OPEN NUCLEUS CROSSBREEDING SYSTEMS FOR BREEDING CATTLE IN THE TROPICS.

M.M. Osorio
CEICADES-CP, Apdo. Postal 24, Cárdenas, Tabasco, México.

SUMMARY

Genetic variation among breeds offers an oportunity to develop efficient cattle for the diversity of cattle production systems. In the tropics where resistance to the adverse environment is essential to realize potential production, it is necessary to amalgamate resistance and potential production through practical breeding schemes that can be implemented at commercial level. In this paper a breeding system that combines crossbreeding and selection in a Open Nucleus Breeding Unit linked to commercial herds and that is generally called Open Nucleous Crossbreeding System is presented.

INTRODUCTION

The recorgnition of great variation in cattle productions systems and the possibility of matching their livestock needs by using the variability among breeds by means of some way of crossbreeding has been long recognized (Dickerson 1969, Robertson 1971). However it is not until great scale breeds evaluations had been found (Cundiff et.al.1986, Thiessen and Taylor 1986) that the exploitation of that variation has been strongly encouraged (Koch et.al.1989). In order to use that great genetic variability different breeding systems that involve crossing has been sugested (Koch et.al.1989), but has been concerns on the need of selection of the crossbred population and open nucleus breeding units has been suggested (Cunningham 1981, Smith 1988). In the present paper a breeding system that combines crossbreeding and selection of crossbred animals within open nucleus units named Open Nucleus Crossbreeding System (ONCS) is presented.

OPEN NUCLEUS CROSSBREEDING SYSTEM

The main features of the ONCS are: a) A structure having a Open Nucleus Breeding Unit (ONBU), linked to one or two downward tiers. b) Crossbreeding is used in the ONBU to produce a crossbred population that assembles traits level needed in the downward commercial tier. c) The female initial population must be from a well adapted breed to local conditions. d) intensive recording in the ONBU. e) Selection in the ONBU crossbred population aims to fine tune the traits level to local conditions. f) Once the structure is stabilazed, each tier will produce their own crossbred females. g) ONBU should search for new genetic material among the world breeds. Specific strategys must be developed for the intoroduction of new material into a ONBU.

THE GENETIC IMPROVEMENT OF CATTLE IN THE TROPICS THROUGH ONCS.

The genetic improvement of productivity in adverse environments should start by recognizing that realized productivity is determined by two group of factors, one related to production potential and the other to resistance to environmental stress (Frisch and Vercoe 1982). Cunningham (1981) claimed for the need of clarifying the role of heterosis, additive diferences between populations and the interaction of both of them with variations in the

varying environment. Frisch (1981 and 1987 and Frisch and Vercoe (1984) gave physiological reasons that would explain the genotype x environment and heterosis x environment interaction observed in realized productivity in the tropics. In breeding animals under those conditions to improve realized productivity what is needed is to found or developed animals with high resistance and high potential production. Although these two determinants of realize production are negative related across and within breeds (Frisch and Vercoe 1984) there is no physiological incompatibility between them as the F1 Hereford-Shorthorn x Brahman enjoyed high levels of both set of traits (Frisch 1987). Therefore crossbreeding using different breeds to combine high potencial production and high resistance and selecion to fine tune the crossbreeding product, seems a sound strategy to overcome the limitation of the environment to realize high levels of potencial productivity.

ONCS FOR DUAL PURPOSE (milk and beef) CATTLE.

It is common to find in the tropics native cattle (Zebu, Sanga, Criollo, etc) or their crosses with European breeds in small dairy or dual purpose herds, wich enjoy high adaptation to local adverse conditions. Progeny (C1) of those cows by A1 european bulls migth be the start point of the ONBU. C1 Females selected on contemporary ONBU performance difference for growth, first lactation milk production and calf weaning weight are mated to selected C1 bulls or A1 to european bulls, accordingly to their level of european breeding. Males are selected on their own growth performance. From the next generation onwards Cn females would be selected on their dam ONBU contemporary productivity difference and their own contemporary ONBU performance difference for growth first lactation milk production and calf weaning weight. Cn bulls are selected on their dam ONBU contemporary productivity difference and their own contemporary performance difference for growth in the presence and absence of local environmental stresses. As this point potential production is introduce in the ONBU by A1 matings of Europian breeds(E) to high resistant C cows(Cr). Resistance for any environmental stress(es) is introduce to the ONBU by A1 matings of tropical adapted breeds bulls(R) of high resistance to that environmental stress(es) to CrE cows (See figure 1).
The proportion of Cr, CrE and C cows in the ONBU would vary according to specific situations in a given ONCS. As the level of environmental stresses might vary across commercial herds, bulls for specific herd should posses high resistance to the stronger local stress(es).

ONCS FOR BEEF CATTLE

Zebu(Z) breeds are the most used in the Tropics for beef Cattle production. This is due to the extensive beef cattle systems used that require high resistance to tropical environmental stresses which is enjoyed by Z breeds. However, as they are of low growth potential (Frisch and Vercoe 1984, Thorpe et.al. 1981), they have poor response to any amelioration of a stressful environment. Crossing Bos taurus x Bos indicus has been successful to solve this problem but the solution is not a long term one and has some pitfalls as discussed by Frisch and Vercoe (1982). Frisch (1987) proposed as an alternative solution a 3-way cross involving Brahman x European Beef breed(E) follow by a third unrelated breed that has high level of resistance and high level of productive potencial (those levels have no neccesary be as high as the F1BE). ONCS could be used to utilize

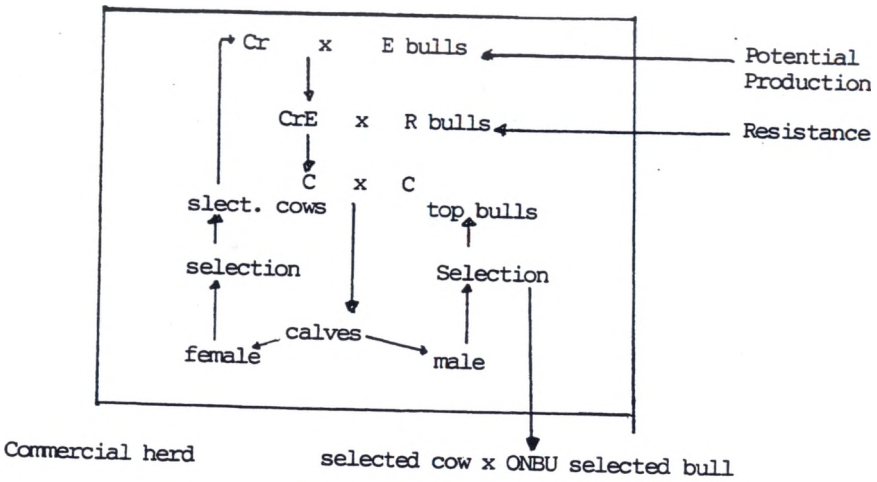

Fig. 1.- Schematic representation of a ONBS for dual purpose cattle.

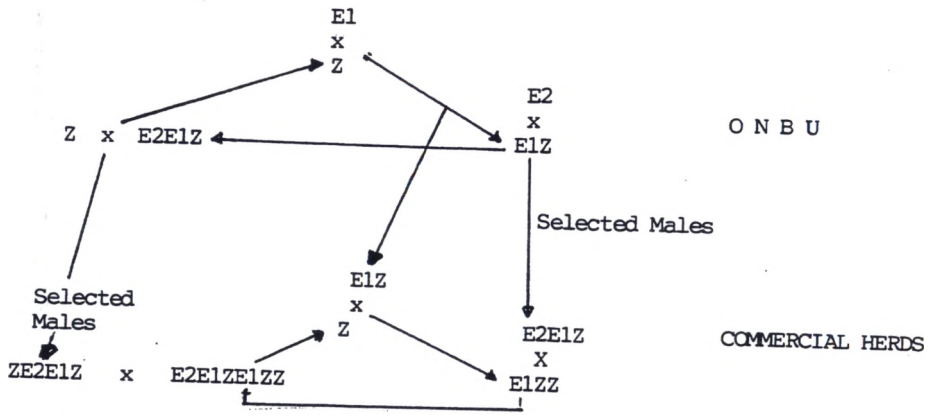

FIG. 2.- ONBS with two 3-way cross linked, one in the ONBU and the other in commercial herds.

those principles perhaps with great flexibility. For example, a ONBU is stablished starting with Z local cows and using A1 matings to E1. Selected F1 females(Ce1) of high resistance to environmental stresses are mated to a second European beef breed (E2) that complements productivity traits to E1 and avoiding decrease of heterosis. Then Z bulls are used on selected females sired by E2(Ce2). Selected crossbred males (Ce1, Ce2 and Cz are used in multiplier or commercial herds serving as bulls of another crossbreeding system (See fig.2). Selection is for growth in presence and absence of environmental stress(es). Care should be taken that bulls to be used each cycle have been the top for the main components they are expected to contribute to their crossbred progenie. Crossbred female selection would be for weigth for age at first oestrus and then productivity in first reproductive cycle. Also it should be mention that Z can be other zebu breed if it would improve resistance by trait or genetic complementation. The same applied to other E or european composite breed that might be introduced in the ONBU in subsecuent cycles.

REFERENCES

Amble, J.N. and Jain, J.P. 1967. Comparative performance of different grades of crossbred cows on military farms in Indian Journal Dairy Science, 50 : 1695-1702.

Cundiff, L.V., Gregory, K.E., Koch, R.M. and Dickerson, G. (1986) Genetic diversity among cattle breeds and its use to increase production efficiency in a temperate environment. Proc. 3rd World Cong. Genet. Appl. Livestock Prod. 9: 271-282.

Cunningham, E.P. (1981) Selection and crossbreeding strategies in adverse environments. Animal Production and Health paper No. 24 FAO, 279-283.

Dickerson, G.E. (1969) Experimental approaches in utilizing breeding resources. Anim. Breed. Abst., 37 : 191-202.

Frisch, J.E. (1987) Physiological reasons for heterosis in growth of different cattle genotypes reared in different environments. J. Agric. Scie. Camb. 103 : 137-153.

Frisch, J.E. and Vercoe, J.E. (1982) Considerations of adaptive and productive components of productivity in breeding beef cattle for tropical Australia. Proc. 2nd World Congr. Genet. Appl. Livestock Prod. 4 : 307.321.

Frisch, J.E. and Vercoe, J.E. (1984) an analisis of growth of different cattle genotypes reared in different environments. J. Agric. Asic. Camb. 103: 137-153.

Koch, M.R., Cundiff, L.V. and Gregory, K.E. (1989) Beef cattle breed resource utilization. Rev. Brasil. Genet., 12, 3 Supp. 55-80.

Robertson, A. (1971) Optimun utilization of genetic material with special reference to crossbreeding in relation to other methods of genetic improvement. Xth International Congress of Anim. Production. Paris. Reports. Theme II Genetics, 57-67.

Smith, C. (1988) Genetic improvement of livestock using nucleus breeding units. World Anim. Rev., FAO, 65 : 2-10.

Thiessen, R.B. and Taylor, C.S. (1986) Genetic variability among cattle breeds for beef production. Proc. 3rd. World Cong. Genet. Appl. Livestock Prod., 9 : 261-270.

Thorpe, W., Cruikshank, D.K.R. and Thompson, R. (1981) Genetic and environmental influences on beef cattle production in Zambia. 4 Weaner production from purebred and reciproccally crossbred dams. Anim. Production, 33 : 165-177.