agriculture
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PROVINCE OF KWAZULU-NATAL

DAIRYING IN KWAZULU-NATAL

Breeding and Selection of Dairy Cows

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BREEDING GOALS

"Cattle breeding is a relatively simple endeavour. The only difficult part is to keep it simple".

Tom Lasater, a noted beef breeder, made this statement almost fifty years ago. It is as relevant to the dairy industry today as it was then.

In breeding dairy cattle, certain objectives must be set out. These include:

- to increase milk production
- to breed better functional characteristics that will allow the cow to produce more milk over a longer period of time.

It is an accepted principle that the more characteristics for which one selects, the less progress is made. Therefore, in line with the above quotation, it would be advisable to restrict selection criteria to the following:

- milk yield
- fat and protein yield
- feet and legs
- udders
- capacity
- "dairyness"

Each will be analysed separately. Collectively, selection for these six characteristics would go a long way to ensuring more productive dairy cows in South Africa.

MILK YIELD

A dairy cow produces milk. Simple as that statement might seem, it is imperative to select primarily for an increase in milk production. It is of no use at all to breed a fantastic looking cow

which produces no milk. In order to achieve this, the farmer must select bulls that are positive (on whatever ratings) for milk production.

An average bull in any category is likely to breed average-yielding daughters, i.e. most of them will be average cows. Very few average bulls will breed exceptional daughters.

The whole breeding programme is negated by selecting bulls that are negative for milk production. After all, a dairy farmer theoretically wants to run fewer cows yielding more milk. It is inconceivable to think of using a minus milk index i.e. below average index bull.

FAT AND PROTEIN YIELD

American research has shown clearly that selecting for milk yield only also increases the total fat and protein yield. However, the percentages (or deviations) of fat and protein from the average would remain more or less the same. The same can be said if one selects only for fat and/or protein yield, i.e., a corresponding lift in total production will occur. However, selection entirely on percentages, i.e., +0.00 % fat, or +0.00 % protein, or both, will decrease milk yield by as much as 300 kg. There will also be a significant decrease in component yield. The effect of selection for a single trait is shown in Table 1.

FEET AND LEGS

South African dairy farmers have always boasted how tough and extensive their farming conditions are. Our cows may have to walk long distances to and from their feed, unlike cows elsewhere in the world. It is therefore imperative that the cow has good feet and strong legs.

What are good feet and legs ? Quite simply, one is looking for a hind leg which is slightly sickle-shaped (from the side view) with a steep (strongly-attached) pastern. Only bulls breeding good feet and legs should be used in a dairy herd.

Cows with weak pasterns are a curse to any dairy farmer, because the cow then walks on the soft part of her "heel" (actually on flesh), and not on her hoof as she is supposed to. On can conclude that she will only be able to walk with great difficulty, and will suffer from numerous infections.

Cows with straight, or post hocks, are to be avoided, because they are highly heritable (passed on from generation to generation), and cause cows to walk with an abnormal stiff-legged gait.

Any cow which is unable to stand up and/or walk with ease is useless, even if she has the most perfect udder in the world. Functional legs are very necessary on a dairy cow. Cows which are able to walk properly are long lasting, "no hassle" cows which are definite economic units in the dairy enterprise.

Table 1. Changes in milk yield and composition after 23 years selection for a single trait (Ewing, 1989)

Selection goal (trait selected)	Herd average after 23 years selection			Changes after 23 years selection				
	Milk kg	Butter-fat %	Protein %	Milk kg	Butter-fat kg	Protein kg	Butter-fat %	Protein %
Controls (unselected)	5797	3,85	3,35	-	-	-	-	-
Selection for milk yield	8853	3,46	3,01	+ 454	+ 11,8	+ 8,6	- 0,08	- 0,03
Selection for butterfat yield	7844	4,32	3,55	+ 304	+ 16,3	+ 9,5	+ 0,07	+ 0,03
Selection for protein yield	7631	3,99	3,62	+ 272	+ 11,3	+ 9,1	+ 0.02	+ 0,04
Selection for butterfat %	3807	5,94	4,09	- 295	+ 9,5	+ 2,7	+ 0,31	+ 0,11
Selection for protein %	4590	4,99	4,29	- 179	+ 6.8	+ 5,4	+ 0,17	+ 0,14

The moral of the story here is: Do not blindly use a bull just because of positive fat and protein percentages but only average milk production. Select bulls which will increase milk, fat and protein yield.

UDDERS

The udder must be pliable, silky in texture and sack-like in nature. Ideally, the udder, when viewed from the side, ideally, should not hang below the cow's hock.

The single most important part of the udder is the central, or median, suspensory ligament. This must be extremely strong and well attached. It is an accepted fact that an udder with an excellent central ligament is a long-lasting one.

Teat placement is next in importance. Ideally, the front teats should be even and centrally placed on each quarter of the udder. Simple as this may seem, many cows in South Africa

suffer from the inherent problem of wide front teats. Teat size (over- and undersized teats should be avoided), shape and placement are highly heritable.

What does this all mean when selecting a bull? Great emphasis must be placed on a bull that breeds improvement in all udder traits, or characteristics, especially a strong central ligament and acceptable teat placement and size.

BODY CAPACITY

Viewed from the side, a cow with a deep, long body with wide, well-sprung ribs is said to have a large body capacity. Large body capacity is associated with ample space for the rumen and digestive system, and this, in turn, is associated with superior milk production.

It should be obvious, but still needs to be stated, that a dairy cow with little body capacity cannot be a great milk producer. This is because the gut size is limited by the capacity of the abdominal cavity.

Besides a deep body, what are the other pointers of capacity? These are:

- A broad muzzle ("shovel-nose" the Americans call it). A broad, strong muzzle implies the ability to get the food into her mouth and to masticate (chew her cud) effectively
- Width between the fore legs. This shows whether, or not, there is plenty of room for the vital organs situated between the shoulders and front legs. Cows with a narrow chest are not normally good producers
- Width of rib. If at least two fingers, can be placed between the ribs of a dairy cow, she is said to have a fair degree of capacity. Ideally, in any cow, three flattened fingers would indicate great capacity.

These pointers are quite acceptable rules-of-thumb to measure body capacity. The bulls ability to breed capacity should be considered in any breeding programme. However, milk yield, fat and protein content, feet and legs, and udders, are most important, whereas with body capacity a certain amount of leniency is allowed.

DAIRYNESS

Dairyness is a subjective evaluation made on dairy cows. It is extremely difficult to measure, and equally difficult to describe. It is not more important than the preceding five criteria.

Dairy cows are refined animals which produce milk. Beef cattle produce beef, and are solid and well muscled. We hardly expect beef cows to produce the same volumes of milk as do dairy cows.

What, then, is the refinement we want to see in dairy cows? The following are good pointers:

- Refinement can be related to sharpness across the shoulders (or crops) instead of being broad (thick) and beefy.

- It can also be related to flatness of bone, seen especially on the inner thigh where the bone should be flat and "clean" rather than strong and coarse.
- A thin, fine tail instead of a thick, robust and coarse tail.

These are subjective judgements, arising from the observations of practical dairymen, rather than scientific facts.

Bulls which breed high-producing daughters, tend to breed "dairy" looking daughters, with good feet and legs, a functional udder, great capacity and is sharp over the chines and has a clean, flat bone on the inner thigh. Emphasis should therefore be placed on bulls breeding dairyness (or sharpness).

If these are our goals in dairy-cattle breeding, how can we tie this all together into a practical breeding policy?

BREEDING AIMS

In order to understand what we want to breed, we must know how these goals are passed on from generation to generation.

Heritability

The degree to which a bull is able to influence various characteristics in his progeny genetically is measured by heritability. Different characteristics (traits) have different heritabilities. This obviously influences the development of the breeding policy because faster genetic progress can be achieved for traits which are higher in heritability, compared to traits which are lower in heritability. It is difficult to make much genetic progress through selection and mating unless a trait has a heritability of .10 or higher. Table 2 contains estimates of heritability for the linear traits currently summarized by the Holstein Association in America. These will hold good for all the dairy breeds.

Table 2. The heritabilities (h^2) of the Holstein Association linear type traits (HFA Sire Summaries)

Trait	h^2	Trait	h^2
Stature	.37	Foot angle	.10
Strength	.26	Fore attachment	.18
Body depth	.32	Rear udder height	.18
Angularity	.23		.16
	.29		.15

Rump angle	.24	Rear udder width	.25
Rump width	.16	Udder support	.21
Legs, side		Udder depth	
		Teat placement	

As shown in Table 2, the linear type traits differ substantially in heritability. For example, foot angle has a much lower heritability than udder depth. As a result we can expect a greater response when breeding for udder depth as compared to foot angle. Both the heritability of the trait, and its relative economic relationship to overall profitability, must be taken into consideration when the breeding policy is constructed.

BREEDING POLICY

Registered dairy cows

If the farmer belongs to a breed society and has his cows registered with that society, that enables him to obtain semen from outside the borders of South Africa.

In most herds, complimentary mating is practised where the short comings of each cow, e.g. high pins, shallow heels, faults which were pronounced in the daughters of S-W-D VALIANT, are matched with a bull which will improve and compliment the daughters characteristics. In this case a bull which sires level or sloping rumps, steep heels, e.g. an ELEVATION son, would compliment the characteristics of the cow to be mated.

Grade dairy cows

Almost all dairy farmers keep records and so obviously, the farmers with grade dairy cows would avoid using a bull on his daughters. Such inbreeding would most definitely be undesirable. If however, there is blanket mating of the herd with one or two bulls, the following are useful guidelines:

- 100 units of semen will yield 20 milking daughters of a bull.
- 2 bulls should be used per 100 cows, and these bulls should be sold after 3 years before they came back to cover their daughters

GENERAL

In any cattle herd, between 20 and 30 daughters of any bull can give the breeder a realistic impression of the breeding value of that sire. Far too many dairy farmers use each and every bull, resulting in between 1 and 5 daughters per bull. With such a small sample, no positive evaluation can be made regarding the impact, or complementarity, of the bulls used in the herd.

It is vitally important to make a sound selection and to use such a bull extensively (mated to at least 50 cows) which would then enable the breeder to gauge his worth. Obviously if the bull is successful, he could be used extensively to produce more, desirable daughters. If he is unavailable, then a bull of similar, if not identical breeding, can often fill the gap.

SEMEN PRICING

Remember that the most expensive semen is not necessarily from the best bull, especially in the case of overseas bulls.

Two options are available to the dairy farmers:

- Use the best bull across the herd, viz if there are 300 cows to be bred, use the best bulls available (50 cows per bull).

- Alternatively, and somewhat more economically, you can divide the herd into three:

    - TOP PRODUCERS : use the best bulls on them
    - MIDDLE PRODUCERS : use the best reasonably priced bulls on them, NOT forsaking milk production
    - LOW PRODUCERS : these should be bred to beef bulls/semen, thereby ensuring better management of fewer replacement heifers, out of the top section of the dairy herd, and a gradual elimination of the weaker cows and their progeny out of the herd. It is all very well to say, use the best bulls across the herd, but in many instances cash flow and other financial constraints prevent this management/breeding decision.

CORRECTIVE MATING

Many breeders, including the old masters of the art, believe in corrective mating. Under corrective mating, cows which may be highly productive yet have some objectionable characteristics are mated to a bull that is especially outstanding in the trait in which the cow is inferior. The object of this article is not to prove or disprove this theory. What is important is that the six essentials discussed are adhered to in any sire selection. If this is done, then it would be unnecessary to apply corrective mating down to the last minute detail.

What is important is the complementarity of bloodlines (nicking ability), e.g. CHIEF X BELL or VALIANT X ELEVATION to name a few. Do not inbreed. Ensure that the selected sire compliments the breeding of the cows he is to be mated to. Ask your breeding consultant for further advice.

SELECTING A BULL FROM A DAIRY SEMEN SIRE DIRECTORY

Such a directory ultimately puts together all the above selection criteria, allowing an effective decision in the choice of a bull. Make sure the selection is a good one, using the above guidelines, as the resulting progeny will only be in production in five years time. Poor decisions can force you out of business.

Table 3 gives the analysis of the production characteristics of a bull available from the USA. Most other international sire directories are similar. Table 4 illustrates the production of a typical South African bull.

The following explain the various categories listed in the sire analysis and serve as an additional check list when you aim to choose a bull from almost any sire directory:

ADSRI 6/91.

This shows that the analysis was performed by an official body, and gives the date of the most recent information.

R (%)

This figure is the degree of confidence one can have when you want to use this bull. If this figure if low (60% or less), the bull can get either better or worse. However as there are more and more daughters of this bull being milked, the picture becomes clearer of what they produce and what they look like. Consequently the degree of confidence rises as does the reliability, R (%). Reliability. When this figure is high (95% or more), there will be little change in the proof of the bull.

MILK, BUTTERFAT, PROTEIN

These indices show an improvement with a figure greater than 100. If we consider this example (Table 4), the daughters of this bull will produce more milk, butterfat and protein than daughters of the average (index = 100) bulls. Never select a bull with a low index, e.g. 95 or lower, as this is a backward step.

EPD

This stands for Expected Progeny Difference. The daughters of this bull (Table 4) can be expected to yield 537 kg more milk in their first lactations than can the daughters of the average bull (with which our bull was compared). Ensure that your choice is always amongst the best available because as stated earlier, the sole function of a dairy cow is to produce milk.

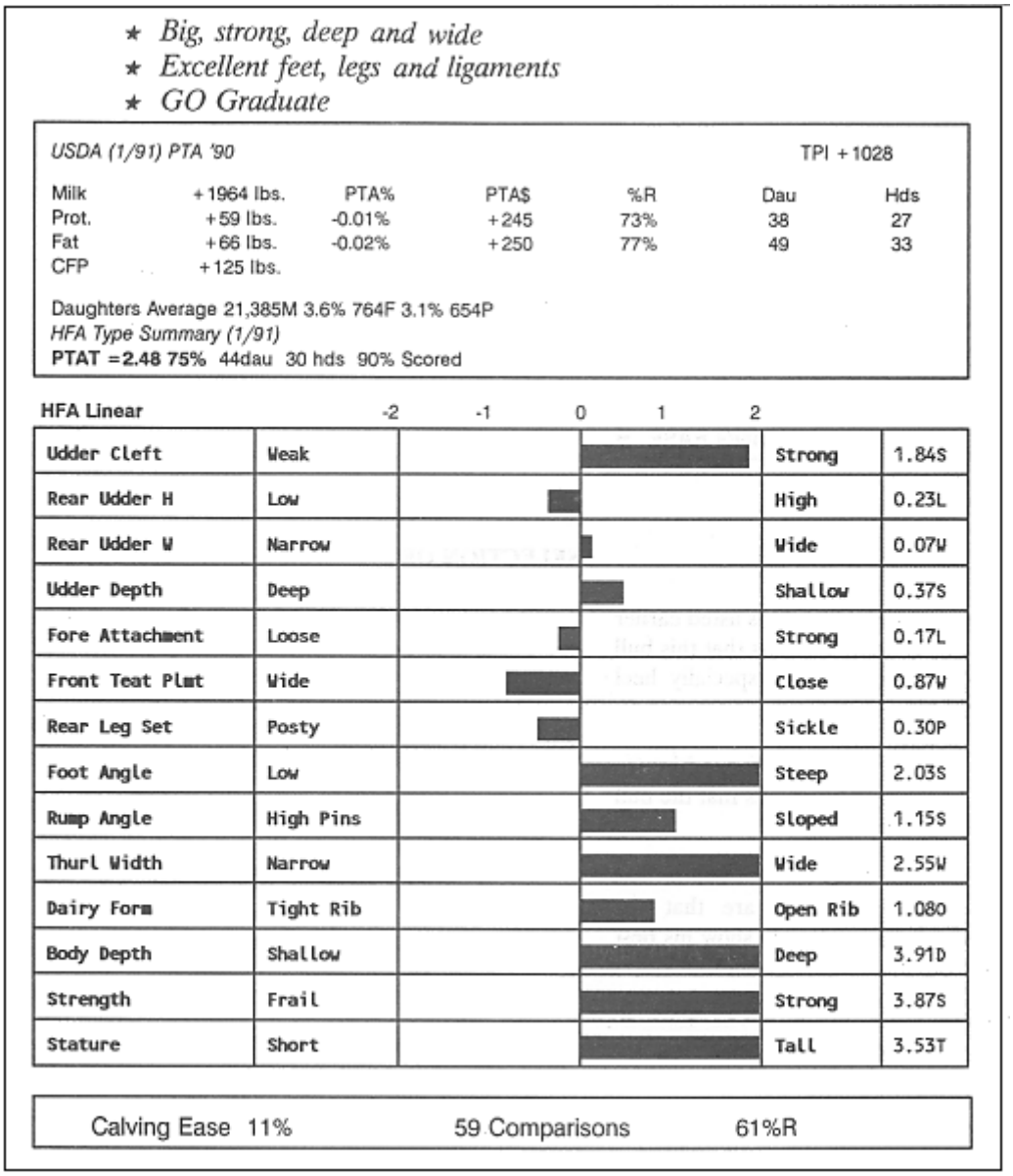
PERC. DIFF.

These figures show the deviations of fat and protein percentages of the daughters of this bull in their first lactation. In other words, avoid bulls whose daughters have large negative deviations in fat and protein. These figures should be no worse that -0.19%. If they are worse, it means that the resulting daughters will probably give less fat and protein than their herdmates. This can affect the herds profitability.

RED FACTOR

This indicates that this bull carries the recessive genes for a red colour pattern in Holstein-Frieslands. When mated to a cow carrying these recessive genes, it could result in red and white offspring.

Table 3. An example of a USA Holstein sire analysis (PTA = Predicted transmitting ability; PTAT = Predicted transmitting ability type; TPI = Total performance index; HFA = Holstein-Friesian Association)



★ *Big, strong, deep and wide*
★ *Excellent feet, legs and ligaments*
★ *GO Graduate*

USDA (1/91) PTA '90 TPI +1028

Milk	+1964 lbs.	PTA%	PTA$	%R	Dau	Hds
Prot.	+59 lbs.	-0.01%	+245	73%	38	27
Fat	+66 lbs.	-0.02%	+250	77%	49	33
CFP	+125 lbs.					

Daughters Average 21,385M 3.6% 764F 3.1% 654P
HFA Type Summary (1/91)
PTAT =2.48 75% 44dau 30 hds 90% Scored

HFA Linear		-2 -1 0 1 2		
Udder Cleft	Weak		Strong	1.84S
Rear Udder H	Low		High	0.23L
Rear Udder W	Narrow		Wide	0.07W
Udder Depth	Deep		Shallow	0.37S
Fore Attachment	Loose		Strong	0.17L
Front Teat Plmt	Wide		Close	0.87W
Rear Leg Set	Posty		Sickle	0.30P
Foot Angle	Low		Steep	2.03S
Rump Angle	High Pins		Sloped	1.15S
Thurl Width	Narrow		Wide	2.55W
Dairy Form	Tight Rib		Open Rib	1.08O
Body Depth	Shallow		Deep	3.91D
Strength	Frail		Strong	3.87S
Stature	Short		Tall	3.53T

Calving Ease 11% 59 Comparisons 61%R

UNBIASED PROGENY TESTING PROGRAMME

In South Africa the major A.I. station runs such a programme. Be sure to ask any competitor how their bulls are tested. The most effective manner to identify bias is to divide the number of effective daughters (Eff. Daugs.) by the number of herds. This figure should be between 1,0 and 3,0, meaning that there is effectively between one and three daughters of the bull in many dairy herds around the country. This rules out any preferential treatment the daughters may get, which if this were the case would bias the results. In our example (Table 4), the number of

effective daughters per herd is 1.25 which means that only a few herds have 2 daughters of this bull while the majority of the herds have 1 daughter each.

CALVING EASE

A rule of thumb in this regard is that one calving out of ten is difficult. If this figure falls to one difficult calving out of every three, then there is a large problem. Therefore the ideal easy calving figure is between 5% and 12% whilst bulls with between 15% and 25% should be avoided.

While calving difficulty is often closely related to

feeding levels, some bulls are problematic.

In South Africa, the "A" rating is easy calving, "B" somewhat more difficult, and "C" are bulls to use with caution. The latter two ratings should be exclusively used on cows, whilst the former can be used on both heifers and cows.

Table 4. An example of a South African sire analysis

RBV (ADSRI 6/91)

MILK

BUTTERFAT PROTEIN

RVI: 118

124	116	119

Milk				Butterfat		Protein	
R (%)	Herds	Eff. Daugs.	EPD (kg)	Perc. BF	Diff. (%)	Perc. Prot.	Diff. (%)
67	24	30	+537	3.52	-0.10	3.20	-0.06

CALVING EASE B RED FACTOR

LINEAR SCORE

This summarizes the conformation points listed earlier in the article. The above example shows that this bull (Table 5) improves all these traits, especially heel depth and teat placement.

- Strive for **all** these characteristics to be positive (to right of 0, viz. +1 or +2). This means that the bull improves these characteristics.
- Deviations from normal occur e.g. if a bull breeds very shallow heels, the chances are that the A.I.marketing organization will **only** show his best daughter, with exceptional depth of heel.

- Beware of negative bulls. Form follows function. If a cow cannot walk, she will be unable to graze and therefore unable to produce milk.

SELECTION OF DAIRY COWS FOR BREEDING

Selection should be practised at all stages in a dairy cow's life, especially during her first lactation. The following are the different levels of selection:

- Do you breed this cow to give you a possible replacement heifer?
- Do you raise this heifer calf to mating age or do you sell her

i) as veal (together with the bull calves) or

ii) as an unmated heifer or

iii) as a mated heifer on sale

- Do you inseminate the heifer

i) with dairy semen

ii) with beef semen

Table 5. A South African sire linear score

		-2 -1 0 1 2
Height	0.5	
Strength	0.5	
Legs	1.5	
Heel Depth	2	
Fore Udder	0.5	
Rear Udder	0.5	
Teat Placement	1.5	

- In her first lactation, the peak day yield gives a reasonable indicator of her potential within this lactation. Therefore, at this stage, a decision has to be made to rebreed her or leave her open. An absolute minimum standard of 4500 kg for Holstein-Frieslands and 3500 kg for Jerseys is necessary in the first lactation.
- A 50% replacement policy is not unrealistic (this involves breeding all the heifers born on the farm), but 20 to 25 % would be better policy. This would enable the dairy farmer to eliminate the poor doers, that is those with undesirable

characteristics or those from low yielding dams. After all, this is how selection should be performed. Unfortunately, most dairy farmers have to breed all their heifers because poor management during the replacement heifers' life causes too many to be culled at any early stage in their productive life as dairy cows.

To conclude, it was stated earlier that cattle breeding is relatively simple, and that the only difficult thing is trying to keep it simple. Six characteristics have been identified as factors important in the selection and breeding for high-producing, efficient dairy cows.

These factors are equally pertinent to all dairy cows, pure (registered or grade) or crossbred. Arguments, applied by all breeders, claim that one breed is superior in efficiency and therefore economically better than its competitors. Beware of falling into this trap and resting on the laurels of any one breed, as all dairy cow breeders are striving to be more economical under the present constraints of our industry.

FURTHER READING

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