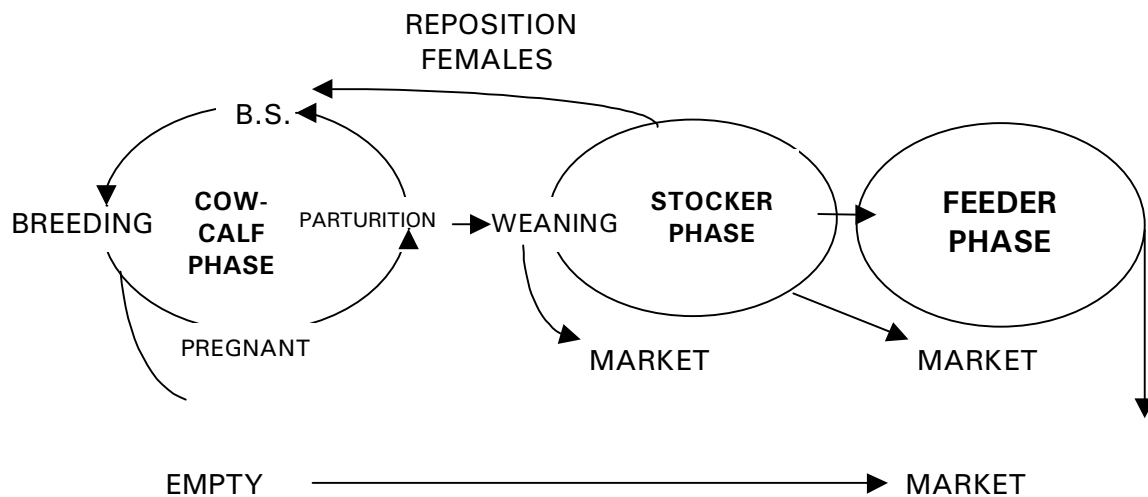

Cross-breeding strategies for beef cattle production in Brazil

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Introduction

Beef cattle production in Brazil is an activity of historical importance. The bovine was introduced here in the first decades after discovery and since then, has not only been an important component of the socio-economic development, but also a fundamental element in the formation of the Brazilian agriculture Gross Income. The Brazilian bovine herd comprises of approximately 159 million head, while the *per capita* beef consumption is around 38 kg (ANUALPEC, 1997). The Brazilian beef production system is formed by three distinct phases: cow-calf, stocker and feeder phase. In spite of having some producers who develop any of these particular phases independently, the large majority of cattlemen work with the complete system, according to figure 1.



*Figure 1. Structure of a complete Brazilian beef cattle production system.
Source: Euclides Filho (1999a).*

During the last years, similarly to what is happening in other important segments of the economy, this activity has been the object of a complete transformation. In fact, the different segments of the beef cattle production chain are becoming aware of the need to change due to the pressure imposed by different segments of the agricultural sector, especially those related to the production of swine and poultry and more recently, by external markets. The improvements should allow the establishment of a profitable, efficient and competitive business. In other words, the search for alternatives, which allow the establishment of a sustainable activity, becomes crucial. This scenario of changes is completed by modifications in the behaviour of consumers in Brazil that began to demand better quality products.

In such a context, the competitiveness of the final product constitutes an element of fundamental importance. In order to adjust them to this new reality it is necessary that the Brazilian beef cattle production systems make some changes. Among these changes are those which allow the production of animals to be more precocious in reproduction as well as in the finishing phase. Furthermore, it is important for such animals to produce beef of good quality, which should be understood as meat that is tender and free of residual toxicity as well as having low content of components known to be harmful to human health.

Among other things, Euclides Filho (1997) predicted that cross-breeding will, in the near future, play an important role in beef commercialised in Brazil.

On the other hand, it is clear that efforts are being made to integrate the different segments of the beef cattle productive chain. This, plus the demands put forth by the consumers, with respect to the quality of the final product, creates a requirement for animals which are able to produce tender meat in a biological and economic way. The average indexes observed in Brazil, however, are incompatible with such a need and are far from the known potential (Table 1).

Despite this scenario, several analyses performed during the last three to four years have indicated a clear possibility of increase in the participation of beef cattle in the Brazilian Gross Income. This is so, not only due to the increasing importance observed in the activity itself, but also by the great opportunities of insertion of Brazil in the international beef market.

This is possibly one of the reasons for enhancing beef production and for the establishment of an increasing number of animal breeding programmes in the country. Thus, what is presently observed is the existence of a great number of such programmes, with partner participation, all of them directed to genetic improvement of pure-breds and/or cross-bred animals.

Table 1. Mean performance indexes of the average Brazilian herd and in more developed technological systems.

Indices	Brazilian average	Improved System-1*	Improved System-2*
Birth rate	60%	>70%	>80%
Mortality until weaning	8%	6%	4%
Weaning rate	55%	>66%	>77%
Post-weaning mortality	4%	3%	2%
Age at 1 st calving	4 years	3 years	2 years
Interval between parturition	20 months	<17 months	<15 months
Slaughter age	4 years	3 years	2 years
Slaughter rate	17%	20%	35%
Carcass weight	210kg	230kg	240kg
Dressing percentage	53%	54%	57%
Stocking rate on pastures	0.9 an./ha	1.2 an./ha	1.6 an./ha

Source: Modified from Zimmer & Euclides Filho (1997)

* Estimates taken from producers and from some experiments in process.

Among the several alternatives available to meet the demands mentioned above, cross-breeding could be emphasised. According to Euclides Filho (1996), this is an important tool for promoting improvement in the production and productivity of the beef cattle industry.

However, it should be mentioned that such expectation would only be met if the combination of breeds results in a composition that meets final business priority, which is, profitable. To meet this requirement, it is necessary that the animals resulting from cross-breeding produce high quality beef at competitive costs.

Under these circumstances, one way to fulfill demands related to meat quality and productivity of the systems, can be reached by crossing *Bos taurus* with *Bos indicus*. This tool has been utilised for many years with good results, but the frequency with which it has been applied varied through the years.

There are many experimental results and experiences in real production systems, which attests to the effectiveness of cross-breeding in contributing to the beef production chain as a whole, by improving biological performance (Euclides Filho *et al.*, 1995; Euclides Filho *et al.* 1997a, b; Perotto *et al.*, 1998). The contribution of cross-breeding can also be observed in the reduction in time of the production cycle by reducing the age at first calving and also, age at finishing and slaughter (Cezar & Euclides Filho, 1996 and Euclides Filho & Cezar, 1995). It is necessary, though, to proceed with

Cross-breeding as an alternative for genetic improvement

more detailed evaluation, taking into account not only the capacity of the production systems to be profitable, but also account for their biological and economic efficiencies.

Cross-breeding involving an adapted European breed can also make a huge contribution, mainly, if that breed is combined with a specialised European breed. This should be done as a means of improving performance and carcass conformation.

Thus, the question is to find an ideal combination of breeds, which will meet expectations and contribute to sustainable and competitive production systems. Work done by Euclides Filho *et al.* (1999c) suggested that these needs can be attained by combining 75 percent of European genotype with 75 percent of adapted genotype (adapted European x half non-adapted European – half Zebu); or even, 75 percent and 50 percent, (non-adapted European x half adapted European – half Zebu), respectively.

Other experimental results have indicated that crosses between European and Zebu breeds, and even between adapted European breeds, can produce individuals which are good performers and have tender meat (Razook *et al.*, 1986; Nardon *et al.*, 1996; Euclides Filho *et al.* 1997a; Perotto *et al.*, 1998).

**First approach
adopted by
Embrapa Gado
de Corte with
respect to
cross-breeding
programmes**

After the first great emphasis put on beef cattle cross-breeding programmes in the forties, this tool was largely forgotten in Brazil. Three decades later, however, in the beginning of the seventies, cross-breeding was rediscovered. At this time, several important cross-breeding programmes were initiated. During this period, the preference was geared to big size animals in clear support of breeding the objectives of weight and weight gains. Among the European breeds the chosen ones were the “Continental” breeds, and among the Zebu, the Nellore was the breed most utilised. At that time, late seventies, The National Beef Cattle Research Center from the Brazilian Agriculture Research Corporation (Embrapa Gado de Corte), started a cross-breeding programme based on a rotational scheme, which involved three continental breeds: Fleckvieh, Charolais and Chianina and the Nellore breeds. These crosses had weight gain and final weight as its main breeding objectives. After more than ten years of evaluation, it was concluded that the breeding objective should be changed and at least two aspects of the programme should be re-evaluated: the cross-breeding system to be utilised and the type of animal, which should integrate such a system. It is important to emphasise that the production system must be based on pastures, mainly for the cow-calf phase. This is so, due to the increasing requirement for efficiency improvement and to the need for maintaining pastures as one of the most important components of the beef cattle production systems in Brazil. This characteristic is crucial in the definition of the activity’s competitiveness.

However, it should be emphasised that, in general, these production systems are moving from a low input level to a medium and even, in smaller scales, to a high input one. This is true, especially for the other phases, namely, stocker and feeder phases (Figure 1).

With respect to the first point, cross-breeding programmes, it became clear that it should be set based on simplicity. As far as breeding objectives are concerned, the experience and the changes which have occurred in the demands pointed out the need for decreasing the emphasis on weight and weight gain. Discussions carried out on several workshops and meetings conducted with breed associations and representatives of other segments of the beef production chain led us to conclude that the breeding objectives should emphasise precocity while keeping in mind the importance of animal adaptability.

This new approach is focused on the search for genetic groups adapted to less use of chemical control of internal and external parasites, even though adaptation is not a breeding objective. Similarly, this approach will require profitability despite this trait not being included in the breeding objectives.

At this point in time, mid nineties, it became clear that the shift in the breeding objectives and precocity became the most important trait in their definition. Thus, the animals or genetic groups we are looking for should be early maturing, starting the reproductive life as young as possible; having moderate adult sizes and should also be able to produce tender meat in an efficient way.

Other important limitations related to the Brazilian production systems which affect their performance, include low managerial level of the farmers, inadequacy of labour reduced use of artificial insemination and limited capacity for investments. These constraints should be taken into account because they can limit the possible actions one can take and guide the introduction of any technology into the system.

Thus, any cross-breeding programme for such conditions should be based on two main aspects, which in turn will be the solution of the binomial profitability-simplicity. Euclides Filho (1999b), suggested that for tropical conditions, especially tropical Latin America, the beef cattle production systems should be based on the following cross-breeding types: i) terminal crosses; ii) use of a composite breed; and iii) use of cross-bred bulls, mainly the F_1 s, as sires under natural service. More specifically the author classified the cross-breeding types as:

**The new
cross-breeding
approach
adopted**

Terminal cross

- 1a) simple terminal cross; and
- 1b) classical terminal cross.

Composite genetic group

- 2a) Formed by F₁s in *inter se* crosses;
- 2b) Formed by crosses between F₁s out of two different sire breeds and from the same dam breed (third breed); and
- 2c) Formed by crosses between F₁s out of two different sire breeds and from two different dam breeds (third and fourth breed).

These main lines of cross types in combination with the demands evidenced by the several meetings and workshops previously mentioned, have provided since 1993, the support that Embrapa Gado de Corte needed to redirect the work being conducted. Thus, the new approach was set up on the basis of three different lines of action:

- i) comparison of efficiency of beef production systems that utilise F₁ females out of an European breed of medium size (Angus) and the Nellore breed, with the efficiency of systems based on F₁ female progenies of a large breed (Simmental) bulls and Nellore dams. In this case, a terminal sire is used and all the progeny is finished in a feedlot. This approach has the objective to identify the most profitable type of cattle for this production system;
- ii) establishing the basic knowledge for the development of a composite breed involving Nellore, Caracu and Red Angus/Devon; and
- iii) evaluation of crosses with the objective of developing, in a further step, a composite breed that combines only European breeds. In this case, two British breeds (Red Angus and Devon) will also be used with the objective of improving the reproductive and finishing precocity and carcass conformation. In order to execute these projects and to attend the proposed objectives it was necessary to establish cooperative work, in which farmers, breeder associations, research centres, private enterprises and universities have been involved. Such integration of efforts should contribute to greater efficiency in the transferral of the results to the entire beef cattle production chain and dramatically increases the scope of the project.

The last two approaches are based on the expectation that a composite breed, besides being able to utilise the benefits of heterosis would allow that small farmers utilise such benefits. Furthermore, the last approach would produce an animal that could be crossed with Zebu breeds allowing the system to capitalise important levels of heterosis.

Considering the first case mentioned above, the comparison tries to identify the animal type (medium or large adult size) that best adjusts to production systems where the cow-calf operation is kept exclusively on pastures. Since there is a need for less dependency on artificial insemination, the decision was to use a composite breed instead of an European one as a terminal breed. The composite breed chosen was a result of a cross between

Charolais and Nellore, named Canchim. The second cycle of this project should be based on the organization of an integrated system which combines Nellore breeders, F₁ female producers and terminal cross holders. The European breed to be utilised at this stage will be the most efficient one during the first phase.

Preliminary results of this project have indicated important differences between the systems based on animals of different adult sizes (Euclides Filho, 1995; Euclides Filho *et al.*, 1996 and Euclides Filho *et al.*, 1999a, b).

Considering the second and third alternatives, the initial work has been concentrated on the evaluation of crosses involving two different genetic bases for the dams: one based on a Zebu breed (Nellore) (ii), and the other where the dams are from an adapted European breed (Caracu) (iii). The results of this phase, also preliminary, indicate a great possibility of success. Euclides Filho *et al.* (1999), in a trial to evaluate the crosses involving one Zebu breed (Nellore) and three European ones, two non-adapted (Angus and Simmental) and one adapted (Caracu), observed that the cross-bred animals (half Caracu – quarter Simmental – quarter Nellore and half Caracu – quarter Angus – quarter Nellore) had higher weight gain and better food conversion than the Nellore. Furthermore, the authors observed that the cross including Angus conferred best food conversion and the greatest weight gain. Panel tests and the Warner-Bratzler Shear evaluation have indicated a high degree of acceptance of the meat produced by these animals with special reference to tenderness.

Regarding the crosses involving Caracu dams (iii), the results are still not available as the first inseminations were performed in the last breeding season. This project is being carried out in cycles. Each cycle should last for three to four years and will be composed of different groups of breeds. During the present cycle the following breeds are being evaluated: Caracu, Belmont Red, Senepol and Romosinuano.

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