As phosphoric acid is a food indispensable in the formation of grain, we must come to the conclusion that phosphate of lime should be used on almost all soils, especially on clays and moory land.

In moory soils, the lack of lime produces certain effects injurious to the quality of the crops. These soils contain a great amount of vegetable matter, and lime prepares this matter for the plants to feed upon by converting the nitrogen held in combination into ammonia and nitric acid. It also neutralises the acid humic matter. *Muck* or *black earth* sometimes contains as much as 97 0/0 of vegetable substances, and in these soils, unless lime, in a caustic state, and phosphoric acid be liberally employed, the crop will be light in grain, though abundant in straw.

Lime is not a manure but an improvement. And, so, when land grows sorrel plentifully, it is an evident proof that it contains acidity in abundance, and that lime is wanted to dissipate it. (1) *From the French.*

D. C. Emile Roy.

Selection in grain-growing.

BY JAMES CHEESMAN, MONTREAL.

The principle of selection has long been appreciated by stock-breeders, and they have largely profited by the application of its teachings. As applied to the growth of cereals it has not found a very wide acceptance, not having had time to force itself on the attention of the average farmer. The founder of the practice of selecting grain for seed is Major Hallett, F. L. S., Brighton, England. In 1861, he planted ten grains of wheat, from a variety known there as Bellevue Talavera wheat, which up to that time had been sown as a spring wheat, and was declared to be quite incapable of withstanding the frost of winter. (2) Nine of the ten plants from these grains were killed by the severe frost, but the other plant, although from the same ear, remained as healthy and vigorous as any of the winter varieties of wheat by their side. From this surviving plant seed has been selected, and grown year after year as a winter wheat. Close observation shows that in the cereals, as throughout nature, no two plants or grains are exactly alike in productive power, and hence, that of any two or greater number of grains or plants one is always superior to all the others, although the superiority can only be ascertained by actual field tests. It may consist in several particular characteristics, as power to withstand frost; prolificness; size and character of ear; size, form, quality and weight of grain; length and stiffness of straw; powers of tillering; rapidity of growth; and many others.

Throughout continued observations and experiments, extending over twenty years, the grower has found only three instances recorded in which there were two ears on a plant containing an equal number of grains, and one of these related to the Bellevue Talavera wheat, which must be considered quite exceptional as to variation. In both the other instances there was only a low stage of development, the equally finest two ears of each plant containing but 59 and 49 respectively. In every case where the plant presented an ear containing 60 grains and upward, the next best ear was of less contents than the finest one. In twenty such instances taken consecutively and without omission, and referring to seven varieties of wheat, the average difference between the contents of the first and second ears was seven and a half grains. The difference in four of these instances was only one grain, but in other four it amounted to from seventeen to nineteen grains. The superior productive power of a grain over that of another may consist in a greater number of ears upon the plants it produces, or in their individually containing a greater number of grains.

During these investigations, no single circumstance more forcibly illustrated the necessity for repeated selection than the fact that, of the grains in the same ear, one is found to excel greatly all the others in vital power, as in the case of the Bellevue Talavera. The original two ears together contained 87 grains; these were all planted singly. One of them produced ten ears containing 688 grains, and not only could the produce of no other single grain compare with them, but the finest ten ears which could be collected from the produce of the whole of the other 86 grains contained only 598; yet supposing that this superior grain grew in the smaller of the two original ears, and that this contained but 40 grains, there must still have been 39 of these 86 grains which grew in the same ear. So far as regards *contents* of ears.

The next year, the grains from the largest ear of the finest plant of the previous year were planted singly, twelve inches apart, in a continuous row; one of them produced a plant consisting of fifty-two ears; those next to and on either side of it of twenty-nine and seventeen ears respectively; and the finest of all the other plants consisted of only forty ears.

The following are the *chief* points of the standard in the order of their importance, but all have to be duly considered:

1. Hardihood of constitution.
2. Trueness to type.
3. Quality of sample.
4. Productiveness.
5. Power of tillering.
6. Stiffness and toughness of straw.
7. Earliness of ripening.

The system of selection here pursued is as follows: A grain produces a plant, consisting of many ears. Then, are planted the grains from these ears in such a manner that each ear occupies a row by itself, each of its grains occupying a hole in this row, the holes being twelve inches apart every way. At harvest, after the most careful study and comparison of the plants from all these grains, the finest one is selected, which is proof that its parent-grain was the best of all, under the peculiar circumstances of that season. This process is repeated annually, starting every year with the *proved* best grain, although the verification of this superiority is not obtained until the following harvest.

The subjoined statement will illustrate this system of selection, as the facts given are due to its influence alone: the kind of seed, the land, and the system of culture employed, were precisely the same for every plant for four consecutive years; neither was any manure used, nor any artificial means of fostering the plants resorted to.

The following table shows the character of each additional generation of selection:

(1) Sorrel, *rumex acclosella*, almost always shows itself on sandy and gravelly loams *with a clay subsoil* when such land is first brought into cultivation. The sorrel disappear after drainage in places where, as in my part of England (Kent), lime is hardly ever used. "Tom Gisborne" says that, as regards our cultivated crops, the acidity is a *caput mortuum*—i. e. of no consequence one way or other. A. R. J. F.

(2) Bellevue Talavera—a Spanish wheat, cultivated for many years by Col. Lecouteur, Bellevue, Jersey. The grain is long in shape, and in colour of an opaque white; makes splendid biscuits (*crackers*, not rolls), and is worth from 18c to 25c a bushel more than ordinary white wheats. How Major Hallett can say "it was sown up to the year 1861 as a spring wheat and was incapable of withstanding the frost," I don't understand, seeing that his neighbour Wm. Rigden, my old farm-tutor, had certainly grown it regularly as a fall-wheat some years before 1852, when I went to him. The crop generally ripens a week before other wheats, and renting farmers usually have a field of it, which is threshed out and sold in harvest time to pay the wages. A. R. J. F.