JIVA, 7(1):2009, 5-8

INBREEDING IN OUR CATTLE POPULATION-A WAKE UP CALL

Raghavan K. C.

During the last semester of this academic year, I had offered a course in Animal Breeding for the undergraduate students of the college. As a part of the course, I had given an assignment for which each student was expected to go to her/his respective Panchayath and collect details about the trend in the population of domestic animal and poultry, as well as information on different measures taken by the government for improving the production potential of our livestock. Most of the students took the job very seriously and all of them narrated the details with utmost care.

One of the students brought a photograph he had taken from the notice board of the Veterinary hospital in his panchayath. It detailed the pedigree of the bulls used in the insemination programme. The genuine doubt of the student was whether the contents of the notice were not contradictory to what I had taught them in Animal Breeding classes. On keenly going through the notice, which I learnt, is displayed in majority of Veterinary hospitals of the state, I realized that almost all the bulls used in the programme had excellent pedigree with regard to dam's yield and while thirteen of them belonged to Holstein Friesian (HF), three were Jersey breeds. Though Jersey bulls had an average dam's yield of 13 kg, HF excelled in this trait and one had an average of 30 kg. This was fine but then I found that seven out of 16 bulls had the same sire!! It was also mentioned that the semen of these bulls were available in all Artificial Insemination centers. I asked my students to analyze the situation. Their observation made me really proud. A sample is as follows.

1. A substantial reduction in genetic base could be expected.

2. Thirteen out of sixteen were HF and three were Jersey, and the usage of purebreds would increase our already high exotic inheritance.

3. The breeding value of the sire of bulls was not provided.

4. The yields of dams of the sire was not very high. It varied from 13 to 30 lit per day.

There is no doubt that our genetic base will get narrower. With an approved breeding policy promoting the use of pure breds only in local populations and high ranges, it is better that these sires are not used throughout the state. I need not explain the detrimental effects of increasing the exotic inheritance beyond 50%. The common sire probably has very high breeding value, the details of which should also be displayed. A perfect bull rotation programme is essential, which I am sure the authorities are adopting. But then the question arises as to how the semen can be made available in all AI centers as detailed in the notice. It would be helpful if this rotation programme is also intimated to the public and veterinarians. Also, is it not be possible to get dams (especially of Jersey) whose yields are better than these? However it may probably satisfy people requiring medium producing animals. I would like explain these issues a little deeper.

Is the genetic base of Kerala's cattle population shrinking?

Unlike European countries, our country and state were blessed with a very large cattle biodiversity. However the crossbreeding programme adopted for increasing milk production (which without doubt was a necessity), has reduced this genetic base substantially. Notwithstanding the practical difficulties in production and distribution of high quality semen, I feel that we should take utmost care while taking decisions on this very critical subject of breeding policy.

We have no idea to what extent our population is inbred, since we do not have valid records. The one point programme of increasing milk production

should not affect other traits, especially reproductive performance and other traits related to fitness, which are not sustainable. We should remember that a wrong decision made in the animal production programme, especially breeding, cannot be revoked because we build upon the population already existing. If the bulls are selected from the farmers' flocks under an open nuclear breeding concept, and if bulls' semen used is from a central pool, it is possible that the best sires may have the same grand sires. A Similar situation may also occur if many sires are selected from a single farm where a very superior breeding animal was used.

Does the present programme make the genetic base still narrower?

Assuming that the population now we have are completely outbred (which may not be true as we might have used a few highly producing bulls and its progenies already in the population), if the related bulls listed in the notice are used, the population produced will be a mixture of half sibs and cousins. That is, we will produce different groups having the same sire (which happens in AI) and a very large group of first cousins, whose grand sire is common. The population will become inbred, if these bulls are used for more than three years continuously. That is to say that the progeny produced will be mated again with the bulls that are either their own sires, or sire's cousins. Using the bulls for only one generation may not do much harm, if the bulls selected subsequently are not related to the bulls already used in the population.

If the same bull semen is used in the AI centre for more than three years, the first thing that can result is an intense form of inbreeding that is the mating of daughters with their own sire with coefficient of inbreeding (F) of 25%. If sons or grandsons of this sire are used, an inbreeding coefficient of 12.5 and 6.25 % can result. If any of the seven out of the sixteen sires listed are still available beyond 3 years the situation will be that of mating of the cows with sons of the grand sire, which results in an inbreeding coefficient of 6.25% , which is fairly high even in an outbreed population. Hence care should be taken to withdraw these sires from the population after three years for at least three to four generations. But if the semen from the aforesaid bulls are made available in all panchayaths (as shown in the notice) even if it is used only for one generation, we are going to have a large population of related individuals. Genetic susceptibility to diseases, about which very little is known at present is a factor about which we should be very cautious.

We sincerely hope that such a casualty does not occur and that the authorities will take care to see not only that that the bulls are not used for more than three years but also a carefully laid out bull rotation programme is followed.

What are the effects of inbreeding?

The positive aspect of inbreeding is that the genotypes of sperm or egg cells from inbred animals are more predictable than outbreds. For this reason, highly related individuals are used for breeding superior quality animals. If the inbred animals are superior and transmit their superiority with regularity, the advantage is obvious. Inbreeding can also be used to purge a line of cattle of undesirable genes (recessive genes.) Every cow and bull may carry many such (often called recessive genes) that can reduce health and productivity, and inbred animals have a better than average chance of inheriting bad genes from the parents. For this reason, animals with high level of inbreeding typically have lower milk production, more health problems, poor reproduction and shorter productive life. Inbred animals become homozygous at more chromosomal locations than non inbreds. Unfortunately inbreeding produces many undesirable side effects as well. When undesirable recessive genes appear in the homozygous state, the condition is often fatal. The fatality may occur very early in embryonic development and may look like a failed conception to farmer. If the genes are semi lethal, and the individual does survive, it may be totally unproductive. Most animal species carry low frequencies of lethal or semi lethal genes hidden in the heterozygous state, Inbreeding by increasing the frequency of homozygous individuals removes the protective cover of the non lethal dominant gene, exposing more offspring to lethal combinations.

Unlike developed countries, in India, we do

not have a proper recording system, which is very vital for genetic improvement programmes. Hence the harmful effects of inbreeding, even if present in our population, cannot be determined. We have to depend solely on available literature which is mainly based on studies in European countries and North America. Inbreeding reduces profitability in dairy cattle. The reduction in performance observed in inbred animals is termed inbreeding depression. A study conducted at Virginia Tech reported that 6.25% inbreeding can cause a loss of 150 dollars during the lifetime of a cow. Research in Canadian Holsteins has shown that for every 1% of inbreeding, the average cow will produce 25 kg milk, 0.9 kg fat and 0.9 kg protein less during first lactation in conjunction with poorer reproductive ability (Doormaal, 1999).

Is the inbreeding rate alarming?

Selection for higher production and improved type of dairy cattle has reduced genetic diversity. Today a limited number of animals in each breed serve as parents of highly influential sires in each generation. Wiggans etal. (1997) found an average inbreeding of 4.7 percent in Ayrshire cows, 3% in Guernsey, 2.6% in Holstein, 3.3% in Jersey and 3% in Brown Swiss breed. It should be noted that these inbreeding coefficients are estimated over a very long period of time. The critical issue in Kerala is whether the inbred animals are functional under today's management conditions? To find an answer to this we should be able to refer records to analyse whether the drop in production over the years is due to higher percentage of inbreeding. There is no doubt that cattle today are more inbred than their ancestors, but they are also highly productive. So under western conditions these percentages may not be alarming, because every effort is made there to diversify the genetic base. But are we doing the same? I am afraid not. Instead, we are narrowing the very broad genetic base of our population. Though it may pay for a short while, such shortsighted decisions will definitely harm our future production.

The biggest advantage we have is that we have started our breeding programme in the fifties from a very broad base of local cattle. But if the current cry for Holsteins continues and if their usages continue without a clear bull rotation programme, I fear we are heading towards a very deep crisis, the result of which will be disastrous and impossible to correct.

How to control inbreeding ?

Controlling the inbreeding in a population is mainly done by maintaining a balance between genetic superiority and diversity when selecting young sires. Diversifying young sire pedigrees without sacrificing high genetic potential is the most powerful tool for controlling inbreeding.

Is privatization of AI harmful?

In a literate state like Kerala where there is a very good network for insemination under the government set up, we are still not able to maintain proper breeding records. Then imagine a situation where private inseminators also come into the field. The example of Kenya should be an eye opener for all of us. In Kenya their National Insemination service, could control the problem of inbreeding through the rotation of bull semen between regions after two years of use. Farmers using AI service were issued a red file with cow index cards. The details of each farmer and each cow inseminated were recorded. The inseminator was required to carry a minimum of two bull's semen of each breed, and was expected to check on the breed information in the file before carrying out an insemination to avoid inbreeding. A team of Veterinary officers supervised the whole procedure. This near total perfect system, it is reported, completely collapsed after privatization of AI services because of improper record keeping.

Profit oriented agencies use sires with maximum breeding value which can probably be traced back to a few bulls, and the resultant progeny groups are highly related.

So what should we do?

Presently in our country, every individual has a right to information from a government sector and it is always better to place all details of our insemination programme before the public and explain to them the possible advantages and ill effects of different systems of breeding. The farmers may not know that the semen used in AI services comes from the same or related bulls. Hence there

should be a correct system of record keeping at farmers' level. All the details of bulls used and the rotation programme should be made available on the internet and farmers and veterinarians should be able to access it. Each and every breedable cow should be identified and records of its insemination should be maintained in the AI centre. Private AI should be discouraged and every AI should be supervised by the veterinarian. We have Veterinary officers in all panchayaths of the state and it is not difficult to maintain a record of less than 1000 breed able animals in each panchayath with the aid of a computer. Along with this, there should be facilities to record at least the peak yields of daughters of the sire inseminated so that we will have an idea about the production potential of the progeny which gives the basic record for progeny testing.

The number of sons of the top sire should be limited in any given time period. The expanded list of sires of sons should be used, with particular focus on bulls with divergent pedigrees. Selection for single breeding objective can increase inbreeding even in large populations. We should remember that diversity of breeding objectives stimulates diversity of genetic background also.

References

Doormaal B. V. (1999) Inbreeding in Canadian Dairy Breeds, www.cdn.ca/Articles/9908

Hermas S. A., Young C. W and Rust J. W. (1987) Effects of mild inbreeding on Productive and Reproductive performance of Guernsey cattle *J. Dairy Sci.* 70:712-715.

Kamau P. (2007) Dairy Industry threatened by Inbreeding. *The Organic Farmer,* March 2007:5

Weigal K. (2006) Concerned About Inbreeding? A computerized Mating Programme is the Answer, www.thedairysite.com

Thomson J.R, Everett R.W and Wolfe C.W. (2000) Effects of inbreeding on production and survival in Jerseys. *J. Dairy Sci* .83:2131-2138

Wiggans G.R., VanRaden P.M. and Zuurbier J. (1997) Calculation and use of inbreeding coefficients for genetic evaluation of United States dairy cattle. *J.Dairy Sci.*78:1584-1590

Author

Dr.K.C.Raghavan
Professor
Centre for Advanced Studies in Animal Genetics and Breeding
College of Veterinary and Animal Sciences
Mannuthy, Thrissur

****