YEAR.	EARS SELECTED.	Height.	Containing grains.	Number of ears on finest stool.
		Inches.		
1857	Original ear.....	4¾	47	..
1858	Finest ear.....	6¼	79	10
1859	Finest ear.....	7¼	91	22
1860	*Ears imperfect from wet season*.....	..	..	39
1861	Finest ear.....	8¾	123	52

Thus, by means of repeated selection *alone*, the length of the ears has been doubled, their *contents* nearly trebled, and the "tillering" power of the seed increased fivefold.

The following table gives similar increased contents of ear obtained in the other varieties of wheat:

Grains in original ear.	KIND OF WHEAT.	Grains in improved ear.
45	Original Red commenced in 1857.....	123
60	Hunter's White commenced in 1861.....	124
60	Victoria White commenced in 1862.....	114
32	Golden Drop commenced in 1864.....	96

It was supposed by ancient writers that the powers of grains differed in relation to their positions in the ear. This Major Hallett investigated in 1858, by planting the grains of ten ears on a plan showing their several positions in the ear. The only general result, among most conflicting ones, was that the smallest grains, those most remote from the centre of growth, exhibited throughout, most unexpectedly, a vigor equal to that of the largest; and that the remarked worst grains, in one or two instances, did not by any means fall so far short of the good ones as had been expected. Frequent trials have also been made of the comparative power of large and small, plump and thin grains, and, in the case of oats, which produce a small grain attached to a large one, trials as to their respective powers—with uniform results, viz, that, in good grains of the same pedigree, neither mere size nor situation in the ear supplies any indication of the superior grain.

Very close observation during many years led to the discovery that the variations in the cereals which Nature presents to us are not only hereditary, but that they proceed upon a fixed principle, and from them has been educed the following law of development of cereals:

1. Every fully-developed plant, whether of wheat, oats, or barley, presents an ear superior in productive power to any of the rest on that plant.

2. Every such plant contains one grain which, upon trial, proves more productive than any other.

3. The best grain in a given plant is found in its best ear.

4. The superior vigor of this grain is transmissible in different degrees to its progeny.

5. By repeated careful selection the superiority is accumulated.

6. The improvement, which is at first rapid, gradually, after along series of years, is diminished in amount, and eventually so far arrested that practically a limit to improvement in the desired quality is reached.

7. By still continuing to select, the improvement is maintained, and *practically* a fixed type is the result.

THIN SEEDING WITH SELECTION.—Let us discuss what is possible by a combination of thin seeding with selection. In order to do this, we must look at the present modes of cultivating the cereals. Confining ourselves for the moment to what alone, we know that from two to five bushels per acre are sown. The bushel of ordinary wheat contains 700,000 grains and more, and, taking two bushels per acre as the quantity sown, we have about 1,500,000 grains per acre. Major Hallett has counted at harvest the number of ears upon a quarter of an acre of wheat (drilled 20th of November with one and a half bushel of seed per acre, and which proved an exceptionally heavy crop of fifty-six bushels per acre), and the number of ears found was 934,120 per acre, or not so many ears as the grains sown. Here, it is evident, from the number of grains sown, that either the natural powers of tillering could not have been exercised, or that the greater part of the seed must have been sown uselessly. Doubtless some of the grains did produce more than one ear, but this only makes the case still worse for the remainder. Not only was the number of ears below that of the grains sown, but each ear was but the stunted survivor of a struggle for existence. A high authority has said that, if a square yard of thickly-sown wheat be counted in spring, and the supposed number of ears then recorded, it would be found that ninety per cent of them would be found missing at harvest. Beyond all question, in thickly-sown wheat, very many of what appear as stems in the spring die away before harvest, and have thus grown not only uselessly, but in the struggle for existence have *starved and stunted those which ultimately came to ears.*

In ordinary English crops the number of ears produced per acre being taken as about 1,000,000, and the crop as 34 bushels, we have, at 700,000 grains per bushel, 23,800,000 grains per acre, or an average per ear of only 23 to 24 grains; and, if more than 1,000,000 ears per acre be claimed, it must be at the expense of their contents. Five imperial pints (=6.1 American measure) of wheat per acre planted in September, 12 inches × 12 inches, gave 1,001,880 ears per acre, or 67,760 ears in excess of those produced on the other side of the hedge from 1½ bushel, or *more than thirteen times the seed.* Again, 6·1 pints (American measure) of wheat planted 12 inches × 12 inches, October 17th, gave 958,320 per acre; and planted similarly, October 4th, 966,792 per acre; while one bushel, planted October 15th, gave only 812,160.

Two plants of 24 ears each gave 1,911 and 1,878 grains, or 79 per ear; 20 ears per foot, at 48 grains only per ear, would produce 88 bushels per acre. All the conditions of time and space being fulfilled, we can obtain from a *single parent-grain* as many ears as are ordinarily obtained from *twenty grains*, with this most important advantage, viz.: these ears being produced from plants which have attained (or nearly so) perfect development of their growth, contain more than double the common number of grains, and their contents may be largely increased by the continued annual selection of the most vigorous parent-grains. These small quantities may be drilled on a large scale in the following manner: The object is to insure perfect *singleness* and regularity of plant, with uniformity of depth. The two latter may be obtained by the drill, as may the former also by adopting the following plan: The seed-cups ordinarily used in drilling wheat are so large that they deliver in *bunches* of grains, consisting of six or seven, which fall together within a very small area, from which a less produce will be obtained than if it had been occupied by a single grain. The additional grains are thus not only wasted, but are positively injurious. By using seed-cups which are only large enough to contain one grain at a time, *a stream of single grains* is delivered, and the desired object, viz., the depositing of *grains singly*, at once attained. The intervals *in* the rows will not be exactly uniform, but *they will be sufficiently so for all practical purposes.* The width of these intervals will, of course, depend on the speed with which the seed-barrel revolves, which can be regulated at will by adjusting