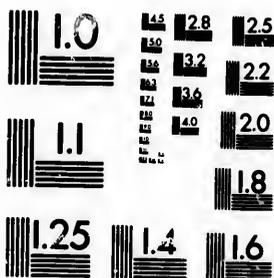


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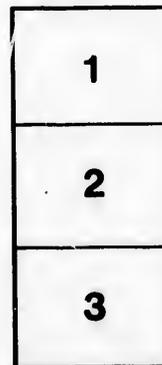
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IX. — *Note on the Progress of Experiments in Cross-fertilizing at the Experimental Farms.*

By WM. SAUNDERS, F.L.S., F.C.S., Director Experimental Farms.

(Read May 25, 1894.)

At the meeting of the Royal Society of Canada held in May, 1883, I presented a paper on "The Influence of Sex on Hybrids among Fruits," in which reference was made to some cross-bred or hybrid raspberries, crosses between a variety known as Philadelphia, an improved form of *Rubus strigosus*, female, and the Doolittle Black Cap, a cultivated variety of *Rubus occidentalis*, male. From this cross a number of seedlings were obtained which showed distinct evidence, both in the habit of the plants and the character of the fruit, of the influence of both parents on the progeny. I also referred at that time to similar evidence which had been obtained from cross-bred grapes and gooseberries.

Since the establishment of the experimental farms, further and more extended work has been carried on in this direction, and during the past five years many cross-bred varieties of cereals have been produced and some which appear to be true hybrids. Further interesting crosses and hybrids have also been produced among fruits.

In May, 1888, I called the attention of this Society to the efforts which were being made, through the agency of the experimental farms, to introduce early ripening varieties of cereals from other countries, and to the progress being made in that direction, notably with the Ladoga wheat, a variety of grain which had been imported from the northern part of Russia. During the past six years that variety of wheat has been tested under many different climatic conditions, and it has been found to retain everywhere in this country its early ripening habit, maturing a week or more earlier than Red Fife sown at the same date. As the result of a number of careful tests, it has been found that bread made from the flour of this wheat is yellower and somewhat darker in colour than that prepared from the flour of Red Fife wheat. For this reason the Ladoga is not to be recommended as a variety to be grown on a large scale for commercial purposes; it occupies, however, a useful place in those districts in the Canadian Northwest where the season is not usually long enough to mature the Red Fife. Good Ladoga is much better than badly frosted Red Fife. The Ladoga wheat has also been found useful as a basis for cross-fertilizing.

Another source from whence early ripening varieties of grain have been obtained is India, where, through the kindness of Lord Dufferin, late viceroy, a number of different sorts were collected and forwarded to Canada for test on the experimental farms. These cereals were obtained at different altitudes in the Himalaya Mountains, from 420 to 11,000 feet. All the Indian varieties tested have proven early in ripening, and two of the most promising of the wheats, known under the names of Hard Red Calcutta and Gehun, have

ripened as early as or earlier than the Ladoga; but, in common with all the other varieties tested from India, they have been found lacking in vigour and productiveness.

The chief purpose in view in continuing cross-breeding experiments on grain has been to produce in the cross-bred examples a combination of the good qualities of the parents, to obtain early ripening varieties of the highest quality, vigorous in growth and productive. In the endeavour to attain these desirable ends the Red Fife has been crossed with the Ladoga and the Indian varieties. While most of the crosses thus obtained are earlier than Red Fife, the advantage in earliness does not appear to be so great in these new sorts as it is in the Ladoga or the Indian wheats. The experience had with these cross-bred varieties is not yet sufficient to admit of positive statements; it would appear, however, that the average gain in point of earliness will probably be about five or six days. It has been shown that by infusing Red Fife blood into the Indian wheats the crosses become much more vigorous and productive.

The Red Fife is a beardless wheat and the Ladoga a bearded variety. Some of the progeny from this cross have been bearded like the Ladoga, while others have been beardless like the Red Fife. One of the most promising crosses between these two varieties has been named Alpha, and it is beardless. Another promising cross between the Ladoga female and the White Fife male (which, like the Red Fife, is beardless) has been named Stanley. A number of other promising sorts have been obtained by crossing the Red Fife with the Indian varieties, notably with those known as Hard Red Calcutta and Gehun.

The Stanley wheat is a beardless sport from a strongly bearded form. The cross was effected in 1888, and the resulting kernel sown in the spring of 1889. This produced a plant with several heads of bearded wheat. The kernels of these bearded heads sown in 1890 sported to such an extent that more than one-half of the plants produced heads which were almost or entirely beardless. These beardless heads were selected and sown separately in 1891, when they sported again to some extent back to bearded forms. The beardless heads were again selected, and from 5 lbs. 1½ oz. of grain sown in 1892 one hundred and thirty pounds were produced. From this stock the branch experimental farms were supplied, and in 1893 the beardless sports were comparatively few, and it is believed that this variety is now fairly well fixed in type.

Where a bearded wheat has been used as the female, a large proportion of the crosses have been bearded. Usually with the second sowing, both the bearded and beardless sorts sport, the beardless varieties commonly producing bearded sports, while the bearded sorts more rarely produce beardless sports. The bearded varieties will vary in the length and stiffness of the beards, and many of them vary in the colour of the chaff and also as to its smooth or downy character.

In a cross between Red Fife, male, and an Indian wheat known as Spiti Valley, female, both beardless, several distinctly bearded sorts were produced in the second generation. Any of these forms may be made permanent by persistent selection. About 400 new forms of wheat in all have been produced at the experimental farms during the past five years, and there are still under test 227 varieties.

Some success has also been had in crossing winter wheats with spring wheats. These are included in the number of crosses mentioned.

In crossing varieties of barley very distinct hybrids have been produced between the two-rowed barley (*Hordeum distichon*) and the six-rowed (*Hordeum hexastichon*). These ap-

pear to be ancient types and they are both regarded as distinct species. The six-rowed type has been found, according to De Candolle, "in the earlier Egyptian monuments and in the remains of the lake dwellings of Switzerland." The same author states that "the two-rowed barley has been found wild in western Asia, and that the lake-dwellers of eastern Switzerland cultivated it before they possessed metals, but the six-rowed was more common among them."

In the two-rowed barley the additional rows found on the six-rowed form are represented by chaffy scales lying flat on the face of the head. In the hybrids produced by using the two-rowed as female and the six-rowed as male, these chaffy scales, the first season are nearly all filled, but the kernels are much smaller, thinner and lighter than those which occupy the normal position on either side of the head. They have also a peculiar twist in them at each end. While the larger number of plants grown from both these forms of kernels have produced two-rowed heads, many six-rowed sorts have occurred among them some of which are proving very prolific. One variety which has been named Summit, grown from one of the plump kernels, produced the first year from the single kernel 4,529 kernels and the second year the crop was 28 lbs. The kernels in this variety have thus far been irregular in size which is a disadvantage. One acre has been sown with this barley on the Central Experimental Farm this year; it is also being further tested on the several branch experimental farms. Another promising sort named Surprise, produced 2,274 kernels from the single kernel planted the first year, and 15½ lbs. of grain as the result of the second sowing. From the large number of new varieties of barley produced, many of the less promising sorts have been discarded, while other new forms have developed as sports. There are still 79 of these recent productions in barley under test.

Many attempts have been made to cross wheat and rye without success until 1892 when my assistant in this work Mr. W. T. Macoun, succeeded in effecting a cross, using a variety of winter wheat as female, and winter rye as the male. The resulting kernel was sown in September, 1892, and although it was a wheat kernel which was sown, the plant when young had the purplish appearance of rye and the heads at the time of spearing, had stripes of purple on the spikelets as in rye, and in other respects closely resembled rye. Nineteen heads in all were produced but as there was not a single kernel formed in any one of them it is probable that the flowers were imperfect.

PEASE.—About 175 crosses have been made in this group and some very promising and prolific forms originated particularly among the crosses of 1892. From one of these between a variety known as Multiplier female and the Mummy pea as male the single pea produced a crop of 185 pods containing 840 peas. Another example of the same cross has a record of 146 pods containing 730 peas. A third, a cross between the Black-eyed Marrowfat, female, and the Mummy as male, gave a yield of 165 pods, containing 675 peas while many others gave a return of from 500 to 600 fold. A large number of the less promising of these crosses were discarded during the summer of 1893, but eighty-three of them have been preserved all of which are being grown again side by side this year, for further comparative test.

OATS.—Some experiments have also been made with oats, with the object of bringing about increased earliness and productiveness, stiffness of straw, plumpness of grain and thinness of hull. All the less promising sorts have been discarded, but 15 varieties have been preserved for further trial.

In fruits also many additional varieties have been obtained, both by cross-fertilization and selection. Useful varieties of gooseberries have been raised. Many new sorts of raspberries have been produced by crossing some of the leading varieties in cultivation, particularly the Cuthbert, a large red raspberry, as female, with a large black cap known as the Gregg as male. The progeny are all purple caps of large size, and some of them are very prolific.

Probably the most interesting of all the new crosses are the hybrids which have been obtained between the black currant *Ribes nigrum* as female and the white variety of the red currant *Ribes rubrum* as male, also the black currant as female with the gooseberry *Ribes grossularia* as male. Many of these hybrids show the gooseberry and white currant blood very distinctly in their foliage and also in their flowers. Most of those which partake of the gooseberry and white currant types, although raised from seed of the black currant, have entirely lost in their foliage the strong and characteristic odour of the black currant. In two instances only in this class have I been able to detect this odour, and in both of these it is faint. The gooseberry and white currant blood in these hybrids is also recognized by insects and parasitic plants. The gooseberry saw-fly *Nematus ventricosus*, which avoids the black currant, feeds freely on these hybrids, and the mildew *Sphaerotheca mors-aeae*, which attacks the foliage of the gooseberry but does not affect the black currant, thrives on the hybrids. The flower clusters are intermediate in character between the parents, and usually have from three to five and in some instances as many as seven and eight in a bunch, thus resembling the black currant. No thorns have in any instance been found on the wood. Notwithstanding that flowers have been produced on many of the bushes in abundance during the past season, and careful examination has failed to detect any defect in the sexual organs or the pollen, none of the fruit has set.

Several hybrids have also been obtained between one of the cultivated red raspberries *Rubus strigosus*, known as Marlboro, female, and an improved form of the blackberry *Rubus villosus*, known as Agawan, male. One of these will probably fruit in 1895.

