

whole tribe of albuminoids, which enter into our foods and the structure of our bodies. From these elements, or a portion of them, are formed the ammonia and the nitric acid, so essential to our crops.

Truly a wonderful thing this nature within which we exist, and of which we form a part; and a wonderful science this chemistry which unfolds to us these secrets of nature.

**FERTILIZER LAW.**—Mr. S. G. Freedland, of Matawan, N. J., sends us a copy of a law recently passed by the legislature of New Jersey, to control the sale of fertilizers, valued at above \$10.00 per ton. It provides:

"That commercial manure or fertilizer sold or kept for sale in the State of New Jersey, shall be fitted in every bag, barrel or parcel thereof, which may contain fifty pounds or more, a printed name or trade mark, by which the same may be known or designated, with the name and place of business of the manufacturer or importer, together with a true specification of the percentage of phosphate of ammonia, of phosphate of lime, of phosphate of potash, of sulphuric acid, of nitrogen and potash contained in the contents of the package, and also the quantity of the fertilizer contained in each package, and the date of its manufacture or importation."

It also provides for the payment in prosecuting purchasers by the dealer or manufacturer, violating the law, the sum of \$5.00 for every 100 pounds bearing a false or untruthful stamp. But the law does not provide for a State inspection, which seems to us to be essential to the efficient working of the law, and which is the object in Massachusetts, where the law is of inestimable benefit to farmers, and is working smoothly. Let us be thankful, however, for every such step in the right direction.

## Botany and Horticulture.

### Darwin's New Book.\*

BY PROF. W. A. BRAD.

It seems to be the general opinion of all who are prepared and competent to judge, that Mr. Darwin has produced a most wonderful book— as I believe, one which has not been excelled in importance to the farmer by any work in this or in any age.

It is not easy reading, even to the botanist who is more familiar with the subjects treated. The author has recorded in a book of about 500 pages, a vast number of experiments and observations made, and in many cases often repeated, during a period of ten or twelve years. He has crossed the flowers, sowed the seeds and measured the heights of the plants, weighed or counted the seeds and capsules, often two or three times for many years, of several specimens of plants belonging to 27 species, of 53 different genera of 20 families. These are nations of very different parts of the world. He has made a book chock-full of information, valuable to the grower and farmer, yet, in the words of the *Quarterly Review*, "It is certain that these practical results will be a long time filtering into the minds of those who will eventually profit most by them." If the results are so valuable, and if such time must be expended in reaching the understanding of farmers, this slow process cannot begin too soon, nor can its advantages be kept too persistently before their minds.

There is weighty and abundant evidence that the flowers of most kinds of plants are constructed so as to be constantly or habitually cross-fertilized by pollen from another flower, produced either by the same plant, or generally, as we shall hereafter see reason to believe, by a distinct plant. Cross-fertilization is sometimes caused by the sexes being separated, and in a large number of cases by the pollen and stigma of the same flower being situated at different times. It is also caused, in many cases, by mechanical contrivances of wonderful beauty, pre-

venting the impregnation of the flowers by their own pollen. Again, there is a class, in which the pollen absolutely refuse to be fertilized by pollen from the same plant, but may be fertilized by pollen from any other individual of the same species. There are also very many species which are partially aseptic with their own pollen. Lastly, there is a large class in which the flowers produce an apparent obstacle of any kind to self-fertilization, notwithstanding these plants are frequently intercrossed, owing to the propensity of the pollen from another individual or variety over the plant's own pollen."

There are, however, some cases which seem especially contrived for self-fertilization. The number is so much smaller than would be supposed by a hasty observation.

Andrew Knight, more than twenty-five years ago, said that "Nature intended that a social intercourse should take place between neighboring plants of the same species." Mr. Knight, and many since his time, predicted cross-breeding plants quite extensively, for the purpose of obtaining new and improved varieties. As a general rule, there are many experts in this art in Europe and in this country.

By cross-fertilization is meant "a cross between distinct plants which was raised from seeds and not from cuttings or buds." In the proper sense, then, we could not cross a flower of one Northern Spy apple-tree with the flower of another tree of the same variety, as they have all come from the grafts or buds of one soil, in like manner. It would not be a cross to fertilize a flower of the General Grant geranium with others of the same variety, because all our plants have come from cuttings of one parent plant, or some of its descendants.

Many of Mr. Darwin's plants were raised from seeds which were sown at the same time, near each other. The best young plants from the seeds of crossed flowers, and the best which came from self-fertilized flowers were planted on opposite sides of the same pot, where the soil was well mixed. "In comparing the two sides, the eye alone was never trusted."

Fifteen plants of Indian corn from cross-fertilized seeds in height fifteen others from self-fertilized seeds, as 100 seeds 74. He experimented with plants of the common Morsing Gilly for two generations, using the same method of raising them from crossed plants as from those self-fertilized. The average in height for the ten peas is as 100 to 77 in favor of the crossing.

The flowers of this plant are freely crossed if left to themselves, exposed to insects. It is, therefore, altogether likely that the seeds with which Mr. Darwin began were from crossed flowers, yet, in the first generation, the seeds of crossed plants exceeded those self-fertilized as 100 seeds 78. If we compare the number of seeds and capsules produced in the first generation, the crossed plants exceeded the self-fertilized as 100 seeds 84. The relative superiority of the crossed plants is chiefly due to their producing a much greater number of capsules, and not to each capsule containing a larger average number of seeds. When self-fertilized for nine generations, the flowers were of a uniform size, as those of a wild species, while those the beginning were of various colors. The crosses as far mentioned of the flowers of Morsing Gilly, refer to crosses of different plants raised in the same garden, year after year. After nine generations he introduced seeds raised at a distance, under different circumstances. Plants from these were crossed with plants which had been intercrossed in his garden. This cross (called the Cambridge-cross) exceeded in height, the other intercrossed plants of the tenth generation, as 100 seeds 78. In number of capsules, they were to each other as 100 to 57, and the capsules, in weight, as 100 to 53, in favor of those crossed with foreign stock.

Here we get a most important fact, not noticed by Mr. Knight, or any one else, that a cross from a fresh stock increases the size of plant and its fruitfulness, probably owing to their differing somewhat in constitution or character. The

crossing of closely related plants is generally an improvement over self-fertilization; but, crossing with foreign stock of the same variety, is a far greater improvement.

The proof of the truth of the above assertions is taken in work which comes to the notice of vegetarians, the forist, the pomologist, to the general farmer.

In the sixth generation of the self-fertilized Morsing Gilly, appeared a single plant which surpassed its crossed opposite by half an inch in height. Six descendants continued vigorous and fertile, even when self-fertilized. They were not produced by a cross with a distinct stock. Mr. Darwin adds that if this latter fact is trustworthy, it is a curious case, as far as he has observed in all his experiments.

Agri-cult. Coll., Lansing, Mich., April 20, 1871.

\*The effects of cross and self-fertilization of plants, by Charles Darwin.