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Introduction by Christine Chua: John Charles Whitten (1866-1922), professor at the University of Missouri College of Agriculture. He was hailed as a leading figure among the horticultural experts in America.

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Influence of Pollen upon Size, Form, Color and Flavor of Fruits.

BY PROF. J. C. WHITTEN.

[…]

In all of Sprengle's work, it is perhaps remarkable that he failed to learn the most important lesson which his years of patient study and observation might have taught. While he was well aware of the fact that insects frequently carry pollen from flower to flower, he failed to learn that cross-pollination is the roost important result of insect visits. This great truth remained to be first hinted at by Andrew Knight. After experimenting in self-fertilization and cross-fertilization in the pea, and other plants, Knight, in 1799, laid down the law that in no plant does self-fertilization continue for an unlimited number of generations. This theory attracted very little attention until nearly fifty years ago when Darwin came forward with his exhaustive experiments and studies from which he interpreted the natural law that "no organic being fertilizes itself for a perpetuity of generations, but a cross with another individual is occasionally- perhaps at very long intervals- indispensable." Darwin showed that in all the higher forms or animas the sexes are separate, in order that two different sources of blood, of relationship, may be combined in the off-spring. He also showed what we now so generally admit, that in-breeding diminishes strength and productiveness, while a cross with a different strain increases both.

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In his extensive work, "Cross and Self Fertilization in the Vegetable Kingdom," Darwin conclusively proves the value of cross-fertilization in plants. Giving years of patient, untiring labor to the work, he carried on a series of experiments in both self and cross fertilization, in morning-glories, petunias and other plants, for a number of generations. He found, that, where continued self-fertilization was practiced, the plants diminished in size, vigor, and productiveness, with each generation, and that a single cross of these seedlings, with another strain, greatly improved them. He also cross-fertilized a great many flowers saving the seeds and again crossing the seedlings grown from them. These experiments were carried through many generations, with different kinds of plants. He found that cross-

fertilized flowers produced much larger, heavier and more vigorous seeds, and that the seedlings grown from them were correspondingly stronger and more fruitful.

The most important conclusion, resulting from Darwin's extensive studies along this line, during which he carefully compared his own observations with those of other investigators, is exprest in one of his own sentences-

"Nature thus tells us, in the most emphatic manner, that she abhors perpetual self-fertilization," which is round in his work on "Various Contrivances by which British and Foreign Orchids are Fertilized by Insects."

Experiments are ample to prove to us, that cross-fertilization between plants of the same species is beneficial. Through laws of adaption and selection, the stronger, cross-fertilized plants would naturally enough crowd out and supplant the weaker self-fertilized ones. It is not surprising, then, to find that most of our flowering plants are actually constructed to bring about this result, nature having so modified their flowers as to render self-fertilization the exception rather than the rule. In many flowers the pollen and the pistils are not ready for fertilization at the same time, hence such flowers are dependent upon pollen from an earlier or a later flower. Frequently the pistil is longer than the stamens and reaches above them, out of reach of their pollen. In other cases the stamens and pistils are borne on separate plants as is the case in some of our cultivated strawberries. ln such cases cross-fertilization must always be the result. Sometimes the pollen of a certain plant is entirely impotent upon the pistils of that plant. Many of our wild plums are of this class. Frequent instances are cited where plum trees, producing an abundance of pollen, railed to set fruit until a tree of another variety was set among them, when they produced abundantly through the perfect potency of the new supply of pollen.

Certain plants are dependent upon one or more species of insects for the fertilization of its flowers. Our native yuccas being dependent upon a single species of moth, to perform this function, is a most remarkable example. A complete account of the life history of this insect, and its remarkable habits in securing the fertilization of the yuccas may be found in the reports of the Missouri Botanical Garden.

For a long time it has been well known that the fig is dependent upon a certain fly for its perfect fertilization and that, when the pollen is carried from flower to flower, by the insect, the fruit is much larger and of more delicious flavor, than when the flowers are fertilized through any other agency.

The Department of Agriculture has published a most interesting and instructive bulletin upon the pollination of pear flowers. After ample, careful, experiments in cross and self-fertilization of different varieties of pears, the following among other conclusions were reacht:

"Many of the common varieties of pears require cross-pollination, being partially or wholly incapable of setting fruit when limited to their own pollen. Some varieties are capable of self-fertilization.

"Cross-pollination is not accomplisht by applying pollen from another tree of the same grafted variety, but is secured by using pollen from a tree of a distinct horticultural variety.

"The impotency of the pollen is not due to any deficiency of its own, but to a lack of affinity between the pollen and the ovules of the same variety.
"The pollen of two varieties may be absolutely self-sterile, and at the same time perfectly cross-fertile.
"Pears produced by self-fertilization are very uniform in shape. They differ from crosses not only in size and shape, but also, in some cases, in the time of maturity and flavor.
"Self-fecundated pears are deficient in seeds; crosses are well supplied with sound seeds. Even with those varieties which are capable of self-fecundation the pollen of another variety is prepotent.
"The normal, typical fruits and finest specimens, either or self-fertile of self-sterile sorts, are crosses."
Cultivators of strawberries express a preference for certain varieties of pollinators of the various pistillate sorts. This preference is founded upon the fact that the pollen of some staminate varieties is prepotent, as compared with that of certain other varieties which flower at the same time. It Is a commonly noted fact that most piltillate varieties produce

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finer fruit than the staminate sorts. One reason given for this is that the pistillate sorts must always be cross-fertilized.
Since cross-fertilization, as thus far discust, refers, primarily, to the crossing of plants of the same species, it may not be amiss to mention briefly the subject of hybridization, or crossing of two different species. Without going into a lengthy discussion of this subject, it may be stated that, in the vegetable as well as the animal kingdom, there are very few undoubted hybrids. Experiments in the hybridization of plants has generally proven barren of beneficial results. Where hybrids have been secured that have often been monstrosities, being abnormally developt in certain characters and deficient in others. Where hybrids are not actually sterile, it has been shown to be difficult, in most cases, to fix a, type in their offspring.
Finally we may conclude that where cross-fertilization between different varieties is favored, we may expect the most benefical results. Insects are the active agents through which cross-pollination is best effected. Experiment may yet prove the comparative value of different varieties as pollenizers of other varieties. A judicious mixing of varieties is preferred to planting solid blocks of a single variety. Keeping honey-bees in the orchard insures better pollination.