

(J. T. PRIDHAM.)

FARRER ORATION, 1944.

As one who has lived three years with Farrer in his home at Lambrigg in the Queanbeyan district one would venture to use this occasion for the advancement of Plant Breeding which is one of the youngest of the sciences and has for its aim the union of science with practice.

In truth the field of plant breeding is a very wide one and we are not tied down to scientific workers for the production of new forms. For the testing and evaluation of a new variation in field crops, however, we do need the trained mind and scientific methods to rightly assess the value of a departure from type brought to our notice it may be by the man on the land. Farrer was impressed with the value of carefully recorded facts. "We want facts", he would say, "and facts are stubborn things".

It is proposed in this outline to deal first with the man and his work and to seek to co-ordinate this with post-Farrer developments in the Department which have benefited the community.

As is well known Farrer sprang from farming stock in the north of England and was educated at the Blue Coat Boys' School before proceeding to Cambridge University where he took honours in mathematics. He entered the medical school but came out to this country before he had finished his course and was employed as a surveyor in the western districts. He married Miss Nina Fane De Salis of Cuppacumbalong Station in the Queanbeyan district and made his home at Lambrigg. Although wheat improvement became his lifelong and absorbing interest he successively bred horses, roses and fruit trees. One of his favourite books was Darwin's "Variation of Animals and Plants under Domestication", whose marshalling of ascertained facts regarding forms in nature made an appeal to him. He considered that carefully recorded observations in the field were of more value than reading. On being asked whether crossing might not be overdone he did not entertain the suggestion, some of his crossbreds having quite a complicated pedigree. It was his custom to select desirable types from crossbreds before they were fixed, thereby securing his objective much more quickly than if he were limited to material of a fixed character on both sides. When Mendelism came to light near the end of his career, it was disclosed that he had been working on Mendelian lines though unconsciously. The value of Mendel's laws to the plant breeder appears to be that a character can be secured if it exists in either parent. Farrer held that characters secured in a crossbred after a course of selection were of more value for breeding than similar ones propagated on their first appearance. This conclusion probably was sound, as continued pedigree breeding would eliminate certain undesired characters associated with his prime objective.

As already remarked, Farrer was absorbed in his work with wheat, holding that the wheat plant was enough in itself to engage one's mind and energies.

On taking up duty with him one was impressed by his methodical attention to details and his appreciation of integrity in recording notes. He corresponded with many workers overseas, among whom was Carleton who was instrumental in the introduction of durum wheats into America, the Messrs. Vilmorin of Paris, a seed firm of long standing and high repute, Professor Biffen of England, who with Professor Bateson established plant breeding on Mendelian lines. The visit of Mr. Moreland of India towards the close of his life afforded him the personal contact scientific workers so much appreciate and led to the production by the Howards of the Fusa wheat varieties which are believed to be related to Federation in their pedigree. Farrer was born on 3rd April, 1845, and died on 17th April, 1906, was one might say still in harness and preparing to visit the different Departmental Farms where his crossbreds were being tested.

Farrer wheats have been grown extensively in the Western States of America and are in favour for warm districts in certain European countries as well as in India.

In the summer he would visit the wheat paddock before breakfast and continued his crossing till late in the afternoon, occupying the later hours

of the day/

of the day in note taking. Between 200 and 400 crosses would be made in a season. In the long winter evenings he would study pedigrees and relationships, designing crossing to be effected next day. Farrer's delight was to cross swords with an opponent in a literary controversy such as his counter blast of "The too common crow" in reply to Dr. N.A. Cobb's article in the "Agricultural Gazette" on "The Common Crow". He would talk freely on wheat matters but was reserved and silent on other subjects though a visitor acquainted with his College associations could always draw him out. This sketch would not be complete without reference to his family life. Farrer's kindly though shy and reserved nature took shape in hospitality to his De Salis relatives and other friends frequently stayed with him. Mrs. Farrer was known as a "white woman" in the district.

Returning to the wheat experiments what led him first to devote his attention to wheat improvement was the ravages of stem rust in certain districts which provoked a correspondence in the "Australasian". Farrer signified his conviction that it would be possible by cross breeding and selection to check and even overcome the attacks of stem rust. With this in view he imported varieties of wheat from other countries, principally Great Britain and America and later from India and elsewhere. At the same time he made a collection of Australian varieties and selections from these, involving the sorting out and elimination of many varieties going under different names and in some cases isolating superior strains of approved varieties. After experience with this increasing collection of wheats in regard to their rust reaction, he also compiled information on other characters which stood him in good stead in later years.

His main objective may be said to have been the production of a better loaf of bread for the consumer, rather than the mere increase in yield for the benefit of the farmer. It will thus be seen that Farrer had a long outlook and like many a reformer he did not live to see the day when his "dream" was to be realised. Federation wheat, however, was a notable achievement and really brought him fame though not exactly in the direction in which he was working. When Federation appeared he could see that it was a bag-filler but he was not too well pleased with its baking qualities or its resistance to rust. Its susceptibility to rust did not militate against its far reaching adoption in the main wheat belt.

In working for the improvement of the loaf he necessarily made crosses for better baking qualities and in this had the ready co-operation of the Departmental Chemist in those days, Mr. F.B. Guthrie. The experimental mill was much used and led Farrer to pursue with fresh zest his researches in wheat improvement. To-day it plays an important part, with much additional equipment and improved machinery, in our programme of wheat improvement.

With regard to disease resistance, Farrer was much seized with the importance of resistance to bunt in new varieties; all the crossbreds were submitted to the bunt test before being propagated further. To-day flag smut resistance is counted to be more necessary as the dry dust treatment is relatively easy to carry out and the resistant varieties such as Florence and Genoa are not particularly productive.

In all Farrer's crossbreeding work he had in mind the resistance of stem rust. Not knowing the variety of physiologic forms in existence and the methods of combating the pest now successfully employed by Dr. Waterhouse and Dr. Macindoe, he was restricted to morphological forms of plants rather than varying physiologic forms of disease spores. To this end he selected plants with a glaucous green foliage colour, which indicated a thick cuticle and careful notes were taken on individual plant resistance, coloured print strips being attached to desirable plants showing early maturity and resistance to or escaping from rust attack.

Post-Farrer Developments:

Although Farrer kindled the torch, others have passed it on and it is now opportune to mention what plant breeding has done for the State in respect of wheat and other cereals. Dundee and Gular are two instances of the combination of artificial and natural crossing and selection. In the first case Dundee was the result of crossing Hard Federation, a fortuitous variation, with the

crossbred/

crossbred wheat Cleveland. In the second Gular resulted from the union of a crossbred of good baking quality with a productive field selection from a crop of Purple Straw. In Dr. Waterhouse's Fedweb and Dr. Macindoe's Eureka, both highly resistant to stem rust, we have cases of straight out artificial crossing.

Since Farrer's day the experimental milling and flour testing operations have been extended and the infection of unfixed crossbreds with flag smut and stem rust spores has taken the place largely of bunt infection tests and the morphological selection of apparently resistant individuals. Three wheats may be mentioned as of outstanding value in our wheat improvement programme. Hard Federation, Bena and Steinwedel X Timopheevi. The first two were apparently natural crossbreds between Comeback and Federation in the first case and Hard Federation and Marshall's No.3 in the second. It might have been noted that Comeback was perhaps Farrer's best wheat, having a baking value second to none. The crossing of Steinwedel with the primitive Russian type (Timopheevi) was done in order to combine the phenomenal yield of Steinwedel with the high resistance to disease of Timopheevi. The latter has already been secured in some of the crossbred material but yielding qualities have as yet been checked in the progeny. Further back crossing will probably overcome this. Farrer's choice of Cowra as a central breeding station for the carrying on of his work was a happy one as it occupies a central position in the wheat belt and a failure has not been known in this district. His plan of selecting varieties for varying conditions in the districts where those conditions obtain has since been followed out. Thus Warren and Thew wheats, once highly resistant to rust, were selected at the Hawkesbury Agricultural College. Waratah wheat was bred at the Wagga Experiment Farm, Eureka wheat and Belar oats were produced at the New England Experiment Farm at Glen Innes. Lampton oats was bred at the Bathurst Experiment Farm while Dundee, Gular, Hard Federation and Bena wheats were originated at the Cowra Experiment Farm as also the oats Lachlan, Gidgee, Guyra, Mulga, Weston and Kurrajong. The Sunrise oats originated at the Longerenong Agricultural College in Victoria. Breeding work was carried on at Cowra for about 36 years.

Oats:

Farrer gave it as his opinion that Algerian oats were too adaptable and widely grown for oat breeding to be undertaken with any success. Our experience, however, has been that ~~earlier maturing varieties have a definite place in~~ certain earlier maturing varieties have a definite place in certain districts which the popularity of Belar bears out and Lampton has largely replaced white Tartarian in the cool districts. The oat crop has long enough been the Cinderella amongst cereals. The fact that America grows more oats than wheat is not realised because the grain is mostly fed to stock in the winter. Oat growing is not as spectacular as wheat production but its steady increase is undeniable. Oats can be grown in all wheat districts and supplementary feeding is becoming recognised by the man on the land as a coming practice not only for fat lamb raising but for the growing of a uniform staple of wool however the season may turn out. Maize is restricted to certain districts but oats may be grown under any conditions.

Sunrise oats appeared in a crop of Algerian oats and by reason of its scanty stooling, almost fatally condemned itself. Its selection, however, was fully justified as it suits the coastal and certain other districts for fodder production and gave rise by selection to the varieties Belar and Mulga. Oats have yielded more fodder than barleys, thanks to our early varieties, contrary to the experience of American Experiment Stations. This was borne out at the Experiment Farm at Nyngan in the dry country. The second growth after cutting or grazing is also more reliable than that of barley. The grazing value of oats has come to be the more valued by growers as natural pastures are so often deficient and armed with objectionable awns. The protein content of oats 6 inches high may be 20% as against about 6% at the hay stage. Oats are closely associated with wheat growing in the control of footrot and better farm management.

Barley:

Only two varieties, Pryor and Trabut are recommended by the Department. The latter variety, having fairly good straw and a golden yellow grain colour, is popular with both brewers and farmers. It was selected from a range of samples imported from Algeria and supplied by Dr. Trabut the Director of Plant Breeding in that country. Crossing has been done with various barleys but the best barley emerging from the tests was so like Pryor that we did not pursue it further.

Rye:

Many varieties have been imported and crossing attempted with wheat, Farrer made one or two successful wheat-rye hybrids but our experience with these has not been promising. The American Balbo variety is likely to be the most successful of the sorts tested but seed is not as yet on the market. It is not quite so coarse in the stalk as Black Winter and stools more though not quite so early.

Rice:

This crop has been improved by Mr. Poggendorff who has mastered the difficulties of crossing, and it is hoped that the full story may be told at an early date.

Since the career of crossbred varieties is relatively so short and none of the wheats grown 20 years ago are among our recommendations to-day, it may be asked "What is the use of crossing?" We reply, "All advances in plant breeding depend upon variation in plants. Self-fertilisation secures them in a pure state while cross-fertilisation admits of further improvement. Although self-fertilisation is of wider extent in the vegetable kingdom than cross fertilisation, we find such adaptations for occasional natural crossing in plants that new types are continually coming to light in the field and being produced by the art of the breeder.

If one may venture to forecast the trend of wheat improvement in the years that may lie ahead it seems likely that resistance to footrot diseases, flag smut and rust will go hand in hand with moderately high baking qualities and an absence of such field defects as straw weakness and shattering. The footrots, are intriguing in their reaction on the minds of farmers, the partial damage they do results in attributing the condition to frosts or dry weather, not apprehending the presence in the soil of a fungus.

While high baking quality is still pursued by plant breeders the high yield that growers desire can at least be secured in varieties having the "filler" standard of quality.

Nature is lavish in her prodigal variations of form, and it is open to man to step in and secure by selection and crossbreeding not only existing forms that are continually emerging but also to produce new forms for the ever-changing kaleidoscope of our modern civilisation.

The Department has sought to concentrate on "whatsoever things are true, whatsoever things are honest, whatsoever things are of good report" and the public are entitled to be cognisant of things as they are in this line of work.

(Sgd.) J.T. PRIDHAM,
16.5.1944.