

PRINCIPLES OF IMPROVEMENT OF GROWTH OF CATTLE IN THE TROPICS

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Growth rate of cattle under tropical grazing conditions is low by temperate standards. It can be improved by altering the environment to approach that found in the temperate areas or more realistically, developing breeds which make best use of the existing or partially altered environment. An understanding of the principles involved can be expected to lead to the most efficient synthesis of such breeds.

The major determinants of the expression of growth rate of cattle in the tropics are their inherent growth potential and level of adaptation to heat stress factors, disease, parasites and fluctuating levels of generally poor quality nutrition. Eons of continual exposure to these environmental constraints has evolved breeds resistant to these constraints. Prolonged periods of feeding at levels close to or below maintenance has evolved breeds with metabolic rates below those of comparable temperate (*Bos taurus*) breeds. Inherently low metabolic rate is also conducive to high heat tolerance. Metabolic rate and growth potential seem inextricably bound and in consequence, the tropically adapted breeds (*Bos indicus*) have low inherent growth potential. The temperate breeds have higher metabolic rates but cannot express this higher growth potential because of lack of tropical adaptation - each constraint reduces food intake and consequently growth rate. By cross-breeding, the adaptive qualities of the *Bos indicus* can be combined with the productive potential of the *Bos taurus*. Heterosis in the crossbred for growth under field conditions is in its simplest form principally the expression of this combination of both adaptive and productive qualities. In the halfbred these variables lie between the values of the twoparental breeds. Consequently, field growth rate of the F1 will exceed that of either parent provided the plane of nutrition will support increased growth rate and resistance to environmental constraints is sufficient to allow expression of the increased growth potential. Where environmental conditions are severe and the plane of nutrition very low - as occurs over large areas of the tropics - growth rate of the locally adapted *Bos indicus* may be near the optimum attainable without environmental modification.

Interbreeding to produce F2+ generations with concurrent selection in these segregating populations for growth under field conditions will eventually lead to the development of a breed well adapted to local conditions and which has the maximum growth rate sustainable over the long term in that environment. If environmental resistance of the F1 is insufficient, an increase in the proportion of *Bos indicus* will increase, field growth rate and vice versa where only a low level of environmental resistance is required. Selection within an F2+ developed from this back-cross population can thus be expected to achieve maximum growth rate more rapidly than selection within the halfbred F2+.

The species proportion which will give maximum growth rate in the crossbred is thus heavily dependent on the severity of the environment. Consequently, it-cannot be assumed that the introduction of a highly productive *Bos taurus* breed into a cross with a local *Bos indicus* will lead to any dramatic improvement in growth without some concurrent improvement in environmental conditions. These principles should be considered when advising on cattle breeding schemes for tropical areas, particularly those designed for implementation at the village level.

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