

## Looking for an Outcross?

*Starting in February 2004, Canadian Dairy Network will be publishing a "Relationship Value" (R-Value) for every bull and cow in each dairy breed. This new piece of information is the perfect tool for identifying outcross animals in Canada since it reflects the genetic relationship that the animal has with the active female population for its breed.*

### **The Basic Principle**

The long-term sustainability of a dairy herd and/or a breed in general requires genetic diversification. In addition, the existence of genetic variation allows for the selection of superior animals to make genetic progress. This is one of the reasons why inbreeding levels are monitored within each breed population and why outcross bulls and cows are important to identify.

As pedigree information for animals of a specific breed accumulates one generation at a time, the genetic relationship between any pair of animals in the population can be determined. Due to the high popularity of specific sires in each breed (ie: Starbuck for example) and the subsequent heavy usage of their elite proven sons (ie: Aerostar) and grandsons (ie: Rudolph), most animals within the same breed and country have some level of genetic relationship amongst themselves. By analyzing all pedigree information for animals within a given population, bulls and cows that are less genetically related to the others can be objectively identified and labelled as "outcross". Usage of these animals as parents, especially of A.I. young sires, helps to control future inbreeding levels in the breed.

### **Defining the Active Population**

As new heifers are born and older cows die or are culled, the population of active females within each breed in Canada is constantly changing. At any point in time, the pedigrees of these young heifers and active cows can be analyzed to identify all genetic relationships that exist. For the purposes of calculating the "Relationship Value" for each animal in each breed, Canadian Dairy Network (CDN) considers the active population to include all registered heifers under the age of 30 months, unless they have calved and been subsequently culled from the herd, plus any cow older than 30 months of age that is known to be in a herd enrolled on milk recording in Canada. Since the active population of females in each breed is constantly changing so will the resulting "Relationship Values" that are published by CDN at the same time as each new release of genetic evaluations in February, May, August and November.

### **Interpreting "Relationship Values"**

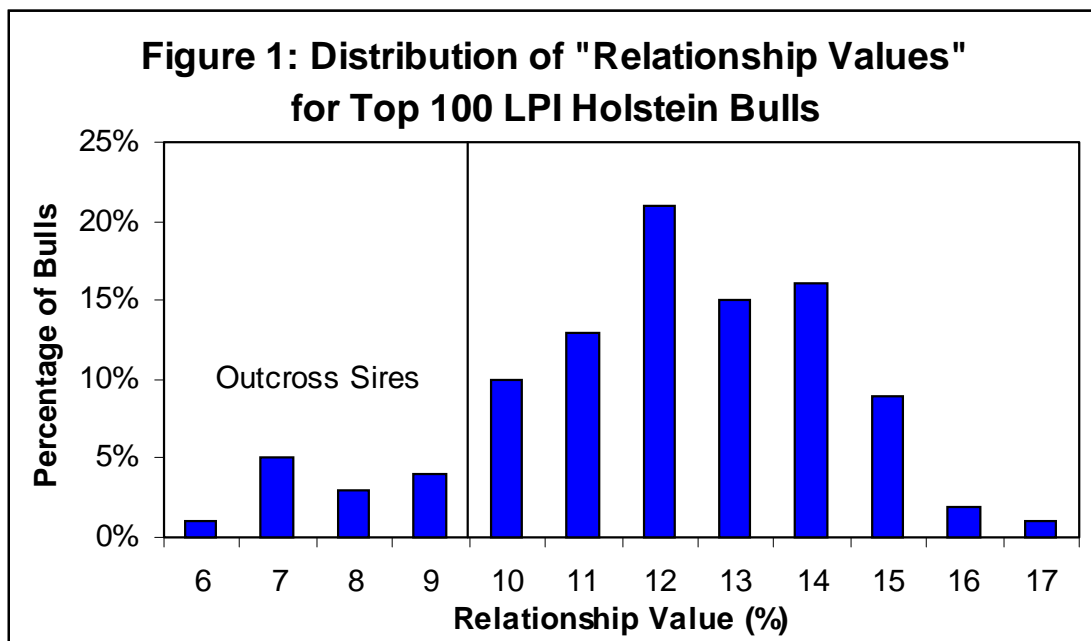
Given the active population of Holstein heifers and cows in Canada, the published "Relationship Value" represents how closely that animal is genetically related to that

population. Basically, an animal's "Relationship Value" is a direct function of the number of descendants (ie: daughters, granddaughters, great granddaughters, etc.) in the active population and the number of ascendants (sire, dam, grandparents, etc.) that have many descendants in the active population. All of these genetic relationships amongst animals are tracked using all pedigree information known at CDN, which is provided by each breed association.

In the Holstein breed, the bull with the highest "Relationship Value" is naturally Hanoverhill Starbuck at 20%. The next highest bulls include his sire, Elevation (18%), his sons Aerostar (19%), Raider (17%) and Astre (16%), as well as his grandsons Aeroline (17%) and Rudolph (16%). Other well-known sires that are closely related to the active population include Lindy at 16% and Storm, Mason, Lee, Lieutenant, Rubens, Prelude and Blackstar, who all have a "Relationship Value" of 15%.

In general, any decrease in a bull's "Relationship Value" will be very gradual as his daughters, granddaughters, etc. become less frequent amongst the active cows on milk recording in Canada. On the other hand, an outcross sire today may find his "Relationship Value" increase over time if he is very popular amongst breeders and as a sire of sons in A.I. A current example is surely the full-brother pair of Inquirer and Igniter. When they were initially proven in August 2000, their "Relationship Value" would have been relatively low due to their different pedigree in Canada (Juror x Mascot). Now that both of these sires have over 20,000 registered daughters in Canada, their "Relationship Value" has reached the 13% level.

Figure 1 presents the distribution of "Relationship Values" for the Top 100 LPI Holstein sires, ranging from 6% to 17%, with the average being 12%. Given this distribution for the Holstein breed, an animal with a "Relationship Value" of less than 10% can objectively be labelled an "outcross" relative to the Holstein population in Canada. Since the sires used in each country can vary widely, an outcross for Canada is not necessarily an outcross for other countries, so care must be taken to use the "Relationship Values" only in Canada.



## Top LPI Sires

Table 1 provides the “Relationship Value” for the Top 10 LPI Holstein sires in November 2003. From amongst these, it is fortunate that half of them are outcross sires in Canada since their “Relationship Value” (R-Value) is below 10%.

Table 1: Relationship Value for Top 10 LPI Holstein Sires in November 2003				
LPI Rank	Name	Sire	MGS	R-Value
1	Hartline TITANIC-ET	Storm	Leadman	12%
2	Braedale FREELANCE	Aeroline	Grand	15%
3	Calbrett-I HH CHAMPION	Rudolph	Horton	13%
4	Ricecrest EMERSON-ET	Elton	Blackstar	9%
5	Altagen SMARTY	Marty	Grand	11%
6	Wa-Del CONVINCER-ET	Elton	Cleitus	7%
7	Comestar STORMATIC	Storm	Blackstar	13%
8	Terrick REGGIE	Jolt	Emory	7%
9	Bosside Roma ROMAN	Fred	Bellwood	9%
10	Bosside RONALD	Bellwood	Tesk	8%

## Summary

In February 2004, CDN will start publishing the “Relationship Value” for every male and female in each dairy breed. Animals with a high R-Value have more genes in common with the active population of females in their breed while a low R-Value indicates an outcross animal. “Relationship Values” should primarily be used by A.I. companies to ensure pedigree diversification amongst the young sires they purchase and amongst the proven sires they return to active service. This additional information is aimed as a tool for controlling the inbreeding levels within each breed in Canada.