

SCIENCE AND AGRICULTURE

New Varieties of Plants.

Improvement by Hybridization.

No. 8.

Continuing his lecture at the University extension lectures class, Dr. A. E. V. Richardson (director of the Waite Agricultural Research Institute), dealing with hybridization of plants, stated they now came to the second method which offered almost unlimited scope for improvement in garden plants, cereal crops, and fruit crops—the production of new varieties by hybridization. Success in selection was dependent on the discovery of new heritable variants—Nature produced the variation—man isolated and propagated them and produced a new race or variety. With hybridization, the plant breeder could create new forms and new combinations which never existed before.

Structure of the Flower.

To understand how hybridization was effective, it was necessary to have a knowledge of the structure of the flower. What might be regarded as a typical or perfect flower contained pollen-bearing and pollen-receiving parts, surrounded by the conspicuous insect signal which was termed the corolla, and a less conspicuous outer shield called the calyx. The calyx was the original protective shield about the flower bud, and its function was over when the flower opened. The most attractive part of the flower was the corolla, made up usually of bright showy petals. Within the petals was a circle of stamens—bearing at their ends, the anthers, or pollen sacs, containing immense numbers of minute pollen grains. In the central portion of the flower was the pistil comprising the ovary with its egg cell; and above the ovary the tube-like style, ending in the stigma that received the fertilizing pollen. The normal process of fertilization was for a pollen grain to fall on the stigma where it germinated—sends a tube down the style, ultimately reaching the egg cell. The contents of the pollen grain then fused with the egg cell, and from the fertilized ovum a seed developed. By the most wonderful miracle in the organic world, the infinitesimal egg cell hidden in the ovary was able to epitomise all the possibilities of a future plant of predetermined size, form, and habit. And each pollen grain contained, as did the ovule, all the hereditary potentialities of the entire plant. It would be almost unbelievable, did they not know it to be true, that a minute fleck of matter such as the pollen grain should contain the potentialities of the future plant or tree, and that it should predetermine the details of structure even down to its remotest leaf and to the smallest detail of its flower and fruit. From the standpoint of the pollenizer—the stamens and their pollen-bearing anthers and the receptive pistil—were the organs that claimed exclusive attention.

Insect, Wind, and Self-Pollinated Plants.

Many ages ago—perhaps millions of years ago—a strange compact was made between a plant and an insect that was of the greatest importance to races yet unborn. The compact was that the plant should manufacture nectar and freely supply it as food, and that the other in return should carry the fructifying pollen grains from flower to flower. Probably no more important compact was ever entered into in the history of animal creation before or since. For out of that compact grew—the rivalry that stimulated development and made possible the evolution of the whole race of plants that bear beautiful flowers and exhale sweet perfumes. But for that alliance, there would never have developed in the world a conspicuously coloured or scented flower of any kind. And a world without beautiful and sweet-scented flowers would be a world robbed of many of its attractions as an abiding place. The alliance did not merely give us things of beauty—it gave us utility as well, for it made possible the bringing together of germplasm from plants growing far apart, thus insuring virile and variant strains. That in a large measure determined the amount and direction of evolution of the highest orders of plants. With rare exceptions the higher plants were precisely those that entered into that co-operative scheme, whereby they trusted their fate to the insects. They risked much—possible extermination—but they profited much, for the cross pollination by the insects afforded the constant stimulus that underlay all evolution. Wherever they found a large tribe of plants showing great diversity of form, large numbers of species and ready adaptability to improvement, they would find

there "entomophilous" or insect-loving flowers dependent upon winged messengers for the consummation of their matings. Vast responsibilities were implied in that coalition with the insects, but the results certainly justified the hazard.

There were some plants that did not join the union. Plants which remained outside the union were the mosses and lichens, and ferns. If those lowly plants had maintained their independence they had done it at a great sacrifice. They were not more independent than they were unprogressive, and indeed they were unprogressive because of their independence. The method of cross-fertilization they had adopted did not enable them to blend the strains of different plants, but in each instance the parents must be growing in the immediate vicinity of each other. Except by the accidental transfer of a plant through the agency of an animal, there was hardly the remotest chance of effecting cross-fertilization between individual mosses, lichens, or ferns growing in widely separated regions. It was the blending of traits from parents growing under different conditions that was chiefly responsible for making plants vary, and furnished the materials for evolutionary progress. There were other plants, however, that had left the plant-insect union. Those apostates were the numerous gigantic trees that no longer depended on insects for the fertilization of their flowers. Among them were the pine, fir, spruce, and the oak, and among field crops the useful maize plant. The trees and the maize plant long ago declared against further co-operation with insects, and adopted the method of producing large quantities of pollen and scattering it in the air to be carried by the wind to female flowers, which in some cases grew on neighbouring branches and in other cases on different trees. The method was in one sense wasteful, inasmuch as it involved the production of immense quantities of pollen, only an infinitesimal portion of which would ever come in contact with a receptive pistil. But, on the other hand, the tree was under no necessity to develop large, conspicuously painted flowers. Nor needed it produce nectar to feed its insect allies, since they had been renounced. The saving of energy thus effected might thus more than counter-balance waste through excessive pollen production. Those were wind loving or "Anemophilous" flowers.

It was probable that the trees changed their allegiance from insect messengers to wind because of the nature of the conditions under which they grew. By raising their heads higher and higher into the air they were able to spread their pollen broadcast across wide stretches of territory. Pollen from pine trees might be carried for scores of miles, and pollen from a maize plant might be transported over a mile from its source. There was, therefore, every opportunity for the cross-fertilization of individual trees growing in widely separated territories, and there was, therefore, no restriction put on the possibilities of progress of evolution of those monsters in plenty for their renunciation of the services of insect messengers. They had benefited by leaving the union. There was another group of plants that had forsaken the plant-insect union, the cereals—wheat, barley, oats, rye—and certain vegetables—peas, beans. Those plants were habitually self-fertilized, and, it would be noted, they were annuals. They did not know why those plants renounced the union. Possibly their ancestors might have fallen on evil days when there was a dearth of insect messengers in the regions they inhabited. With trees and perennial plants it was not absolutely vital that there should be a crop of seeds every year. But in the case of an annual plant the matter was very different. Should plants fail to produce seed for a single season, the entire race would vanish. When they sowed seeds of cereals usually 90 per cent. germinated and the rest of the seed decayed before the end of the season. It was not strange that plants thus perennially threatened with destruction should adopt exceptional measures to ensure fertilization of their flowers. It might well have happened in bygone ages that certain individual flowers that chanced to be self-fertilized were instrumental in saving the life of a species that would otherwise have been exterminated. Through the operation of heredity the offspring of those flowers would tend to reproduce the self-

Farewell by Tutors

Tutors and Mr. G. McRitchie (general secretary) of the Workers' Educational Association, gave Dr. Heaton a farewell dinner at Covent Garden last night. Mr. McRitchie, who will be acting director for the remainder of the year, said that they felt they could not allow Dr. Heaton to leave the State without meeting him in a social way, and thanking him for the help he had been to them. Mr. J. C. McDonnell, M.A. (senior tutor) spoke of Dr. Heaton's many good qualities. He presented him with a typical Australian scene, depicting a large gum tree. The Rev. G. H. Wright, M.A., Principal E. S. Klek, M.A., B.D., and the Rev. G. E. Hale, B.A., spoke in eulogistic terms of the excellent qualities of Dr. Heaton. Dr. Heaton, in responding, gave a clever and interesting characterisation of the various tutors who had served the association, and of the secretary.

DR. HEATON'S LAST WORD

Adelaide for Culture—Perhaps

INCLINATION TO BOAST

Before he left on Friday to take up a position in Canada "The Mail" persuaded Dr. Heaton, formerly Lecturer in Economics at the Adelaide University, to give his impressions of South Australia, gained since he arrived in the State in March, 1917.

"That's a tall order," the learned doctor said when the request was made to him. "I'll do my best."

In fairness to Dr. Heaton it is well to mention that since he arrived in South Australia he has travelled all over Australia, his total journeyings amounting to 30,000 miles. He is qualified to make comparisons between the States.

"Without throwing bouquets," Dr. Heaton began, "I would pick Adelaide as the Australian city. The reason I prefer Adelaide is that it is big enough to get all the social and educational benefits that one needs, and at the same time is not too big to be grasped as a whole. It is probable that the very big city will cut its own throat. Business men cannot afford to waste two hours a day to get to the centre of their city. Adelaide is comfortably big enough."

WORD ABOUT CULTURE

"Now a word about what Foster Fraser said," Dr. Heaton smiled. "We—you will have to excuse me saying we, I will talk about 'We Australians' for a long time yet—should remember Fraser having said 'Adelaide for Culture,' and promptly began to unsay it. I am afraid most of us remember the writer's first assertion, and forgot his subsequent recantations."

"There are times and scenes of our life that make one almost re-echo Mrs. Philip Fox's 'Where is the culture of Adelaide?'"

"There is much that is quite provincial; there is much that is almost mid-Victorian in Adelaide, and, of course, it is inevitable that our isolation from the big world centres should make it difficult for us to keep abreast of new lines of thought and new developments of art, music, and other things."

"Still," Dr. Heaton continued, "the case for Adelaide is not so bad. Once below the surface it is amazing to what an extent Fraser's first impression was fairly true. There are men in Adelaide whose libraries are joys forever; and there are musicians whose range of interest is very wide, but the great trouble throughout Australia is that though there is widespread and deep interest in the things that go to make up culture, that interest has little chance of expressing itself, or of being mobilised."

ABOUT THE WOMEN

Dr. Heaton has decided views upon the place of women in the scheme of things. "I have always been amazed at the energy shown by some of the women organisations in South Australia," he said. "I have often said that Australian women got the vote too easily, and consequently do not appreciate it, or make any effort to use it for good. I still say that is largely true, but at the same time in the work of the National Council of Women, the Women's Non-Political Association, and a dozen other directions, many South Australian women are giving vent to their desire for social service and social betterment."

"Generally, however, my impression is that Australian women do not appreciate their franchise privileges enough. This, no doubt, is because it was thrust upon them, and did not come, as it did to their sisters in England, after a bitter and sometimes violent fight."

MANUFACTURING ENTERPRISE

"Badly handicapped by lack of coal, it has struck me as remarkable that South Australia has been able to build up a number of important manufacturing industries, some of which not only hold their own with local competitors, but with similar enterprises in the other States. The State possesses skilled artisans and efficient business organisers."

"There is I think a more conciliatory attitude here between workman and master than in most parts of Australia. Our arbitration system works more upon conciliation than upon arbitration. People who talk about the prevalence of Bolshevism and subversive revolution are just

insulting their own State. If Bolshevism ever came to South Australia it would be quite as much the fault of a handful of reactionary business men as of a handful of revolutionary fanatics. Revolutions are produced as much by the followers of the extreme left, as they are by followers of the extreme right, and the people who, for instance, in 1921 and 1922 were frantic in their denunciation of our arbitration system are far greater menaces to industrial peace and progress, than those who read pamphlets written in Moscow. In South Australia the gulf between capital and labor is not so wide as in the other States, and in most other parts of the world."

EDUCATIONAL IMPROVEMENTS

"In the last 10 years South Australia has made wonderful strides in educational facilities. There was a time when South Australia, and perhaps Tasmania, were bywords among educationists. Lack of equipment and buildings, under staffing, and overcrowding of schools, and the inadequate training of teachers were some of the things for which the South Australian education system was famous. Over the last decade both parties have worked hard and spent hard to repair defects, and South Australia is now well on the way to possess an education system of which it can be proud. It is a healthy sign that education has never been made a party issue. What a pity the same spirit could not extend over the whole field of politics."

BOAST A LITTLE

"There is one other point. I think we (Dr. Heaton would persist in including himself in his criticisms) in common with most Australians are inclined to boast. We should try and develop a sense of proportion, a sense of humor, and a faculty for criticising ourselves. The cultivation of a national sentiment is a very fine thing, but it should not be allowed to run amok. At times South Australians fall into the habit of bragging and boasting."

"An Englishman once said to me 'an apple is good, not because it is a Tasmanian or Canadian apple, but because it is a good one.' Quite so. We should not say that a poem, a politician, or a peach is best ever produced because it is Australian. We can still learn lessons from the outside world in the fields of industry, government, and art. Make a note," Dr. Heaton added smiling, "that I did not say anything about cricket."

"In conclusion I would like to qualify my foregoing remarks. If Australians—and South Australians are no worse than dwellers in other States—are inclined to boast, they do so in good company. In Canada and America they do their share. Boasting can be a healthy sign, a sign of faith in one's country, and at the same time a retort to those grumblers who will not believe any good thing can come out of a new country."

STUDENTS' WILD NIGHT

Apology and Damages

Something in the nature of a Bacchanalian orgy occurred at a dinner given by the medical students of the Adelaide University at the Piccadilly Cafe, North terrace. Over-indulgence in liquor by some of the young men resulted in the floor being strewn with fragments of bottles, glasses, and flower vases.

When questioned on the matter Mesdames d'Arenberg and Twiss (proprietors of the cafe) said that of the 119 present 18 or 20 so far forgot all sense of decency as to make things exceedingly unpleasant for them and their staff.

"We do not in the least mind noise and fun," stated the proprietors, "but we strongly object to beastliness. This statement we embodied in a letter which we sent to the University authorities protesting against such an abuse of our rooms. We were asked to withdraw the letter and make our complaints to the Medical Students' Association. This we did."

"Shortly afterward three of the students, accompanied by a professor, came to us and proffered a most complete apology. They deeply regretted the incident, and paid for all the breakages and for the cleaning of the cafe."

"We have not said that we will not have them in the Piccadilly again, for we believe that they are genuinely sorry for their behaviour."

ELDER CONSERVATORIUM.

Tonight in the Elder Hall, a concert will be given by the Ladies' Part Singing Class, under the baton of Mr. Winsloe Hall. A particularly fine programme includes vocal items by pupils of Madame Delmar Hall and Mr. Winsloe Hall, as well as an excellent variety of part-songs, Miss Muriel Prince, A.M.U.A., with Mr. Herbert Edwards, A.M.U.A., will be the accompanists. The plan is at S. Marshall and Sons.

Professor Rennie left on Friday afternoon to attend a meeting of the Advisory Standing Committee of the Australian Universities in Melbourne.