# GENETIC EVALUATION OF DAIRY CATTLE IN THAILAND

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## INTRODUCTION

Genetic evaluation of a population is useful in designing the most appropriate breeding program. Thailand has been successful in establishing the dairy industry both in terms of food security and job creation for small farmers. The country is, however, still lagging behind in terms of production levels and genetic improvement. This paper is intended to present the genetic analysis of milk yield under the context of a tropical production environment as represented by Thailand.

Dairy cattle production in Thailand has been partly developed since the government Dairy Promotion Organization (DPO), formerly known as the Thai-Danish Dairy Farm , was established in 1962. There has been an increasing trend in terms of number of farmers involved, cow numbers and milk production as well as consumption. Department of Livestock Development (DLD) statistics show 2001 milk production at 540,000 tons from 17,500 farms. This is amount to around 30% of total consumption. Total cow population is about 300,000 head with 160,000 lactating cows.

**Production system.** The majority of dairy farmers in Thailand (80%) are smallholder farmers with limited resources and education. There are some medium and large scale commercial production. Dairy cows production in Thailand has been based heavily on the feeding of concentrates because few small farmers occupy enough land to grow their own pasture. The lack of high quality forage crop and pasture technology are two other major constraints on raising a demanding ruminant such as dairy cow in a tropical environment like Thailand. The national average milk yield is 10-12 kg/day. There is a wide range of milk producing ability from 7-8 kg/cow/day to over 20 kg/cow/day depending on the proportion of Holstein Friesian (HF) and farmers abilities. Several reports agree that high levels of HF produce more milk per lactation while 62.5% HF or lower show less reproductive failure.

**Pricing System.** A very small proportion of milk produced is for manufacturing. Over 95% is for drinking milk. Farmers receive the equivalent of 30 cents per kg milk. Small premia are assigned to milk containing over 3.5% fat and 8.4% solid not fat. The current pricing system obviously supports milk volume rather than any milk constituent.

**Breeding Structure.** Most of dairy cows are crossbred of native and/or some Brahman origin with varying degrees of HF. Thailand has tried several crosses with various *Bos taurus* genetics such as Red Dane, Brown Swiss, Jersey and HF as well as some dairy breeds of *Bos indicus* origin like Sahiwal and Red Sindhi. The farmers, DPO and DLD settled for HF crossbreds because of the size and milking ability under local management and socio-economic conditions. However, it should be pointed out that no proper evaluation of the different options has been undertaken particularly any which use systems based on the major use of national resources. As far as this author is aware, no desk studies of different breeding options has been undertaken.

It is estimated that the majority of cows are 75% HF and up. Traditionally, farmers practice "upgrading" as long as their cows do not face any health problems related to stress. Some of the more experienced farms have been aware of the shortcomings of very high levels of HF and demonstrate this by looking for proven crossbred HF semen as an alternative.

There are two major organizations, DLD and DPO, responsible for progeny testing bulls as well as semen production and distribution. The two organisations operate independently and use separate data recording and processing systems. Bull dams are selected from cows producing over 4,500 kg./lactation from the members of dairy cooperatives regardless of genetic group. The actual average 305-d milk yield from DPO and DLD are 3,636 kg (DPO Sire Summary, 1999) and 3,800 kg (Harintaranont, 2001) respectively. Progeny tests are conducted in farmers'herds. Milk recording and data handling are conducted either by DLD or DPO officials. DPO produces 50,000 doses/year while AI Division of the DLD produces some 100,000 doses/year. The rest of the semen used is imported. Traditionally the importation has been of high merit (and high cost) semen which is not necessarily the most sound investment given the level of management and environmental stress likely to be encountered in Thailand.

**Selection criteria.** Selection criteria for cows selected as bull dams has been based primarily on milk yield (total lactation and adjusted 305-d). Fat and protein percentages are routinely included in the milk sampling but hardly make any impact on sire selection. Linear type and udder traits which are used as criteria for herd management are also observed. Milk let-down and temperament are observed for culling poorly adapted animals.

## GENETIC EVALUATION

**Heritability estimates.** There have been numerous papers reporting heritability estimates ($h^2$) of milk yield and related traits (Ananthanasuwong *et al*., 1998; Karnluang *et al*., 1999; Himarat *et al*., 2000; Topanurak *et al*., 2001; Buaban , 2002 and Khativorawage , 2002). The estimates range from 0.05 to 0.50 depending on type and size of populations as well as the models employed. The two most recent reports involving relatively large data sets were by Himarat *et al*. (2000) and Topanurak *et al*. (2001). They are summarized in table 1.

**Table 1. Heritability estimates ($h^2$) of milk yield from two distinct populations**

| Author | $h^2$ | Average milk yield, kg | Number of records | Model |
|---|---|---|---|---|
| Himarat *et al.* (2000) | 0.25 | 3,644±1,549 | 17,876 | Animal Model |
| Topanurak *et al.* (2001) | 0.19 | 2,714±1,321 | 22,750 | Animal Model |

Himarat *et al.* (2000) estimated $h^2$ for milk yield from a large commercial herd with above average nutrition and management. Topanurak *et al.* (2001), however, obtained the data from smallholder farmers members of a large and exceptionally well managed dairy co-operative.

The latter represented relatively average dairy farmers in terms of cows genetic potential and level of herd nutrition and management.

**Estimated breeding values and genetic trend.** DPO published the first Sire Summary in 1996 and from then on annually (DPO SIRE and DAM SUMMARY 1996, 1997, 1998, 1999). Genetic progress for milk yield during 1979 to 1991 period from DPO data was estimated at 45.05 kg/yr (Katkasame *et al*., 1996). The genetic progress observed from upgraded cows in a large commercial herd over 1993-1998 period was 40.3 kg/yr (Himarat *et al*., 2000). Topanurak *et al.* (2001). on the other hand, reported a negative genetic trend of 17.05 kg/yr from estimates made on data collected of members of a dairy co-operative. They reasoned that it was due to farmers reluctance to culling poor performing cows either because of psychological bond or poor judgement resulted from lacking solid information regarding the cow's actual genetic potential.

**Other developments.** Himarat *et al*. (1999) studied milk yield of DLD Thai Friesian nucleus herd of Canadian origin and found ranking of the same animal diffred between Canadian genetic evaluation and this study. Khativorawage, (2001) investigated the additive maternal and cytoplasmic genetic effects on milk yield, fat and protein percentages. Buaban (2001) adopted the test day models for estimating heritability for milk yield. Duangjinda and Tramas (2002) included dominance and inbreeding depression in estimating the breeding values for milk yield.

## DISCUSSION

Crossbreds with high level of HF genes tended to be superior in milk output (305 day lactation). This agrees well with Rege (1998). The heritability estimates for milk yield vary but are within the range summarized by Lobo *et al*. (2000). The progress made during the last ten years was in the range of annual genetic trend for milk yield of HF in the United States during 1960s which was reported at 37 kg (Hansen, 2000). In order to accelerate the genetic and phenotypic trends of cows in Thailand, it will be necessary to overcome certain constraints as followings :

1. Farmers : there is a need to educate farmers on the benefits of "correct" culling and it is necessary to broaden the numerical and genetic base in order to increase the intensity of selection.
2. Recording system : The most comprehensive set of data are collected by the DLD and DPO officials. They share the breeding goal but not the data. It is not possible right now to have all animals registered with pedigree information. It is essential that the two systems share resources if Thailand is to make the best use of its limited resources.
3. Realistic and Profitable breeding objectives : At present the base price of milk dictates the selection criteria and therefore farmers are striving for a high percentage of HF genes and then invest heavily in management systems which reduce stress whether due to natural environment or otherwise. A recent report indicated that a large company is investigating evaporative cooling systems for keeping cows in housing maintained at lower temperatures than usually encountered in Thailand. Harintaranont (2001) proposed a breeding program emphasizing economic returns. It is very difficult for farmers to comprehend without herd recording and analysis because the immediate economic return for them is essentially the volume of milk produced.
4. Nutrition and management : The level of nutrition and management must be upgraded to cope with the demand of high producing cows or the type of cow adjusted to one

more adapted to present environments. It is obvious that improving nutrition enhance the phenotypic trend both in Thailand (Himarat *et al*., 2000) and The United States (Cassell, 2001).

Traditional genetic improvement based on selection and using high ranking AI bulls for improving milk yield with certain degree of adaptability will remain a significant tool to develop high profitable cows in Thailand. It is unwise to strive for yield at any cost. Adoption of evolving technologies ie. by surveying the possibility of including existing and new technologies to accelerate the genetic change, to identify certain characteristics of native cattle which may be useful in the future breeding program may be needed. This is, of course, must be based on systematic recording system in order that the information obtained could be fully utilized. Finally, the policy of a separate progeny testing program should be revived in order to increase the selection intensity and cost effectiveness.

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