

## SELECTED ARTICLES

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### EXPERIMENTAL BREEDING OF DAIRY CATTLE FOR THE TROPICS\*

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#### INTRODUCTION

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**I**N the summer of 1941 the writer made a tour of the South Eastern part of the United States of America. He visited the King Ranch at Kingsville, property of the Kleberg family, and met Congressman Richard Kleberg and Dr. Northway. He saw the Brahman (Zebu) herd at Hungerford, property of Mr. Hudgin; the Jeanerette Station, Louisiana—Mr. Rhoad; and met Professor Williams and staff at the Texas A. and M. College; officers of the Federal Department of Agriculture at Washington D. C. and Beltsville, Md.; and finally Dr. Becker and officers of the Experiment Station at Gainesville, Florida. To these gentlemen he is much indebted.

The main object of this tour was to enquire into dairy cattle and their management, feeding and breeding, under sub-tropical conditions, especially from the aspect of nutrition where maximum use is made of home grown foods. Hence forage and fodder crops were of considerable interest. At the same time, knowing how artificial a life is led by good milking cattle in the tropics, the writer wanted to learn whether any attempt had been made to breed or to select a dairy cow more suited to cope with or bear conditions of heat and humidity such as are met with in the tropics, and therefore one able to be kept under more nearly average conditions, comparable with those under which dairy cattle are kept elsewhere. It is generally realized that the greater the artificial aid used to bolster up milk production, the higher the expense; all the factors which operate to reduce the efficiency of the dairy cow in the more tropical countries are not even yet known.

Thus the work done at the King Ranch in evolving a type of beef animal more suited to conditions in that part of Texas than high grade or pure bred Shorthorns and Herefords; and Rhoad's painstaking researches at Jeanerette concerning the behaviour of various types and crosses of livestock under conditions of heat and humidity, were of particular interest. This work all relates rather to animals kept for breeding and beef, the milk-producing side having not yet figured in the work, at least not in any way directly. The work current in the South Eastern United States in connection with pasture, forage and fodder, and especially that concerned with vital mineral elements, vitamins and parasites fits well into the picture, and undoubtedly is going

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\* By E. Harrison, C.M.G. (Imperial College of Tropical Agriculture) in "Tropical Agriculture", The Journal of the Imperial College of Tropical Agriculture, Vol. XIX., No. 4, April, 1942.

to be of increasing service in helping the farmer to surmount some of the admittedly greater difficulties of dairy farming in the more nearly true tropics : Panama, the West Indies, Colombia and countries in which conditions are akin.

### THE PROBLEM

One of the greatest bugbears of cattle farmers in tropical areas is how to breed to maintain virility, size, and the attributes of improved cattle breeds under conditions which vary so much from those in which the breeds were evolved and established. In the past cattle improvement has gone hand in hand with the improvement in availability and quality of foodstuffs and methods of feeding employed ; the yield of milk or of beef keeping pace at least with the extra effort made by the farmer. The standard of production has thus been steadily raised but efforts still are constantly being made everywhere to meet the nutritional requirements of cattle within reason and knowledge, and economically enough to ensure profits. Even then in tropical areas, from causes which were, and in many cases still are obscure, they have failed, and here the work being done in examining the role of minor elements and vitamins and on parasites, is of importance. But with all this and bearing in mind the breeding work which has been done and the researches of Rhoad, is it certain that we can ever accept as the dairy animal for the tropics a breed or breeds originally evolved in more temperate climes where natural conditions are so different and the range of foodstuffs which may be grown, including the composition of the pasturage, is so varied, and where rainfall and heat have not so profoundly affected soil composition ?

There are Asiatic cattle, admittedly not what could be called real dairy cattle, which, under ordinary and reasonably good conditions of feeding, do reproduce, thrive and give moderate to low milk yields in conditions of heat and humidity. They have been used with some measure of success in tropical areas in crossing with beef and dairy breeds evolved in temperate zones, for the purpose of imparting vigour, while considerable success has attended their use with beef breeds for ranching purposes. In the Santa Gertrudis selection something exists which is not just a cross, but rather in the nature of a breed in that animals of this selection, when interbred, reproduce themselves with but little variation from the average. The sooner this selection is described and its character and characteristics settled the better. Whilst it is said that nowhere does this Texas selection do so well as in the zone in which it was evolved, this does not in the author's view vitiate any claim which may be made to have it recognized as a breed. Were there one hundred thousand representatives of this selection, behaving reasonably as a pure breed, it would be recognized as a breed without hesitation.

What must be realized is that the system of crossing between breeds to produce a crossbred dairy animal does not take one far ; the crossbred dairy cow herself, being a cross bred, deliberately produced as a cross, is of no particular importance as a breeding cow. But, if as a result of breeding within the cross and subsequent selection, a blend of blood which carries the desirable characteristics were isolated and concentrated by breeding artifice, as was done with the Santa Gertrudis, then something might be achieved. This work

will have to be done deliberately. No doubt bulls and cows are being produced every year which could be used as the basis for a breed, but in the nature of things these individuals are lost or are never discovered and tested.

What would be contemplated is the mingling of "European" dairy blood with what can be termed "heat resisting" blood—with a view to isolating a suitable blend, and then concentrating the blood of the blend so that it can be bred pretty nearly true, eliminating by rigid selection any tendency to diverge from the original purpose and ideal, and finally isolating a group of individuals which will breed together in usual conformity.

What material exists, and how it should be used, is the next question.

Indigenous herds of cattle in India have, for countless generations, been bred and reared under conditions of high heat and some humidity and often are used to short commons. In Africa, too, there are animals, presumably descendants of cattle of the same generic type as Indian or Zenu cattle, but as a rule they are not so well defined as breeds. In South Africa, from the indigenous red Trek Ox type, specially sorted and matched mainly for hauling purposes, a more or less uniform type called the Afrikaner has been selected, and today is there recognized as a breed. Several enthusiastic South African breeders have been careful to select and breed herds of Afrikanders for milking capacity. In India there is a deliberate attempt to gather together into groups specimens which may ultimately be bred into dairy or milking stock. In parts of Africa attempts, on a quite inadequate scale, are being made to select groups of indigenous cattle showing milking tendencies but much remains to be done. The main reason why it is considered important to select from the indigenous cattle is because they have the ability to withstand the conditions and the endemic diseases prevalent in the country: the more European blood which is infused, the lower the ratio of recovery of calves from East Coast Fever infection, for instance. Thus, today, it is not easy to secure animals with heat resisting ability, which at the same time are renowned for milking capacity.

Rhoad has demonstrated, from data secured in studying respiration rates, sweat production and rise in temperature due to exposure to the direct rays of strong sunlight, that types of animals group themselves in his list in direct proportion to the "amount" of Indian or Zebu blood present. Thus the pure Brahman, a white or silver haired animal with black points, large drooping ears, often a "mealy mouth", a loose folded skin which has black pigmentation, stands out as a type least discommoded by heat and humidity. It has more numerous sweat glands. The Afrikaner—(unfortunately Rhoad has too few of these animals, and the published data from the Messina (Transvaal) Experiment Station are not yet sufficiently extensive)—stands below the pure Zebu, but high enough to indicate that it is equipped for heat regulation far better than a European breed of livestock (*Bos Taurus*). The Jersey, in whose background there may be some of this heat resisting blood, stands higher than the Hereford, Angus or Shorthorn; and as yet insufficient work has been done on the Friesian to enable it to be placed accurately. There are, moreover, no records which might indicate why the South African farmer prefers the more nearly black coated Friesian to the whiter coated strains.

The heat resisting ability of the Jersey is to be noted, its almost typical mealy mouth can be seen dozens of times a day amongst degenerate Zebu types of cattle in Central Africa.

The tropical dairy cow might well be built up of a blend of Zebu blood, if possible with milking tendencies ; and one or other or both of the better class true dairy animals—Jersey or Friesian. South Africa has its “ Cape Cow ”, a dairy animal—resembling and possibly being actually a Friesian grade topped on a *pot pourri* of breeds of all kinds with the Hottentot cow as the original female ancestor—here there is *no known* proportion of heat resisting blood, but there is some present. The Hottentot cow more than probably figures largely in the make up of the Afrikaner and it may be taken that the Hottentot cow was not unrelated to the Indian type of cattle.

But one should not fall into the groove of postulating an optimum proportion of Zebu as against temperate zone (*Taurus*) dairy blood. One should rather think, as did the men of Santa Gertrudis, of how to isolate a decent looking good producing type suited to the conditions, and how to concentrate that blood until a range of stock resembling a breed is obtained which can be multiplied and dealt with as a breed ; namely, a number of better class herds, from which can be drawn bulls showing the best of type and performance and the best of blood, to use on specimens of the type in less productive herds.

The system of Jersey cattle breeding, the “ bull testing ” or the “ proven bull ” system adopted by the United States Department of Agriculture, whilst it takes cognisance of type and points, does not essentially rely on blood lines but on the producing performance of the daughters of a bull. This is an almost purely utilitarian approach. In other words the ability of a bull to raise or maintain in his daughters, the known productive capacity of their dams—good milking specimens of the Jersey Breed—is a measure of the value of a bull. This ability is highly prized. Naturally the fecundity of the bull, likely length of useful life and so forth, has its place in their calculations. But until a bull, through its daughters, has demonstrated his capacity, ability and superiority, he is not a herd header. With the high standards set there is a tendency for blood lines to assert themselves, but these lines are not dominant in the breeding programme. At the Experiment Station, Gainesville, a combination of “ proven utility ” and “ blood line ” is used in the mating of the Jersey herd. So, similarly, in making the new tropical breed, bulls must be found, which, under feasible conditions of dairy herd management, will tend to throw daughters, from recorded females of type and constitution similar to the bulls ; which show an advance on their dams from the butter fat or milk producing angle.

#### SUGGESTED PROJECTS

Now as to making these crosses, namely :—

- (a) Indian type bulls on groups of milk recorded European type females, and the reciprocal.
- (b) European type bulls of milk proven breeding capacity on groups of Indian type cows which are known as milkers.

It should be recollected that type in Zebu cattle is rather dominant, especially in project (a). The concentration of blood in the Zebu is comparable with

the concentrated blood of European pure breeds—what is required is not the milking capacity of the Indian cow, but rather its adaptability to tropical conditions, vigour, and natural adjustment for comfort. Its actual conformation and the nervousness of its females are not wanted. What is wanted is hidden physiological ability. It is suggested that the bulls used in project (a) be the first cross between two distinct types of Zebu, if possible finding a good bull or bulls out of decent milking and reasonably quiet Zebu cows and using them on the best milking cows of another type or breed of Zebu, or alternatively using Afrikander-Zebu crosses.

The young bulls of this first cross should then be taken, with their presumably warring blood, and used on good recorded Jersey cows and, if at all feasible, on good recorded Friesian cows. The first record will be the fecundity of the bull, the next the extent to which the appearance of the dam is dominant and finally the heifer record for milking performance and behaviour compared with that of its dam. Within 4 to 5 years of the production of these bulls information should be available regarding the ability of a "cross bred" bull of double Zebu strain to settle known milking cows, and the extent to which his use has masked or depressed in his daughters the milking capacity as carried in their dams. That, at any rate, might indicate bulls of mixed Zebu origin which do or do not seriously interfere with the milking capacity of their daughters out of recorded cows.

Now to concentrate this Zebu + European blood it will be necessary to inbreed, and to do this at least two bulls of the cross will have to be isolated whose daughters, out of good milking cows of the same origin or cross as themselves, are not deteriorated as dairy cows relative to their mother's performances. It may be assumed with what extent of reasonableness the author is quite unaware, that a son from an original recorded cow is comparable in make up with his full sister, at any rate a son by the same bull following a good performing daughter out of a good recorded mother may be comparable with that daughter. This will not be known until these bulls are tested on the half bred daughters of the other bull, and possibly on pure bred cows of the breed. With luck and replication it may be possible to get a "half bred" which can be used to set up a new type. On the other hand this may fail utterly.

The reciprocal cross of the European type bull on Zebu  $\times$  Zebu or Afrikander  $\times$  Zebu heifers will need to be made. This way, European on Indian has, it is believed, the virtue of giving a more "European" looking female. Grading up should not follow, but rather an attempt be made to concentrate the blood of the best heifers from this second cross by a form of line breeding—using as bulls the full brothers of the best milking heifers. The first cross Zebu-European heifers will have to be handled in a way approximating to the handling of dairy cows; in this way, at any rate, docile animals and animals which milk reasonably well when deprived of their calves would show up. The milk records of these cross bred daughters would be almost sure to be much superior to those of their dams, and their milk records would have to be compared with known records of pure bred heifers, the daughters of the pure bred bulls used. It would mean the use of proven sires on a range of mixed Zebu heifers or cows. The object should be to get a couple of a hundred cross bred heifer calves each year for two years at least, preferably three years; and also a large number of young bulls.

In project (a) where the Zebu cross bull would be used on recorded dairy cows, the mechanism of the work would consist in producing the bulls, letting them out to a number of dairy farmers say twenty or more, for service, each one to say twenty-five of their recorded and known dairy cows, and subsequently purchasing the calves at fixed prices. These calves would be taken to the extensive project centre where they would be reared, and that centre would be equipped for raising and handling a large number of milking heifers as well as a large number of young bulls. It is unnecessary here to expand on the details of management, they would be uniform and the project is large scale. The writer believes this project could only be carried out in one of the southern states of the United States of America, for nowhere else can one find a sufficiently large number of breeders with recorded pure bred cows, and consequently the Project Farm would need to be located there.

For project (b)—the use of proven sires on crossed Zebu dams—a venue in Brazil or India will have to be chosen, and some time may elapse before a large enough herd of females is gathered together. It is certain that it will be difficult to find a group of cattle owners with females of the breeding required, and thus the project itself may actually be more laborious, as the original heifers may have to be bred and raised before the proven sires are brought down.

A number of small herds of Zebu cross cows headed by proven bulls brought down from the United States will be required, and the offspring will need to be reared and tested for milk production. A considerable number of the young bulls will have to be kept also, until the heifer records have been obtained. Thereafter the project will be concerned with line breeding in the second cross.

Why it is felt that both projects are needed is because there is some slight evidence that the use of "European" bulls on Zebu type females gives a half bred animal which resembles the sire much more than the dam, both in conformation and milking capacity. But the evidence is very slender. The basic conditions vary. In tropical areas there are more Zebras and therefore more females of that type. In subtropical areas, there are well recorded herds, and there the "European" female is available in quantity. There may be some sex-linked inheritance—at present we are limited to general statements, admittedly born of observation, such as—the sire determines the shape, the dam has an influence on the internal set up and so on. The author believes that none of these statements made about cattle has any scientific basis.

In both of these projects the finding of individuals which show the desired characteristics will be the more laborious but the more certain the greater the magnitude of the experiment. By the use of artificial insemination it will be possible the more rapidly to increase the numbers of cattle carrying altogether, or in part, the breeding required.

The question arises: are the projects, which will be expensive, really worth while? Will it not do to go on in our present hit-and-miss fashion until by luck some breeder hits on the right thing, or until a group of breeders get together deliberately and purposely set out to do this work?

In view of the increasing importance attaching to the value of milk and milk products in human nutrition, and the need for incorporating the keeping of

profitable livestock in conjunction with tropical agricultural operations, there is no question of the importance of the problem. The real question actually is will it pay to make a deliberate and controlled attempt to create a new strain or strains of tropical milking cattle suited to lower elevations in the tropical regions of the Americas? It is a contribution sorely needed, for we see the great attempts made by dairy farmers in these lower tropics to conduct dairy farming operations, using the highest possible grade of milking stock, under extreme artificial conditions. Practically the whole of the concentrate portion of the ration is imported, but debility of stock becomes apparent. The length of the service period, namely the period which elapses between calving and getting the cow in calf again, shows an increase. Vigour is what is lacking, that and the inability of an "improved" animal to be comfortable in the ordinary conditions of the lower tropics. Dairy farmers in the tropics shelter cattle, kill flies, keep the byres scrupulously clean, exercise the bulls, have cows served early in the morning, rear calves in such a way as to lessen the risk of infection by internal parasites and exclude the chance of pneumonia. They try to and do supply essential major and minor elements and food constituents according to the requirements of maintenance, increase and production. They import known and expensive feeding stuffs, and simulate as far as they can the treatment and feeding of dairy cows in what they think of as the better dairying regions of the world. In spite of all this, the improved dairy cow in the tropics fails to reach a reasonable standard of production from total nutrients fed. In some parts of the tropics dairy cows are taken to the "hills" to recuperate, some owners are using air-conditioning. Others, recognizing the uselessness of going up to too high a grade of European blood, regularly introduce common heifers and cows into their herds—in fact, in the herds there is a continual process of restricted grading up, and at the same time, by the practice of settling shy breeders by the use of Zebu bulls, there is an unsatisfactory process of grading down. The "blood" in the herds is in a state of a continual flux. The author is of the opinion that the tropics should have its own breed, breeds or strains, and that this problem should be tackled systematically in order to achieve the aim of greater certainty of productivity and profit from each individual bred, not high productivity from a few individuals. In Jamaica, where there are many experienced cattle breeders, they are well aware of the problem. A steadily increasing population must demand economical livestock, and so it is with many another tropical country. Ten years ago Hammond recommended the kind of programme sketched here—not on so large a scale however—with a view to producing a dairy cow for Jamaica; but no deliberate large scale attempt was made, which is a very great pity.

Rhoad, in a paper published under the auspices of the Union Pan Americana, has discussed the situation of dairy cattle breeding in Brazil. He shows in that paper and in an earlier one, that crossing, back crossing, and grading up and down pervades the efforts of dairy cattle breeders in Minas Gerais. He has demonstrated the fact also that in these herds there are animals of above average production, and has shown their ability to respond to more continuous and exact supplementary feeding. There is always an attraction in isolating and grouping better specimens and breeding a superior herd, not only with the

object of maintaining a better dairy herd, but also for producing bulls for use among commoner herds. It is assumed that this common sense approach to a solution of the problem is being pursued there. But it must be recognized that it does not give any reliable information as to how the foundation cow should be bred, or was bred. The bulls from such a herd will go out and be used presumably on cows of breeding similar to themselves, but there is no certainty of this.

No attempt here has been made to work out the cost of the suggested projects—they would not be cheap, as a minimum of 400 original cows would be needed for each, requiring a minimum of 20 bulls to create the experimental animals in each project. Subsequently, uniformity of treatment to yield comparable results is essential and continuity of objective and of management is most important. Projects of this nature are long term and twenty-five years would be a reasonable period to set.

This paper does not pretend to cover the subject; it will have served its purpose if it arouses interest, and points the need to a thorough survey of the position. Several countries are interested, and it might well be best for representatives from them to confer on this and related subjects in order that the best lines of approach may be elucidated, and laid down.