Pakistan Vet. J., 18 (2): 1998

SELECTING DAIRY ANIMALS - BEAUTY OR THE BEAST

Muhammad Sajjad Khan
Department of Animal Breeding and Genetics, University of Agriculture, Faisalabad-38040, Pakistan

INTRODUCTION

Contribution of livestock in the national economy has been well recognized. Among the two dairy species, buffalo is the major contributor of milk and milk products. Due to mechanization, the demand for the production of bulls for draught power is decreasing. The traditional role of cattle, is thus, switching to milk and meat production. As milk is the most important economic trait of a fertile female, efforts to improve through genetic selection have been started at Government farms and research stations. At field level, animals are being raised on the traditional husbandry practices. Thus, the physical appearance of the animal usually gets much more importance than any other quality including the milk yield.

In cattle breeds of developed countries, the physical appearance has been studied extensively and now the emphasis is being laid on various aspects of productivity related to such traits. Currently, Holstein bulls, for example, are evaluated for 17 appearance traits and their predicted transmitted abilities are published in the sire summaries along with the other yield traits, disease resistance and herdlife (Holstein Association, 1995). Semen prices of these bulls, thus, depend a lot on the ranking of these bulls as compared to the other population. Selecting a bull for corrective mating in any herd is, thus, a routine decision a farmer has to take.

The term 'type' is commonly used to describe the physical qualities of animals. It refers to the ideal or standard of perfection which combines all the body characteristics. An exact definition can be "body conformation suitable for efficient milking and management under free stall or stanchion barn housing, allowing cows to live a long life and express their inheritance for high milk production" (Hartman, 1979). Breed type would include the desirable characteristics of conformation (such as colour, size, shape, style, and many other traits) and the specific characteristics that distinguish one breed from the other. A good example of this would be the term 'Punj-kalian' which distinguishes Nili-Ravi breed from other breeds of buffalo.

The economic value of type may vary from one location to another and is different from milk production as its value is nearly the same on all farms in a market setup. Also, type is measured by subjective judgment (i.e. beauty is in the eye of the beholder) as opposed to milk yield which is measured objectively. The situation in the developed production systems have changed over time from subjective to the objective measurement, in the form of scores. Thus, there is a need to understand how animals are secored for type and how it should be incorporated in the selection programs for future selection of animals.

What constitutes type

Breed classification programs compare an individual to an ideal. The term linear classification has replaced the type scoring over time. The two type of rating are done for every cow and bull. The cows are evaluated for functional or linear traits, number of which varies for different breed associations. For Holsteins, such a number is 17 (Holstein Association, 1995), the list of which is given in Table 1.

Each trait is given a score between one and 50 points i.e., from one extreme to the other. For example, in case of udder depth, very deep udder floor, well below hocks gets 1-5 points, udder floor above hocks gets 25 points while extreme height of udder floor above hocks gets points close to 50. Apart from these 17 traits, a final score is assigned to each cow. The number is based on the ratings of five major categories (frame, dairy character, body capacity, feet and legs and udder). The weighting of different categories for cows and bulls are as follows:

Classification category	Cows (%)	Bulls (%)
Frame	15	30
Dairy character	20	25
Body capacity	10	20
Feet and legs	15	25
Udder	40	--

Table 1: Linear descriptive traits of Holsteins

Category	Traits
Form	1. Stature (ST)
	2. Strength (SR)
	3. Body depth (BD)
	4. Dairy form (DF)
Rump	5. Rump angle (RA)
	6. Rump width (RW)
Legs/Feet	7. Rear legs, side view (LS)
	8. Foot angle (FA)
Udder	9. Fore udder attachment (FU)
	10. Rear udder height (UH)
	11. Rear udder width (UW)
	12. Udder cleft (UC)
	13. Udder depth (UD)
Treats	14. Front teat placement (TP)
	15. Teat length (TL)
Research Traits	16. Rear legs, rear view (RL)
	17. Udder tilt (UT)

The final score is expressed as a number with a final bracket of Excellent, Very Good, Good plus, Fair or Poor as in Table 2. As an example of final score computation, consider a cow with the following major category scores: Frame, 79; Dairy character, 86; Body capacity, 81; Feet and legs, 77; and Udder, 85. Her final score would be 79 x 0.15 + 86 x 0.20 + 81 x 0.10 + 77 x 0.15 + 85 x 0.40 = 82.70 or 83.

Table 2: Classification categories for various dairy cattle breeds.

Category	Holstein and Brown Swiss	Other breeds
Excellent	≥ 90 points	≥ 90 points
Very Good	85-89	80-89
Good Plus or Desirable	80-84	70-79
Good or Acceptable	75-79	60-69
Fairy	65-74	50-59
Poor	< 65	< 50

The linear scoring program such as the one adopted by Holstein Association of US in 1983 provides a framework for evaluating animals more precisely by simplifying traits. Such a scoring resulted in more consistent scoring (higher heritabilities) with more variation (effective selection). Hand held computers make the linear classification process more efficient. The Herd Linear Summary Graph provides a graphic comparison of herd average versus breed average and is an important tool to decide the "keeps" and "culls".

Factors affecting type

Type scores of cows depend on their true permanent appearance, but may vary according to the scorer (classifier), age of cow, stages of pregnancy and lactation, and other transient factors. Also, such scores are not perfectly repeatable. Wilcox *et al.* (1957) reported results from classification of cows by three classifiers every six month at the same time but independently of each other. The overall final score was highly repeatable with 26 per cent of the total variation was due to variation among inspectors. Correlation among the three classifiers scoring the same cow at the same time was 0.69. General appearance, rump and body capacity were more uniformly rated than the mammary system, dairy characteristics and feet and legs. Correlation was highest for rump (0.75) and lowest for rear udder (0.54) followed by feet and legs (0.55). After the scores were adjusted for time, age, classifier, and stage of lactation, repeatabilities decreased (within animals repeatability) suggesting that animals changed over time.

Now a days scores of cows last classified in or after the month of their fifth birthday are designated permanent. Due to recent freshening or illness, however, animals are waited to become normal for their body condition.

Association of type with other traits

There is much evidence of a direct relationship between type and production. In addition to a higher level of production, animals of desirable type generally produce and reproduce for a longer period of time. The genetic control of various type traits vary. The heritability and phenotypic and genetic association with milk yield is presented in Table 3.

Stature is in the medium to high heritability range meaning that progress in the trait can be achieved quicker as compared to the other traits. Most other traits are lowly heritable although many have heritability in the same range as that of milk yield. Correlation of dairy characters with milk yield (both phenotypic and genetic) is comparatively higher and is in positive direction; other relationships are quite variable. The negative genetic relationship of milk

Table 3: Heritability (h^2) and phenotypic (r_P) and genetic correlations (r_G) of some type traits with first lactation milk yield*

Linear Type Trait	h^2	r_P	r_G
Final score	0.30	0.29	0.00
Stature	0.37	0.11	-0.01
Strength	0.26	0.12	0.07
Dairy character	0.20	0.50	0.68
Foot angle	0.10	0.00	-0.24
Real legs (side view)	0.15	0.02	0.14
Real legs (rear view)	0.10	-	-
Pelvic angle	0.20	0.04	0.19
Thurl width	0.24	0.10	-0.11
Rump width	0.25	-	-
Fore udder attachment	0.18	-0.09	-0.47
Rear udder height	0.15	0.12	-0.13
Rear udder width	0.16	0.16	0.09
Udder depth	0.25	-0.27	-0.64
Suspensory ligament	0.15	0.14	0.12
Teat placement	0.21	0.02	-0.12

*Dickinson (1985) and VanRaden *et al.* (1990)

yieldwith some of the type traits (e.g., udder depth) suggest that improving milk yield can deteriorate type traits.

Relative emphasis on type

Type alone is not a guarantee of an animal's production ability. Consideration must be given to production records, as well as performance of related animals. While selecting animals as foundation animals for any herd, one needs to have an ideal in mind. The emphasis to be placed on type depends on the breeding goals of the farmer. Dairy producers who sell a significant amount of breeding stock on a regular basis usually would place more emphasis on type than if income were exclusively from the sale of milk. For most breeds and most herds, the optimum ratio is 3:1 or more in favor of yield over type (Dickinson, 1985). For breeder herds that may sell animals, a ratio of 4:1 has also been suggested (Schmidt *et al.*, 1988).

Fig. 1. represents the progress expected for milk yield or type if selection is both for milk yield or type.

Graph for progress in type would be similar for different emphasis on type: milk. If all emphasis is on milk yield, progress is 100 per cent (of maximum possible) for milk. But if all emphasis is on type, progress for milk yield is only 10 per cent as great as if selection were for milk yield alone. If three (or more) times as much emphasis is given to milk yield, progress for milk yield. Thus some selection for type would not decrease progress for milk yield to any significant level. But if emphasis on type is equal or greater that of the milk yield, decrease in the progress for milk yield is prominent.

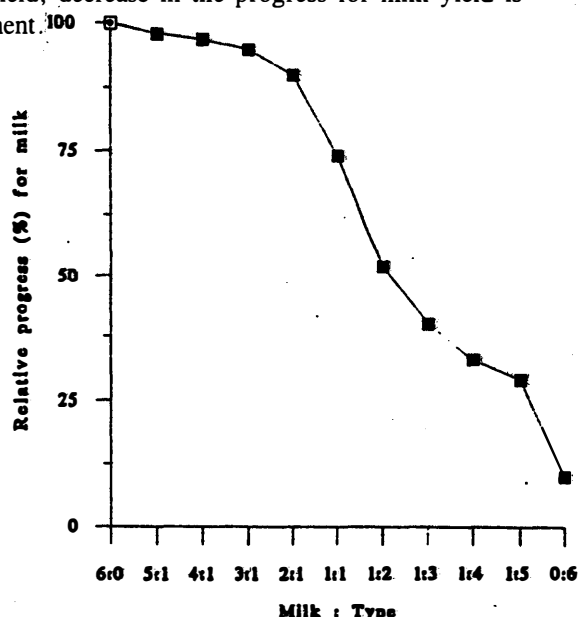

Fig. 1: Progress in milk yield or final type score when selecting for milk yield and type (adapted from Schmidt *et al.*, 1988).

Corrective mating for type is another opportunity for the breeders looking for improved type scores in the next generation. As selection is the process of choosing sires, corrective mating is choosing which sire to breed to each cow attempting to improve upon the weakness in type of the dam. In a group of sires first chosen for production, there is always enough variation for type to be able to correctively mate cows to these bulls. A popular corrective mating system in US and Canada is Animal Analysis system, popularly called as 'aAa'. In this system, every cow is assigned to six codes signifying her needs. Bulls are also coded according to what they contribute (or correct). System requires that the dairy farmers match the codes for their cows to appropriately coded sires. The six codes (for a cow in the order she needs them and on a bull in the order he sires them), with description are listed below:

1. DAIRY Ample will to milk; fast milk let down; more milk for size.
2. TALL Faster growth; higher udder for easy care and modern milking.
3. OPEN Room for the udder; added calving ease; long breeding life.
4. STRONG Larger mature size; healthy udder, feet and legs and lungs.
5. SMOOTH More appetite; less injury to teats and legs; easy milking.
6 STYLE Less foot trimming; more show and sale value and pleasure.

Some breed associations and artificial breeding organizations also offer computer mating service. HolsteinMate, for example is a computer assisted mating program (Holstein Association, 1995) that recommends service sires depending upon the strengths and weaknesses of each animal in any herd. Choices are also offered for mating heifers based on the trait information of sires and maternal grandsires.

Type in indexes

Combining two or more traits in a single unit is called as index. As current market structure in Pakistan allows the farmers to get premiums for fat differentials only, an index with 3:1:1 economic weights to milk yield, fat yield and final type score, or an index with more emphasis on milk yield (4:1:1) would be a good start. Specific names can be used for different species or breeds as the case may be. For example, in Nili-Ravi an index having 4:1:1 emphasis may be called Buffalo Performance Index (BPI) and for Sahiwal name could be SPI. As the market structure changes in the future, and other constituents like protein yield becomes important also, or health traits like somatic cell score or even the herd life/longevity is to be incorporated, such an index or indexes can be modified.

Future outlook

Very basic research is needed in the area of type classification for dairy species of the country. The objective definition of type traits is required. Experience of cattle type definition can help in this regard. After such a work is accomplished, personal working with data recording at the research or breeding institutes should be trained. The research stations should then start recording type scores for animals at different stages of their life with the help of the trained people. Data generated from such recordings can help to establish relationships with other traits of economic importance and relative importance of various traits can then be worked out. Economic index including type, yield and other traits can later be developed. Breeding programs at field level can then be modified to record type traits along with the production traits so that traits of maximum profit can be selected and propagated in the form of indexes. Precise photography of animals and their body parts would also be needed for objective comparison of animals.

CONCLUSIONS

Animals have long been selected for type, definition of which have changed from subjective measurements to more objective traits. The arguments for considering type include better economic returns, reduction in serious functional problems, recreation (sports/ competition) and appreciation of aesthetic values. Although, difficult to measure as objectively as the yield traits, it fulfills the other criterion of traits to be selected genetically, i.e., economics, heritability and variability. There is a need to explore this area of research so that the dairy species of the country can have longer and more productive lives. Beauty and the beast both are important.

REFERENCES

Dickinson, F. N., 1985. Genetic improvement of dairy cattle. Fact sheet I-7. National Cooperative Dairy Herd Improvement Program Handbook, USDA-Agricultural Research Service, USA.

Hartman, D.A., 1979. Techniques of Judging Dairy Cattle. Fourth Printing. 2709 Mt. Vernon Lane Blaksburg, VA.

Holstein Association, 1995. Linear Classification System. Holstein Association USA, Inc., 1 Holstein Place, Brattleboro, VT.

Schmidt, G. H., L. D. Van Vleck and M. F. Hutjens, 1988. Principles of Dairy Science. Printice Hall, Englewood Cliffs, New Jersey.

VanRaden, P.M., E. L. Jensen, T. J. Lawlor and D. A. Funk, 1990. Prediction of transmitting abilities for Holstein type traits. J. Dairy Sci., 73: 191-197.

Wilcox, C. J., K. O. Pfau and J. W. Bartlett, 1957. Variations of scores among different characteristics of Holstein cows for herd-type classification. J. Dairy Sci., 40: 1174-1180.