

the plumpest kernels. That year rust attacked the crops so badly that the seed obtained from these very plump kernels was so much inferior in size and weight to the average grain used at the start that it was considered unfit for sowing. This work was begun again on the same line three years ago, but failed to give the good results anticipated. It is being again tried this year. While I have always been a strong advocate of the use of plump and well-ripened seed, especially when selected from strong plants, and believe that, as a rule, such seed will give larger crops than samples of lighter weight, provided the season is favorable, the result, however, does not always turn out thus.

In the experiments reported by Mr. Zavitz, in the report of the Ontario Agricultural College for 1898, on the "Selection of seed oats for six years in succession," we find the crops recorded as follows: Beginning with 45.7 bushels in 1893, an increase was had to 67.3 in 1894. The results of 1895 are not recorded, but in 1896 the crop fell to 43.4—less than it was at the beginning. In 1897 it rose to 53.4, but was still 14 bushels less per acre than it was three years before, showing that no regular or uniform increase can be depended on. In 1898, however, the difference in favor of the plump seed was more than six bushels per acre.

In another series of experiments with large, plump oats, as compared with medium-sized oats, the medium-sized oats, in 1896, gave heavier kernels than the large, plump, selected seed. In 1895 the difference was only $\frac{1}{2}$ per cent. in favor of the plump seed; in 1897 it was only $\frac{1}{2}$ per cent., and in 1898, 1 per cent. In these experiments, Mr. Zavitz gives the number of kernels in an ounce of each crop, but does not give the bushels per acre. These results show that an addition of from 20 to 30 per cent., as claimed by the Commissioner as a possible and permanent increase in crop by persistent selection of grain, is exceedingly doubtful.

While commending what I believe to be good in the statement of the Commissioner, I endeavored to point out what I thought was erroneous and contrary to experience.

Effect of barnyard manure on a grain crop.—Under the paragraph on page 289 of the FARMER'S ADVOCATE, headed, "Two Great Principles Explained," he said: "The conditions which make for the increase in the size of the root, stems and leaves do not make for an increase in the grains, fruits and seeds." I showed that this idea was not a new one; a similar idea was advanced by Prof. J. C. Arthur, of Purdue, Indiana, a well-known botanist, in a paper read by him, in 1893, before the Society for the Promotion of Agricultural Science, at a meeting held in Madison, Wisconsin. I was present at that meeting and took part in the discussion of this paper. In the application of this principle, however, to the growth of crops, Prof. Arthur took different grounds from that now taken by the Commissioner. Prof. Arthur pointed out that the crops of grain were increased by the use of barnyard manure, but held that the increase in straw was relatively greater when manure was used. Prof. Arthur said: "Extensive farming will give a better return in all crops grown for fodder, or for the roots or other portions of the vegetative part of the plants, than in those grown for grain and fruit." In illustrating the working of this principle, the Commissioner instanced the growth of a bunch of oats on a dunghill. "The root-stems and leaves are unusually large, while the heads contained very few seeds, and these of light weight." Following up this illustration, he says: "Manure should not be applied directly to land for the growth of cereals." The only inference to be drawn from this is that the crop would be injured thereby. Whether such a bunch of oats as is referred to ever grew on a dunghill and produced the poor crop stated or not I am unable to say, but the inference drawn from the illustration is contrary to experience. During the past ten years we have grown at the Central Experimental Farm, on two plots of land, ten successive crops of oats, and to each of the plots barnyard manure has been applied every year at the rate of 15 tons per acre. On the one plot it has been used rotted, on the other fresh from the barnyard. Manure has thus been used on these plots during the ten years to the extent of 150 tons per acre. What has been the result? These two plots have given much larger crops of grain, as well as a heavier weight of straw, than any of the other plots. In this series of fertilizer tests the plot treated with fresh manure has given an average yield of 54 bushels 17 pounds of oats per acre for this ten years; that with the rotted manure, an average of 48 bushels 14 pounds per acre. Similar results have been had from plots of barley and wheat treated in the same manner.

The use of barnyard manure with a root crop or a corn crop is to be commended for other reasons, and is a very common practice with farmers everywhere; but to teach that barnyard manure is injurious to a grain crop is erroneous doctrine.

Inherent productiveness in varieties.—We now come to the question of productiveness of varieties, wherein the Commissioner states that, in his opinion, the work done on the Dominion Experimental Farms, in the comparison of varieties, is of no value without selection, and "is apt to mislead farmers into expecting service from named varieties as such, instead of obtaining the seeds by continued selection from year to year on their own or similar farms." But the work of comparison of

varieties at the experimental farms has not been done *without selection*, but *with careful selection* of seed each year, not from selected heads, but by one of the methods the Commissioner recommends, by taking care "to select the large seeds by the vigorous use of the fanning mill and sieves." Are those comparisons *with selection* also of no value? The Commissioner said, "The question of productiveness does not lie in variety." In another part of his evidence he says: "Some of the most distinguishing characteristics of varieties are shape and size, color, habit of growth, hardness, length of growing period, and *productiveness*." If productiveness is one of the chief characteristics of varieties, how can it be said that the question of productiveness does not lie in variety? In another place, he says: "If there is in variety, as such, superiority in productiveness, that would be the same everywhere." He also said that variation in the productiveness of all varieties appeared to be brought about by growing them under different conditions of soil and climate. I fear that any attempt to reconcile these conflicting statements would be hopeless. Following the expression of the Commissioner's opinion as to the valueless character of this part of the Experimental Farm work, he instanced a case in the growing of peas, where "by successive selections of large peas for three years, the individual peas at the end of that time were twice as heavy as the peas of a crop grown from small seeds of the same variety, under the same conditions for an equal length of time." The object in citing this experiment seems to be to convey the impression that in this case increased productiveness was brought about by repeated selection. This was one of the experiments conducted at the Central Experimental Farm with a new cross-bred variety which sported very much and produced peas varying considerably in size. By selecting two types—one large and one small—and sowing the types separately, the large peas were increased in size as stated; but there is no evidence that there was any increase in bushels per acre. The plots were so small that no attempt was made to determine this. We have often found the smaller-sized peas produce more bushels per acre than the larger ones, and to use such an illustration for such a purpose is misleading. The only evidence offered in support of the statement that "productiveness does not lie in variety" is the fact that out of 195 varieties of oats, barley, spring wheat, and peas, compared at the various experimental farms in 1898, 138 appeared in the selected list of 12 or 6 of the largest yielders at the five experimental farms. Thus, the selected lists include a fraction over 70 per cent. of the whole. It is difficult to detect any proof in support of the Commissioner's statement in this. In these tests all the varieties have been grown in five of the most distinct and widely different climates of the Dominion, and climatic conditions alone would cause wide variation. Further, it is not mentioned that 79 of these 195 varieties tested (more than 40 per cent.) were new cross-bred sorts recently introduced, and hence liable to sport and vary to an unusual degree. Under the circumstances, I think this is a very good showing. If even with five years of careful testing we can show that 30 per cent. of the varieties tried are not profitable for cultivation in any of the climates of the Dominion, this will be a piece of work which will be of great value to farmers and of which anyone might feel proud.

If productiveness does not lie in variety, what explanation can be given of the fact that during the four years' test of these varieties, all grown under the same conditions as to soil and climate, that the Banner, Bavarian and Columbus oats are found twelve times in the list of the best sorts, and sixteen of the other varieties from five to ten times, while a number of other sorts appear in these lists but once or twice? What is it that entitles varieties to a place in this list?—the production of a large number of bushels per acre. In Bulletin 32, in a summary of the results of the test of varieties for 1898, I said:

"The particulars presented in this Bulletin show the importance of choosing the most productive and vigorous growing varieties for seed. They also afford further proof that the tendency to great productiveness in certain sorts is to a large extent fixed and permanent. As an example, the twelve varieties of oats which are listed in this Bulletin as having given the largest average crops at all the experimental farms for the last four years include ten of those given last year as the best for three years. Further, in comparing these two lists of the best twelve sorts of oats for each experimental farm, we find this year, at Ottawa, ten of the former twelve; at Nappan, N. S., ten of the twelve; at Brandon, Man., eleven of the twelve; at Indian Head, N. W. T., ten of the twelve; and at Agassiz, B. C., nine of the twelve."

The seed of these varieties was sent to the several farms from a common stock; the productive sorts carried their inherent power of productiveness with them, and have manifested this power in all the different climates of the Dominion. Are we to deny the power of productiveness in such varieties as the Banner oat, the Mensury barley, and the Preston and Red Fyfe wheats, notwithstanding that they give so large a number of bushels per acre. These and other highly-valued sorts have shown remarkable strains of productiveness from the start, and it was mainly this power to produce a large number of bushels per acre, wherever tried, which has given them the reputation they now possess.

Change of Seed, etc.—The Commissioner also stated that "change of seed was most absurd and unnecessary," but no proof was advanced in support of this. On the other hand, we have the accumu-

lated testimony of practical farmers for many years as to the benefits of this practice.

Another of the Commissioner's statements was: "That the rules which apply to the crossing of flowers do not apply to farm crops." This is contrary to the opinion of all botanists. He also said that "the only result of crossing is an intensifying of the tendency to change." This was also shown to be erroneous.

SUMMARY.

When expressed in plain language, the statements made by the Commissioner may be divided into two groups: 1st. Those which are well known and almost universally approved and which most good farmers have long believed in and practiced. 2nd. Some more or less new ideas, broadly stated, with little or no proof, some of which bear evidence of a very superficial examination of the subject.

Class 1.

(1) The well-known advantages which arise from the selection of seed, which every farmer should practice, and where seed can be selected from vigorous growing plants the best results may be expected.

(2) The desirability of using barnyard manure with a root or corn crop.

(3) That varieties of grain have very useful qualities, and that one of their distinguishing characteristics is productiveness.

(4) That all varieties are liable to vary and have more or less power of adapting themselves to changed conditions of climate and soil.

Class 2.

The following statements of the Commissioner may be placed in Class 2:

(1) That there is no productiveness in variety as such. This is contradicted by another statement of the Commissioner's, and has been shown to be contrary to experience.

(2) It is taught that it is injurious to apply manure to cereal crops. This also is contrary to experience.

(3) That variation in varieties appeared to be brought about by growing them under different conditions of soil and climate. This is not proven. On the contrary, our best and most productive varieties have manifested inherent productiveness from the beginning and have carried this power with them and manifested it in many different soils and climates.

(4) That comparison as to productiveness without selection is of no value. The only illustration used in support of this statement is a series of experiments where selection has been regularly practiced.

(5) That change of seed is most absurd and unnecessary. A statement advanced without proof and contrary to general experience.

(6) That "the rules which apply to the crossing of flowers do not apply to farm crops." This is erroneous.

(7) That the only result of crossing is an intensifying of the tendency to change. This is contrary to experience.

(8) That rolling of land warms the soil. This statement, which is taken from a book on "The Soil," by Prof. F. H. King (pages 230-232), is only partly true, and hence may be misleading.

Farm Crops in Canada not "Lamentably Poor."—I also took issue with the Commissioner when he said that the crops of farm products in Canada are "lamentably poor." Such statistics as are available show a material increase in the crops raised by farmers in Canada during the past five years, and also that they compare favorably with the crops of other countries in similar climates. Were the farm crops of Canada "lamentably poor" the rapid increase which has taken place in the volume of our exports of farm products could not have occurred.

Large Possible Gains.—A word must also be said with regard to the very large sum of money which is held out as a possible gain to Canadian farmers by the general adoption of the plans recommended—by \$50,000,000 to \$80,000,000. While such a handsome addition to the returns realized by Canadian farmers would be greatly appreciated, I fear that the calculations rest on a rather faulty basis. The Commissioner mentions a possible increase of from 20 to 30 per cent. in all farm crops by following his teaching. The \$230,000,000 on which his calculation is based includes the hay crop, the largest of all crops in Canada, and all the root crops and corn. With the exception of a limited area in Western Ontario, the farmer has not the opportunity of selecting his own seed on his own farm with these crops, since he does not produce his own seed. The Commissioner's statement is not very clear as to the basis on which his hopes of an increase of from 20 to 30 per cent. rests, but the impression was that they were built on the results of experiments in the selection of seed grain at Guelph.

The experimental work done there by Mr. Zavitz has been good, and he has shown himself a careful worker, but these particular tests have not been planned in such a way as to admit of their being fairly used in such a calculation. The largest and plumpest kernels of grain were selected for one experiment, and the smallest plump kernels for another, and, in sowing, the number of kernels in each case was the same. Hence the plump grain would have nearly double the weight of the small grain. No farmer selects the very smallest seed he can find for sowing, and if he sows unselected seed he would, in most cases, have in this from one-half