

# CRITICAL MEASURES OF ADAPTABILITY OF FARM ANIMALS UNDER TROPICAL CONDITIONS

Medidas críticas de la adaptabilidad de los animales domésticos bajo  
condiciones tropicales

Mesures critiques de l'adaptabilité des animaux domestiques  
sous conditions tropicaux

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The object of this paper is to challenge the old and very often unjustified believe that the genetic improvement of cattle in tropical and subtropical regions «must always be strictly relative to the prevailing environment» viz. that the aim of the breeder should be to breed cattle «whose genetic potentialities conform as closely as possible to the facilities of that environment for optimum phenotypic expression and that the limits set by that environment must never be exceeded» (1).

## INTRODUCTION

In modern animal production we are less concerned with animal survival, for cattle can stay alive in almost all climates. Of much greater importance is the extent to which environment affects productivity, because this knowledge enables decisions to be made as to the degree of modification of an environment which is required to support optimum performance.

In short, the effects of climate on the animal have two components: the direct effect is on the physiology of the animal in terms of body temperature and respiration rate. This in turn effects feed and water intake and brings about changes in the animal's productivity. The secondary effect of climate is on the feed supply and health of the animal, because in certain areas diseases are a serious barrier to efficient production. Another very important point must be added here; those countries where environment is at its most severe are frequently in the early stages of development and technical skills tend to be at a low level.

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It is impossible to mention all papers dealing with physiological aspects, like sweating, coat type, coat and skin colour and heat production and the reader is referred to PRESTON & WILLIS's textbook (2). In several publications dealing with the effects of climate on growth and efficiency and reproduction, often interesting conclusions are reached like «it would be unwise to select for improved genetic types on a plane of feeding and management superior to that predominantly found under African ownership, and that genetic studies ought to be carried out on a maintenance level of feeding» (3).

Other research workers in the field conclude that climates with mean average temperatures in excess of 18°C were not suitable for British and European breeds of cattle. Classifications schemes have been put forward to place cattle breeds into regions according to altitude and temperature (5, 6). The statement «cattle of improved breeds cannot thrive under tropical conditions and their productivity may be of no account» expresses a negative attitude, which is completely unacceptable to this author.

#### RESULTS OBTAINED WITH «BOS TAURUS» BREEDS

The basic question is thus as to which extent high performing *B. taurus* breeds can be used in adverse environments normally inhabited by *B. indicus* types. The data are fragmentary, but it can be concluded that with respect to heat stress the Brahman, the Afrikaner and similar *B. indicus* types are superior. It is due to the fact that these animals are able to dissipate heat easier but not from lower heat production. These animals are better adapted to the climatic conditions, firstly, as a result of natural selection for survival and secondly, as a result of their lower productivity. In 1958 the opinion was brought forward for the first time (8) that high producing strains of tropically adapted *B. indicus* animals would be under the same stress as high producing European breeds. It seems to be easier and more certain to adapt high producing *B. taurus* to the conditions than to make *B. indicus* high producing.

TABLE 1

BIRTHRATE OF AFRIKANER AND SUSSEX COWS AS EFFECTED BY STAGE OF PRODUCTION AND AGE  
(Armoedsvlakte data)

	Afrikaner		Sussex	
	<i>n</i>	Birthrate %	<i>n</i>	Birthrate %
All cows ... ..	662	64	700	78
Dry cows ... ..	187	84	129	79
Nursing cows ... ..	475	61	571	78
3 year old cows ... ..	125	51	142	78
Heifers ... ..	164	87	175	92

TABLE 2

THE DAILY MASS INCREASE UNDER INTENSIVE CONDITIONS OF AD LIB. FEEDING AFTER WEANING  
(Mara data)

	Daily gain Kg
Afrikaner	0.67
Hereford	0.99
Bonsmara	0.78
Simmentaler	0.90
Afrikaner × Hereford	0.88
Afrikaner × Simmentaler	0.79

The first example compares Sussex and Afrikaner cattle under the same stress conditions and shows that the fertility is more severely effected in *B. indicus* as in *B. taurus* (9). There is a clear difference between breeds in their response to lactation stress, the incidence of «lactation anestrus» was markedly higher among Afrikaner cows (Table 1).

In the following three tables the superiority of the purebred European breeds over the *B. indicus* types is clearly indicated. The data have been collected at the Mara Research Station, situated in a very hot and dry area in South Africa (10) (Tables 2, 3 and 4).

Complete data could be given of a comparative study of the growth potentiality, slaughter weight, carcass measurements and economical value of 10 breeds of cattle at the Omatjenne Experimental Station in South West Africa», but only two aspects will be mentioned, the average calving percentage and the total yearly income out of oxen from 10 cows. The experimental station is situated on the 20° Southern latitude and 18° longitude, 4500 feet above sea-level, with an average summer temperature of 25°C and winter temperature of 16°C. It is in a summer rainfall region with an average annual precipitation of 490 mm and can therefore be considered as semi-arid. The comparative cattle breed experiment was started in 1951 under extensive veld conditions (Tables 5 and 6).

TABLE 3

GAIN OF HEIFERS OVER A PERIOD OF 140 DAYS ON VELD  
(Mara data)

	Total Gain (Kg)
Afrikaner	78
Hereford	81
Bonsmara	79
Simmentaler	86
1/2 Afr.: 1/2 Her.	84
1/2 Afr.: 1/2 Sim.	86
3/4 Afr.: 1/4 Her.	84
3/4 Afr.: 1/4 Sim.	80

TABLE 4  
 VARIATION IN GAINS WITHIN BREEDS AND CROSSES OVER ONE SEASON ON VELD  
 (Mara data)

	Best gain Kg	Poorest gain Kg	Difference Kg
Afrikaner .....	68	25	43
Hereford .....	82	41	41
Bonsmara .....	91	50	41
Simmentaler .....	107	66	41
1/ Afr. : 1/2 Her. ....	73	57	16
1/2 Afr. : 1/2 Sim. ....	77	36	41

These data indicate a difference of 75,6% between the extremes and again the superiority of some of the European breeds over the *B. indicus*. More examples could be given indicating the superiority of the former (12, 13).

DISCUSSION

These series of examples provide enough evidence for new critical measures of adaptability of farm animals in tropical and subtropical areas. As far back as 1955 Cartwright considered that animal resistance to heat stress as measured by rectal temperature in climatic chambers was not necessarily an indication of their potential to grow in hot weather (14). In general one should be careful of transferring results of climatic chamber experiments to the potentialities of growing or fattening animals. It will also be remembered that the use of heat tolerance rating as an aid in selection was discontinued in the Louisiana experiment (15).

TABLE 5  
 AVERAGE CALVING PERCENTAGE OVER 10 YEARS  
 (Omatjenne data)

	Average cal- ving per- centage
Simmentaler .....	86.0
Pinzgauer .....	83.6
Hereford .....	82.5
Afrikaner .....	81.2
Brown Swiss .....	80.6
Sussex .....	78.8
South Devon .....	77.8
Aberdeen Angus .....	76.0
Shorthorn .....	72.1
Red Poll .....	71.5
Average .....	79.0

TABLE 6

TOTAL YEARLY INCOME OUT OF OXEN FROM 10 COWS  
(Omatjenne data)

	Rand *
Simmentaler .....	761
Hereford .....	749
Brown Swiss .....	714
Pinzgauer .....	706
Afrikaner .....	677
South Devon .....	672
Sussex .....	627
Brahman Crosses .....	577
Shorthorn .....	504
Red Poll .....	488
Aberdeen Angus .....	439
Average .....	628.44

\* 1 Rand = 87,15 pesetas.

The measurements usually used in beef production, weight for age, daily gain, feed efficiency, weaning weight, carcass data should also be used in animal improvement in tropical and subtropical regions. Selection for live weight gain or efficiency in tropical conditions will both improve performance in these traits and will lead to the development of cattle with the best sweating ability and coat types.

#### SUMMARY

In conclusion, it is stated that the negative philosophy put forward by the so-called tropical specialists that no improvement is possible in tropical areas and that large areas of the world are consigned to low levels of animal productivity must be replaced by a positive approach: European breeds have a good chance in many of the subtropical regions. The tropics and subtropics can support a more intensive animal production than the temperate regions in view of the great future potential. The writer believes that the former regions will be able to produce not only enough animal proteins for their own population but also will be able to export to the developed countries, e.g. to supply the EEC with beef of which there will be a shortage of 15 percent in 1980 (16). The climate does not play the same rôle as 20 years ago, we are doing more and more for our animals; the climate has been overemphasized for many years, it is much less of an obstacle than the level of the technical development of the countries in these regions.

The most sceptical reader will be convinced if he considers the phenomenal development in Israel, where the Friesland cattle produces more milk than the same breed in Europe and where in spite of a decrease in the conception rate of cows during the summer months due to the hot weather and lactation

stress the average number of inseminations per cow is not higher than 1.75 (17). This is really the proof of the superiority of technology versus nature, and of optimism over pessimism.

#### RESUMEN

En conclusión, se llega a la deducción de que la filosofía negativa, patrocinada por los llamados especialistas en asuntos tropicales, de que no es posible la mejora ganadera en las áreas tropicales y de que grandes zonas del mundo están condenadas a mantener bajos niveles de productividad animal, debe ser sustituida por una afirmación positiva: las razas europeas tienen una buena probabilidad de éxito en muchas de las regiones subtropicales. Los trópicos y los subtrópicos pueden albergar una producción animal más intensiva que las regiones templadas en vista de su gran potencial futuro. El autor sostiene que tales regiones no solamente podrán producir proteínas animales en cantidad suficiente para su propia población, para abastecer al Mercado Común Europeo con carne de vacuno, de la cual podrá proporcionar un 15 % en 1980. El clima no juega el mismo papel que hace veinte años, porque cada vez se perfecciona más el manejo de nuestros animales. Este clima ha sido sobrevalorado durante muchos años y constituye un obstáculo menor que el nivel del desarrollo técnico en dichos países.

El lector más escéptico debe estar convencido de ello cuando considere el desarrollo fenomenal de Israel, en donde el ganado frisón produce más leche que la misma raza en Europa, y en donde, no obstante el descenso del porcentaje de concepciones en las vacas durante los meses del verano y al *stress* de la lactación, el promedio de inseminaciones por vaca no es mayor de 1,75. Ello constituye realmente la prueba de la superioridad de la tecnología frente a la naturaleza y del optimismo frente al pesimismo.

#### RESUME

En résumé, on arrive à la conclusion que la croyance négative, patronnée par ceux qu'on a appelés «spécialistes» en sujets tropicaux, qui affirme qu'il n'est pas possible l'amélioration du bétail dans les aires tropicales et qu'il existe de larges zones du monde condamnées à maintenir de bas niveaux de productivité animale, doit être substituée par la croyance positive: les races européennes ont une excellente probabilité de succès dans un grand nombre de régions sub-tropicales. Les tropiques et les sub-tropiques peuvent héberger une production animale plus intensive que les régions tièdes, vu leur grand potentiel futur. L'auteur soutient que de telles régions pourront produire autant de protéines animales en quantité suffisante pour leur propre population que pour les exporter aux pays développés; par exemple, pour approvisionner le Marché Commun Européen avec de la viande bovine, dont elles pourront fournir 15 pour cent en 1980. Le climat ne joue pas le même rôle qu'il y a vingt ans, car le maniement de nos animaux se perfectionne de plus en plus. Ce climat a été surestimé pendant beaucoup d'années et il constitue un obstacle plus petit que le niveau de développement technique dans ces pays-là.

Le lecteur le plus sceptique doit être convaincu de cela s'il considère le développement phénoménal d'Israël, où le bétail Frison produit une quantité de lait

supérieure à celle qu' produit en Europe, et où, malgré la descente du pourcentage de conceptions chez les vaches pendant les mois d'été et le stress de la lactation, la moyenne d'inséminations par vache n'est pas supérieure à 1,75. Réellement, cela constitue la preuve de la supériorité de la technologie sur la Nature, et de l'optimisme sur le pessimisme.

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