OPEN NUCLEUS CROSSBREEDING SYSTEMS FOR BREEDING CATTLE IN THE TROPICS.

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SUMMARY
Genetic variation among breeds offers an opportunity 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 Nucleus Crossbreeding System is presented.

INTRODUCTION
The recognition of great variation in cattle production 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 suggested (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 stabilized, each tier will produce their own crossbred females. g) ONBU should search for new genetic material among the world breeds. Specific strategies must be developed for the introduction 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 differences 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 FI Hereford-Shorthorn x Brahman enjoyed high levels of both set of traits (Frisch 1987). Therefore crossbreeding using different breeds to combine high potential production and high resistance and selection to fine tune the crossbreeding product, seems a sound strategy to overcome the limitation of the environment to realize high levels of potential 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, which enjoy high adaptation to local adverse conditions. Progeny (Cl) of those cows by Al european bulls might be the start point of the ONBU. Cl Females selected on contemporary ONBU performance difference for growth, first lactation milk production and calf weaning weight are mated to selected Cl bulls or Al 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 Al matings of European breeds(E) to high resistant C cows(Cr). Resistance for any environmental stress(es) is introduce to the ONBU by Al 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 potential (those levels have no necessary be as high as the PIBE). 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 will great flexibility. For example, a ONBU is established starting with Z local cows and using AI matings to El. Selected F1 females (Cel) of high resistance to environmental stresses are mated to a second European beef breed (E2) that complements productivity traits to El and avoiding decrease of heterosis. Then Z bulls are used on selected females sired by E2(Ce2). Selected crossbred males (Cel, 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 progeny. Crossbred female selection would be for weight 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 subsequent cycles.

REFERENCES