SUMMARY

Tropical environmental conditions include in addition to extreme weather, some social, economical and political conditions which have to be considered as a whole. The gap between production marketing conditions prevailing in Latin America and industrial countries has widened, making transfer of technology increasingly difficult. The most important point is how the technical knowledge, already available, is to be brought into production. This is the main challenge. Fast increase of genetic potential for economically important traits can be brought by use of additive genetic differences among breeds, but there are economical limits to wide environmental modifications that allow the expression of those potentials. Resources should be concentrated on developing and improving stock for the production-marketing conditions. Wide applications of performance testing schemes have to be applied to monitor the success of the breeding schemes applied.

INTRODUCTION

The central issue of this paper is beef cattle breeding under tropical conditions. The same basic principles of breeding applied to temperate climates hold true for tropics. However, two major factors: environment and socioeconomic constraints, make other considerations mandatory. Under most tropical conditions, beef cattle plays a major role in the utilization of grassland areas unsuitable for cropping. These areas are characterized by scarce and seasonal rainfall, poor soils, low quality forage and wide infestation of internal and external parasites, all of which, seriously limit beef production. As the degree of modification of the natural environment is determined by the value of the increase production relative to cost of improving the environment, it should be realized that it looks improbable that long term solutions would include, radical environment modifications rather than breeding the proper genotypes. Under these circumstances breeding for increase production will be just an indirect selection for adaptability, however, everybody recognizes that the situation is not as simple as it looks. The most critical aspects in defining a breeding program is to determine the goals to achieve. At the same time, this is also the most difficult task, because long term goals are required in order to tilt further developments of the industry. In order to be more specific I will try to discuss, from present conditions, future trends, and finally define long term goals, and what is been done to achieve these goals.

THE FUTURE

In the years to come, the producer will continue struggling to increase income, elude risk and manage with reasonably efficiency the limited
resources available. The different phases of the beef production process will be more clearly separated. On one side, the cow-calf operation will produce a feeder male to be sold soon after weaning, on the other, the stocker and fattening operations, where bulls will be finished. The major consideration on meat quality will be sex, weight and age of the slaughtered animal. The larger portion of the beef cattle population composed of brood cows and replacements will be on the less developed and productive areas. New developments in cultivated forage will be first supplied to milk or dual purpose cows, then to fattening bulls and the remaining land, suitable for higher levels of improvement, will be utilized by the livestock breeder. A great deal of progress will be made in terms of improved management practices of proven effectiveness and limited risk. Individual identification of the animal will permit better record keeping; more generalized use of breeding season, allowing better synchronization of nutritive resources and herd requirements; systematic weaning and the following division of the herd by sex, age and productive status, will permit limited use of strategic supplementation of young and lactating animals; development of practical techniques of forage conservation, range improvement practices and soil conservation; general improvement of transportation; wider use of mineral supplementation, vaccination, dipping, and higher level of sanitary control. All these practices are been used and proven to be cost effective, but in a very limited number of ranches. At low stocking, where selectivity of the diet is optimum, very high levels of production per cow could be achieved. Of most importance to realize, is that for years to come, the beef cow will be relegated to marginal areas, where the main drawback is the nutritional value of the forage.

THE GOALS

The shape, size, color and hide annexes of the beef cow have been a subject of controversy between producers, and frequently professionals have taken part in these controversies. However, under any feasible production-marketing situation to come, reproductive efficiency i.e. proportion of weaned calves from cow exposed to breeding, by year, is the biological component of highest economical value (Ordoñez,1981). To properly assume its role, the cow should be fully adapted to the conditions in which she is going to live, in order to insure a long productive life. She has to start calving early, to maximize lifetime production. In addition, she has to calve every year and wean a healthy calf, not necessarily fat. Her milk production should be such to guarantee high survival of the calf without affecting her reproductive activity. High milk production would reduce system efficiency due to reduced reproductive performance (Ordoñez,1978). There is strong evidence that milk production in Bos Indicus cattle is sufficiently high (Neidhardt et al.,1979; Cundiff et al.,1986). Other secondary traits under consideration are those related to fitness and management (tick and disease resistance, temperament, etc.).

The final product of ranching is the weight of cattle sold, insuring high reproductive performance, will increase the amount of product sold. However, increasing growth potential to attain higher marketing weight, is
another component of high economic value (Ordoñez, 1981). Increasing absolute growth rate brings an increment in feed efficiency on the fattening operation and improvement in some carcass traits. Unfortunately, high absolute growth rate is highly and positively correlated to mature weight and age at puberty (Cartwright, 1970) and with age at first calving and calving interval (Mariante et al., 1978). Series of studies have shown (Long et al., 1975; Ordoñez, 1978) that increase in mature size in breeding herds would reduce efficiency of the whole system due to increased maintenance requirements of the cow herd and reduced reproductive efficiency. At the same time, selection for weight per day of age at eighteen months considerably increases birth weight (Plasse et al., 1979). Those further increments could surpass optimum birth weight for highest survival of the calf (Ordóñez et al., 1979). Falconer (1960) explained how the mean value in a population is the optimal value under the environmental conditions to which the population is subjected. Large mature size seems to be an adaptive disadvantage in the tropics. An optimum mature size which corresponds to the environment-management system combination has to be found for the more important particular situations. Nevertheless, adaptive limitations in mature size would limit the extent to which growth rates can be increased under extensive conditions.

**BEEF MONITORING SYSTEMS**

Once the breeding objectives have been defined it is necessary to establish techniques to evaluate the individuals subject of improvement and the success of the whole breeding program. Data collection, processing and interpretation will not be cost effective if they are only used to evaluate individual animals for selection. The gains to the producer and breeder have to be large enough to support interest and provide investment in genetic improvement (Smith, 1989). That is why, a beef cattle recording scheme should evaluate the whole production system, specially monitor success of the breeding schemes been applied. It should be directed to identification of biological types of known genetic composition that match genetic potential to general and specific production-marketing conditions and to establish the matting systems that produce numerous individuals of those genotypes (Contreras and Ordóñez, 1990).

Producers should satisfy minimum conditions that allow accurate data collection. However, monitoring systems have to pay attention to the producers circumstances. They should be adapted to the production system and satisfy the following requirements. They must be simple; help the general herd management; have to be of low direct cost; reports should allow the producer to accurately identify good and poor individuals; information has to be prompt and simple; finally, proper technical assistance to make full use of the results has to be provided.

In Venezuela and Brazil, experience exists on Beef Cattle Performance Programs (Ordóñez, 1973; Rosa et al., 1987), nevertheless, just a very small proportion of the ranches are involved. Many reasons are responsible for the limited application of Beef Performance. Some of them should be mentioned:
low level of instruction of producers, lack of technical personnel at the
production areas, lack of producers organization, deficiency in
transportation and communications, in addition to unawareness of the
advantages of its use.

Some progress has been made to simplify and increase accuracy of the
process. Monitoring reproduction efficiency has been stressed in the
tropics. Its absolute and relative economic values are very high to be
ignored. The interaction of environment with milk production levels and
mature size in determining fertility rates, calf mortality, calf crop
percentages and production efficiency have been clearly illustrated, in a
quantitative manner, in the tropics and should not be disregarded. Actually,
pregnancy test at the end of breeding season is a generalized practice, but
the identification of environmental factors that affect it, is a requirement
to allow proper statistical adjustment of the results in order to increase
accuracy. The recording of cow weight and conditions, evaluated just by
counting ribs exposed, at the end of the breeding season, allowed to increase
R-Square values from .20 to .70 (Ordóñez et al., 1980).

Growth rate has traditionally been evaluated by birth, weaning and long
yearling weights or other weight at fixed age. These measurements require
work throughout the herd monthly or bimonthly, with great effort and cost.
Weights at fixed dates, instead of ages, at the beginning and end of the
growing season, (May and September), and gain between both dates were
evaluated as a way to simplify recording. As the results have shown (Ordóñez
et al., 1981) we can expect the same selection response utilizing either
September or 18 month weight. The generalization of the method to commercial
operations is been done with apparent success.

BEEF CATTLE BREED RESOURCE UTILIZATION

Crossbreeding between Bos taurus and Bos indicus breeds has been done in
Latin America since the early thirties. A large number of research results
were summarized by Plasse (1989) and Barbosa and Duarte (1989).
Crossbreeding systems that exploit heterosis, complementarity, and match
genetic potential with feed resources, offer the most effective means of
managing genetic antagonisms previously mentioned (Koch et al., 1989).

When developing breeding systems applicable to the current production
conditions of the tropics, some requirements have to be satisfied. To be of
use, such crossbreeding systems must: (1) allow female replacements to be
generated throughout the herd (2) effectively exploit heterosis (3) not
interfere with selection for additive traits (4) both male and female have to
be fully adapted to the conditions under which they will have to work.

Choice of crossbreeding systems by predicting crossbreds performance
through application of genetic parameters might be misleading, since genetic
parameters are environmental dependent. If production conditions or lack of
adaptation limit the expression of the genetic potential, predicted
performance will not resemble actual performance (Ordóñez, 1985). Resources
should be concentrated on developing and improving stock for general and specific conditions to the country concerned. Mainly directed towards (1) evaluation of potentially competitive breeds within the conditions, (2) testing breeding systems that combine different attributes of each breed and (3) monitoring success of the breeding scheme (Smith, 1989).

Rotational Cross has been promoted as the system that fits all the previous conditions. Nevertheless, there is evidence of limited success, specially due to intergenerational variation, number of breeding pastures and size of herds, and limited use of artificial insemination in the whole herd.

Composite populations have been proposed and tested. They need to be further investigated. New breed development may be indicated when (1) heterosis is important, (2) initial unfavorable recombination effects are negligible, (3) there exists new objectives or altered production-marketing conditions and (4) in areas where simplicity of the breeding program is essential.

Composites will contribute to simpler management requirements, number of pasture required will be minimal, particularly favorable to small ranchers. Selection for additive traits will be limited in the first generations if inbreeding is to be kept at minimal levels. The necessity to increase number of individuals as the breed develops will restrict selection intensity in further generations. If epistatic effects are important, loss of heterosis will be larger than what is theoretically expected. A large herd has to be kept in order to keep inbreeding at a low level. Finally, the success or failure of the breed developed is determined at the precise moment when it is decided to close the population. Sampling errors, inappropriate evaluation of the prevailing conditions, and unexpected performance of the new breed, may result in the loss of resources, time and efforts. The literature contains just the successful trials, while many failures stay withheld to the public.

Another crossbreeding scheme that has been proposed for extensive condition is the repeated use of F1 bulls on successive generations of crossbred females (Ordoñez, 1975). The properties of such a system have to be studied in more detail. At the moment it is used in ranches of Venezuela. Some expected advantages of such a system are: simplicity of management, as it produces its own replacements and has minimum pasture requirements; it is flexible, allowing changes in the exotic breed due to adjustments in performance or changes in production-marketing conditions; high adaptation of parents genotype that combine in itself different attributes of the participant breeds; full exploitation of heterosis in parents and offspring. The expected heterosis from the system at equilibrium is equal to that of an interse mating, but increasing in successive generations, allowing time to provide the genotypes with the appropriate environment. There is not renewed inbreeding since the population is kept open. Also, selection in the exotic breed in the exporting country can be capitalized at a minimum cost.

The discussion on Beef Cattle breed resources cannot be complete if the
role of Criollo cattle is not considered. Hernández (1981) in Colombia, Plasse (1981) in Venezuela and recently Barbosa and Duarte (1989) in Brazil, have very well documented the outstanding performance of Criollo in crossbreeding with Zebu. De Alba stated how crossbreeding has proved to be both a blessing and a curse of the Criollos. Criollo x Zebu crosses have shown superior reproductive performance and growth to both, parent average and pure Zebu. However, after a few generation of upgrading to Zebu, performance decreases up to a point where all the advantages of intermediate crosses between Criollo and Zebu are lost. Limited but important efforts are been made mainly in Brazil, through the Brazilian genetic resources conservation program (Mariante and Trovo, 1989), where “local” Criollo populations are been identified, characterized, evaluated and preserved through semen and embryo storage. With the help of the fast growing biotechnology now available, the chances of saving the Criollo are much greater.
REFERENCES

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