

Cross-Breeding and Grading of Cattle in India.

K. W. FORMAN, B.S.A.,

*Professor of Dairying and Animal Husbandry, Allahabad
Agricultural Institute.*

IT has long been an understood fact that cross-breeding as well as in-breeders, when used as a regular practice, is detrimental. Our master breeders used both these methods only as a means to an end of the establishment of our present-day breeds of cattle of the West. The same must be done if we wish to establish a breed of cattle in a short period of time which will be supreme in milk-producing and disease resisting qualities. In general cross-breeding is defined as the mating of individuals which are not related, but as a rule cross-breeding means the mating of individuals belonging to different breeds or the union of animals belonging to different species.

As in-breeding tends to simplify the germ-plasm and strengthen the powers of transmission, cross-breeding tends to weaken the prepotency and complicate the elemental constitution of the hereditary substance. Crossing has a tendency to break up established characters. It destroys combinations of characters which have long existed in the strains and which under the system of pure breeding have behaved in a manner like unit characters in transmission. Because of this, cross-breeding cannot be carried on indefinitely. It does, however, serve a good purpose in the starting of a new breed. The very fact that crossing disturbs the balance of characters and brings about recombinations in the germ-plasm gives it a peculiar value in causing variations to appear.

The breeder who is working with pure-bred animals which owe their purity of breeding to a long period of careful selection by skilful breeders cannot hope to cause any great degree of improvement. Pure-bred animals are already improved. About all any breeder working with pure-bred animals can do is to select out the highly desirable strains from those of lesser value already in the breed. But, as Johanssen has shown, there are very definite limits beyond which the improvement of pure lines cannot go. If Indian breeds could be improved to the high degree of efficiency of the Western breeds in a reasonable length of time then pure line breeding would be well worth while. There may be three or possibly four indigenous breeds which could be bred to a fairly high degree of milk-producing efficiency in a reasonable length of time and this should certainly be done, but it is very doubtful that any Indian breed will reach the high degree of efficiency of our major dairy breeds of Europe. Marked improvement must come through variation. Crossing is a common cause of variation. Variations which appear as the result of crossing may be desirable or undesirable. Desirable variations may be perpetuated by in-breeding or a new and valuable quality may be secured in this way.

There are two methods that may be followed after the first cross. The first method is the practice of grading after the first generation from two different breeds have been attained. The continual mating of pure-bred bulls to the first generation and to all the generations that follow will gradually develop a type identical to the breed the sires represent.

The second method is the practice of again crossing members of two separate families which are the first generation of two separate breeds. By applying Mendelian principles, which will differentiate the qualities of an animal and will determine their behaviour in transmission, the practical breeder will then carry on breeding methods upon the principles of segregation and dominance which are the foundation stones in the theory of Mendelian inheritance. Just a start in this second method has been made at the Lucknow Military Dairy and some very hopeful results have been reached so far. In this article, however, we will take up what has been accomplished through the first method at the Lucknow Military Dairy. Colonel Matson, Assistant Controller of the Military Dairies of the Southern Circle, has very kindly allowed me to make use of this information in any way for the advancement of breeding in India.

The first method was the method adopted in America. The Americans benefited by all that Europe built up through scientific breeding. They imported pure bred animals from Europe and mated them to native or unimproved animals. By the continuous use of pure-bred sires many high-producing animals of different breeds were established. This method unfortunately has proved unsuccessful in India as far as the Ayrshire is concerned. This fact is well recognized by the Military Dairy authorities who have done the most extensive work in cross-breeding in India. The main reason for the failure of the Ayrshire is due to the fact that it has not the characters which will blend with the characters of the Indian breeds on which it has been tried in the making of a progeny which will have constitution as well as good milking qualities in the second and third generations. Just how far this will apply to all the other European breeds is yet to be seen. However, it may be said that the Holstein-Friesian breed has so far surpassed the Ayrshire breed.

The $\frac{3}{4}$ -Ayrshire is very inferior to the half-bred Ayrshire and the $\frac{7}{8}$ -Ayrshire is a hopeless animal both from the point of breeding as well as a milk producer. The $\frac{3}{4}$ -Friesian has proved to be a superior animal to the half-bred Friesian. Just how far the Friesian can be used for grading-up purposes is not yet known. The $\frac{7}{8}$ -Friesian-Hariana grades are proved to be animals of good constitution and good milkers. Colonel Matson showed me many cases at the Lucknow Military Dairy to substantiate the above statements.

A cow in the Lucknow herd named Carnation has $\frac{25}{32}$ European blood, of which $\frac{24}{32}$ is Friesian and $\frac{1}{32}$ Shorthorn. The remaining $\frac{7}{32}$ is Hariana. She has an excellent dairy conformation, a good constitution, and gave 10,000 lb. milk during her first lactation period at three years of age. Carnation's granddam, on her dam's side a $\frac{1}{8}$ -Shorthorn-Hariana cow, only gave an average of four pounds of milk per day, which goes to show that the pure-bred Friesian sires in the third and fourth generations were responsible for this excellent animal. It will not be surprising if Carnation makes a record in milk-production for all India at the end of her fourth lactation. It is doubtful if any three-year-old cow in her first lactation has done so well, up to this time. Carnation's half sister, Gwendolyn, has $\frac{25}{32}$ European blood, $\frac{16}{32}$ of which is Ayrshire, $\frac{8}{32}$ Friesian, and $\frac{1}{32}$ Shorthorn. The remaining $\frac{7}{32}$ is Hariana. She has a very poor constitution and gives a very small amount of milk. Colonel Matson attributes this to the Ayrshire blood.

A fairer comparison, however, between the Friesian and Ayrshire breeds can be shown where both breeds were crossed to the same Indian breeds and where only two lines of blood were used in both cases. The half-bred animals in both cases are always good, although the Friesian half-breds invariably gave more milk than the Ayrshire half-breds.

The Friesian-Hariana half-breds and grades average 10,000 to 15,000 lb.

The Ayrshire-Hariana half-breds and grades average 3,000 to 9,000 lb.

The Friesian-Sahiwal half-breds and grades average 8,000 to 10,000 lb.

The Ayrshire-Sahiwal half-breds and grades average 3,000 to 9,000 lb.

The $\frac{3}{4}$ and $\frac{7}{8}$ Friesian-Hariana and the $\frac{7}{8}$ Friesian-Sahiwal always proved to be far superior in constitution and in milk production to the $\frac{3}{4}$ and $\frac{7}{8}$ Ayrshire-Hariana and the $\frac{3}{4}$ and $\frac{7}{8}$ Ayrshire-Sahiwal. Janet, a $\frac{3}{4}$ -Ayrshire-Hariana grade, gave about 2,900 lb. of milk in her first lactation, while Abigail, a $\frac{3}{4}$ Friesian-Hariana grade gave about 4,900 lb. of milk in her first lactation. Many more instances like the above go to prove conclusively that the Friesian is superior to the Ayrshire in crossing and grading up with the Indian breeds. The Friesian not only transmits its milking qualities to its offspring but its characters blend rather than conflict with the characters of certain Indian breeds, so that the progeny do not lack constitution as in the case of the Ayrshire grades.

Camella, a 15/16 European cow, of which 10/16 is Friesian and 5/16 Ayrshire, leaving only 1/16 country blood, gave a 42 lb. daily average during her first lactation at three years of age. She is a fourth generation cow, and in spite of the fact that the Ayrshire was used as the foundation bull and was used again in the second generation, the Friesian blood was strong enough to produce a cow with a strong constitution and a capacity for milk-production. It so happens that the Ayrshire-country $\frac{3}{4}$ and $\frac{7}{8}$ grades fall off badly in constitution; and milk production always falls off accordingly. Although according to Galton's law there is only twice as much Friesian blood as there is Ayrshire in the cow Camella, yet it is quite possible that there may be more Friesian blood represented in her, knowing what we do to-day about the make-up of the germ-plasm. In the Lucknow herd $\frac{7}{8}$ Ayrshire-country grades having poor constitutions were crossed with Friesian bulls and the progeny were quite often good, which seems to bear out the point that the Friesian blood in the cow Camella was responsible for her good record. It was Colonel Matson's opinion last November that the Ayrshire was a complete failure as far as using it for grading purposes in the tropics was concerned.

A very interesting experiment of crossing half-bred cows to country bulls showed that the progeny were poor milkers but when country cows were crossed with half-bred Friesian bulls the progeny turned out to be good milkers. This seems to indicate that the sires in both cases were more potent than the dams, in spite of the fact that in the second case the sire was a half-bred Friesian. When $\frac{1}{4}$ -European cows (Friesian or Ayrshire) were crossed with country bulls the results were poor, giving a $\frac{1}{8}$ cross averaging 6 lb. daily. When the same cows were crossed with a $\frac{1}{4}$ -Friesian bull the results were good; when crossed with pure Friesian bulls it gave $\frac{3}{8}$ crosses averaging 28 lb. daily. The $\frac{1}{4}$ -Friesian bull had to have a half-bred Friesian bull as a sire. He could not be the descendant of a country sire and a half-bred Friesian dam in order to make any improvement. This all goes to prove that if one knows the breeding of his Friesian bulls, even if they are not pure-bred, he can get fairly good results. Of course it is always safer to use the pure-bred animal. If, however, the Holstein-Friesian proves to be worth while for grading purposes, it would be better for a beginner to start with a grade-bull and then to follow up with a pure-bred Friesian bull rather than delay until he can afford to buy a pure-bred Friesian bull.

The best indigenous herd in India, which has been developed through careful selection for many years, has obtained an average of about 8,000 lb. of milk per year. The foundation cows for this herd were obtained from great distances and were most carefully picked. Are we satisfied with an 8,000 or 10,000 lb. average? Yes, at present, we are, but in the future we will not be. We must strive for higher levels, and I am doubtful if any indigenous breed even after many years of pure-line breeding will pass the 8,000 to 10,000 lb. level.

It may be that this first method of grading with pure-bred Holstein-Friesian bulls as well as with other European bulls that have not been tried may prove unsatisfactory. In that case as far as using this method as a general policy to be recommended for all would be unwise. However, we must wait and see how the experiments now being carried on turn out before any general policy for cattle breeders can be determined.

Experiments in the second method will take many years to work out. In the long run, however, a breed which can be produced according to Mendelian principles is sure to be satisfactory. It will take expert supervision and a great deal of time and money, but it would be time and money well spent.—*The Journal of the Central Bureau for Animal Husbandry and Dairying in India.* Vol. I. Part 3.