PREVENTING AND PROTECTING DAIRY HERD FROM HEAT STRESS: RESEARCH RESULTS AND FIELD APPLICATIONS IN NORTHERN VIETNAM

Dr. Le Trong Lap
Director, Bavi Cattle & Forage Research Center
National Husbandry Research Institute
Bavi District, Hatay Province, Vietnam

INTRODUCTION

Vietnam is a tropical country with a monsoon climate. The total area of the country is 332000 km^2 and nearly 80M inhabitants densely populate it. The arable area is small, about 7M ha. Agriculture is based mainly on rice production, supported by other crops such as maize, potato, sweet potato, cassava, groundnut, soybean, sugarcane, fruit trees and other perennial commercial trees such as coffee, rubber, tea and coconut. Livestock production constitutes 25% of the agricultural output value. In this sector, production is almost entirely in the hands of smallholders. Livestock enterprises themselves are very small and deal mainly with pigs, cattle, chickens and ducks.

With the use of special intensive farming systems, Vietnam has overcome a long historical period of grain deficiency. By 1989, just a few years after the institution of economic reforms in 1986, the country was able to produce enough rice of about 1.5 - 2 million tons, not only for self-sufficiency but also for annual export to international markets.

Vietnamese agriculture has been divided into seven agro-ecological zones according to ecological and economic conditions. They are:

Northern Mountainous and Middle Highlands
Red River Delta
North Central Coast
South Central Coast
Central Highland
North East of Southland
Mekong River Delta

The development of animal production in the country has been promoted during recent years. The populations of livestock and poultry as well as the diversity of animal production are shown in Table 1.

There are different components of the livestock herd in each economic zone. For example, in the Northern Mountainous and Middle Highland regions the buffalo herd is dense, while in

Central Vietnam cattle are most numerous, contributing 47% to the total national herd. The population of chicken is distributed over the whole country while ducks are concentrated mainly in the Mekong Delta where 57.7 % of the total duck flock is raised. Table 2 shows the disposition of livestock and poultry in the various zones.

Table 1. Livestock and poultry population in Vietnam, 1992-2000 *('000 hd).*

	1992	**1994**	**1996**	**1998**	**2000**
Pig	12,140	15,000	16,202	16,768	17,056
Cattle	3,151	3,335	3,515	3,542	3,614
Buffalo	2,885	2,962	3,000	3,062	3,614
Goat	312	353	402	405	411
Sheep	3	3	3	3	3
Dear	12	12	12	12	12
Chicken	9,750	10,239	14,210	15,780	18,500
Duck	27,000	31,000	32,000	34,000	35,000

Table 2. Livestock and poultry distribution in different ecological economic zones (%).

Ecological economic zones	**Pigs**	**Cattle**	**Buffalo**	**Ducks**
Northern Mountainous	24.3	15.4	42.8	10.6
Red River Delta	22.7	8.0	12.3	6.1
North Central Coast	17.1	19.8	19.7	7.6
South central Coast	11.4	27.8	5.2	5.2
Central Highland	4.6	11.2	2.0	2.0
North East of Southland	4.5	7.2	5.0	5.0
Mekong River Delta	5.0	9.8	11.9	11.9

Being located in Bavi District in Hatay Province, a place which is 50 km far west from Hanoi capital, Bavi Cattle and Forage Research Centre was founded in 1989 and became the unique research agency for cattle husbandry in Vietnam. The centre has the main function of implementing different experiments to determine the best dairy breeds for tropical conditions in northern Vietnam and the most suitable methods to develop, collect, store and process forage for ruminants.

Even though the branch of dairy production has just started to develop in the North Vietnam, the centre has been taking an important part in the enterprise. According to the support and the policy agreement of the Vietnammese government, the centre has implemented many

different researches on crossing dairy breeds by using artificial insemination techniques.

Dairy breeds such as Holstein Friesian was introduced and imported into Vietnam as early as the 60th decade of the 20th century but it has been really emphasized since the end of 80th decade. So far, technical progress in cattle husbandry has been judged as second only to pig husbandry.

To support dairy production, Bavi Cattle and Forage Research Centre, together with the other relevant institutions, have carried out the basal survey, which helped record the distribution, breeds, herd quality and rearing techniques of cattle and applied a sound improvement plan for beef and dairy cattle according to the economic conditions of the various locations.

Pure Zebu bulls (Red Sindhi, Sahiwal and Brahman) have been used for "Zebulisation" of local stocks to increase the Zebu content. The local bulls have been replaced gradually by Zebu crosses for mating with local stocks in remote zones. This work can bring some advantages and heterosis, which can be seen in Table 3.

Table 3. Mature weight of native yellow cows and Sindhi crossbred cattle.

	Native yellow cows				Red Sindhi Crossbred			
	Non-Selected		Selected		Bull		Cow	
	Bull	Cow	Bull	Cow	Mean	Range	Mean	Range
No. of animals			539	2163	15	15	262	262
Body weight (kg)	200-250	140-160	250-280	180-200	416	314-440	275	200-370

Biological characteristics and milk production of F1 and F2 Holstein have been studied to develop suitable rearing techniques for each kind of animal. Some of the figures showing these biological characteristics have been collected in Tables 4 and 5.

Table 4. Milk production of pure HF reared at Bavi and Moc Chau State Farm.

Location	Climatic Conditions				Milk yield/lactation (kg)					
	Temperature ^{0}C			RH	Lactation					Milk fat
	Min	Mean	Max	(%)	I	II	III	Max	Min	%
Bavi	5.4	25.3	39.5	84.32	3220	3398	3474	4093	1669	3.5 - 3.7
Moc Chau	0.2	18.2	35.5	82.96	3376	3496	3558	6247	1951	3.4 - 3.5

Table 5. Body weight and milk production of different genetic groups reared presently at Bavi Cattle and Forage Research Centre.

Genetic group	Age at first calving (Months)	Body weight (kg)	Milk yield/300 days (kg)	Milk fat %
F_1 50 % HF 50 % LaiSind	37.5 ± 3.4	331 ± 22	2882 ± 97	3.89 ± 0.11
F_2 75 % HF 25 % LaiSind	30.6 ± 8.0	358 ± 12	3428 ± 112	3.9 ± 0.14
F_2 75 % HF 25 % Sindhi	33.3 ± 2.2	392 ± 11	3628 ± 224	3.8 ± 0.28

Milk quality has been analysed for nine components with a view of evaluating its quality thus serving as the basis for determining milk price and improving dairy production. This work has been done right in the centre's laboratory by experienced staff.

Parallel to the scientific research topics on cattle husbandry, the centre has implemented many experiments to develop pastures, forage and storage and processing of cattle feed. Technical progress in the area of animal feed includes ensilage of rice straw with urea (2-4 % of urea); utilisation of molasses-urea-multinutrient blocks; and intensive growing of many grass species and legumes such as king grass, elephant grass, guinea, stylosanthes, leucaena etc.

In Vietnam, grass cultivation has been studied and developed over many years in research institutions and on state farms, including Bavi Cattle and Forage Research Centre. Many varieties of grasses have been studied and screened, and some of them developed in large areas. The three varieties of grass, which have been cultivated most, are elephant grass (Pennisetum purpureum), guinea grass (Panicum maximum) and pangola grass (Digitaria decumbens). These grasses are highly productive with elephant grass yielding 200t/ha per year equivalent to 22t of dry matter (DM). Panicum maximum, which has high drought tolerance, can yield 100 tons/ha per year (19tof DM). Farmers prefer these two species of grasses, whose productivity depends on the amount of fertilizers applied. They can be grown in the garden but yield better under improved conditions. Another grass, which is called Guinea TD58, has been experimented on successfully, with yield reaching 120-150 t/ha per year.

Para grass (*Brachiaria mutica*) survives very well in lowland areas along flooded riverbanks in central Vietnam. This grass also grows well in other areas in the North with productivity of about 80t/ha.

Leguminous fodder was rarely found in animal rations but its use is increasing at present. The two varieties that can be developed are *Leucaena leucocephala* and *Stylosanthes* species. In acid soil with a pH > 5, *Leucaena leucocephala* can give 40-50t/ha with crude protein of 25%. *Stylosanthes guyanensis* is also a promising legume with a yield of about 40t/ha.

Research Results Obtained by the National Institute of Animal Husbandry in Bavi

Holstein Friesian (HF) cattle were imported from China in 1968. This cattle was first reared in Bavi and then transferred to Moc Chau state farm. This transfer was prompted by disease outbreaks in Bavi (caused by protozoa transmitted by ticks and characterised by fever and sudden death) where the temprature is higher especially from April to October. The milk yield per lactation of pure HF cattle reared in Bavi was 3360 kg (2001) while this figure was 3300 - 3500 kg in Moc Chau where the average temprature was lower. Therefore, Bavi Cattle and Forage Research Centre focused on researches, which help to produce HF crosses that can demonstrate higher productivity in tropical conditions.

After ten years of research, results showed that the F1 progeny (HF bulls x Zebulised cows, especially Red Sindhi crossed cows) have higher body weight and milk yield compared with

those of Red Sindhi crossbred cows. The F1 (HF bull x Red Sindhi crossbred cow) has the average milk yield of about 2800kg per lactation, which is always accepted by the farmers. Considering this result, rotational breeding of three breeds (HF bull x Red Sindhi x local yellow cow) was thus recommended as the best alternative for creating dairy crossbred cattle in Vietnam.

With the aim of creating dairy crossbred cows of 75% HF blood, F1 cows (HF bull x Laisind cow) were backcrossed with HF bulls. It was found that the milk yield of the groups with 75% HF bloodline was significantly higher than that of the groups with 50% HF blood (in average, 3600kg/lactation compared with 2800kg/lactation). Succeeding researches demonstrated that the F2group with 75 % HF bloodline was the most suitable and has the highest adaptability to regional conditions. This group has better resistance to common tropical diseases than pure HF and the F3 group with 7/8 HF blood. And of course, F2 cattle have fewer problems with heat stress than the others.

Heat stress is a very complicated problem related to both the environment and the animal's own body. Environmental factors include temperature, solar energy, precipitation, humidity, altitude and radiation.

Cattle belong to homoiotherms that always attempt to maitain a constant body temperature. This requires a delicate balance between the heat produced within the animal, the heat gained from the environment and the heat lost by the animal to the environment. In certain areas, high environmental temperatures create problems in adaptation.

At Bavi Cattle and Forage Research Centre, the following measures have been applied to dairy production to decrease the danger of heat stress for the animals:

1. Selecting and crossbreeding suitable cattle, which are well adapted to hot climate (eg. crosses of Brahmans or Red Sindhi);
2. Supplying cattle with shade such as roofs and trees to reduce solar radiation and heat. Shade from trees has special meanings for pasturing cattle. At Bavi Cattle and Forage Research Centre, dairy cattle are mostly accommodated in their houses. They are sometimes kept under the shade of surrounding trees.
3. In summer, cattle are washed once or twice daily with clean and cool water, which is pumped up from drilling wells.
4. Using electric fans at some positions in the stall to ventilate the air and decrease the body and room temperature.
5. Supplying cattle freely with clean and cool water source.
6. In summer, on very hot days when the environmental temperature reaches 34-35^{0}C or higher, cattle are fed very early and late every day, for example at four to seven in the morning and at six to eight, or even later, in the evening. This increases the cattle's food intake and its digestibility.

Table 6. The age at first calving and calving interval of different genetic groups.

Traits	Formula	HF	LaiSind	F_1 1/2	F_2 3/4
Age at first calving	$\bar{X} \pm m_{\bar{x}}$ CV %	30	31.7 ± 1.4 12.46	32.1 ± 1.1 13.17	30.8 ± 1.7 14.8
Calving Interval	$\bar{X} \pm m_{\bar{x}}$ CV %	12.3	13.8 ± 0.3 5.7	14.6 ± 0.43 12.3	14.4 ± 0.33 12.27

Table 7. Development of Vietnam's dairy herd, 1991-2001.

Year	Total dairy population (heads)	Crossed Dairy		Pure Dairy	
		Population	Milk yield per lactation (kg)	Population	Milk yield per lactation (kg)
1991	12100	9300	2200	1800	3000
1992	13100	11500	2200	1600	3200
1993	15100	13500	2200	1600	3200
1994	16500	15000	2250	1500	3200
1995	18700	17200	2300	1500	3300
1996	22000	20500	2330	1500	3300
1997	24500	23050	2500	1450	3400
1998	27000	25650	2700	1450	3500
1999	29500	27800	3000	1700	3600
2000	35000	33000	3600	2000	3850
2001	38000	36000	3600	2000	3850

Dairy herd size

- In ten years (1990 - 2001), the total dairy population increased 3.8 times.
- In the past three years (1999 - 2001), the total dairy population of 30,000 heads increased up to 38,000 heads, including 25,000 cows, of which 18,000 are milking cows.

Distribution

- In Ho Chi Minh City and the neighbors: 85 %
- Northern Provinces: 13 - 14 %
- Central Provinces: 1 %
- The pure HF imported from Cuba were reared and bred in Moc Chau from 1970 to 1975 and transported to Central Highland (Lam Dong Province) in 1975. To date, there are 2000hd of pure HF herd though out the country.
- At the end of 2001, 130 pure HF and Jerseys were imported from American for Vietnam's dairy production development program. These cattle have been being reared in Moc Chau, Bavi and Lam Dong province.

Table 8. The average milk yield of Bavi dairy herd.

Genetic Group	1980 - 1985	1986 - 1990	1991 - 1995	1996 - 2000	At present
Average	1659	2136	2435	3236	3550
F_1	1612	1827	2118	2769	2934
F_2	1706	2195	2531	3415	3768
F_3	-	2387	2657	3524	3947

Table 9. Milk yield and milk quality of private dairy herd in Bavi (2001, in average).

Norms	F_1 (50 % HF)	F_2 (75 % HF)	F_3 (> 75 % HF)
Milk yield	3420	3618	3705
Fat rate %	4.29	3.89	3.74
Crude Protein %	3.54	3.46	3.38
Dry matter %	13.01	12.88	11.97

Table 10. Milk production and consumption in Vietnam.

Norms	1990	1995	1997	1998	1999	2000	2001
Total dairy population (heads)	11000	18700	25000	27000	29000	35000	40000
Development rate (%)		11.6	16.2	8.0	7.4	10.3	18.5
Total fresh milk produced internally (tons)	12000	17000	31000	36800	39000	54000	70000
Increasing rate (%)	7.2	6.9	16.4	18.7	19.5	22.7	20.3
Fresh milk production per capita/ year (kg)	0.170	0.230	0.420	0.450	0.530	0.690	0.810
Milk consumption per capita/ year (kg)	0.470	2.050	3.700	5.000	6.000	6.500	7.000
Milk production/consumption (%)	36.1	11.2	11.3	9.0	8.3	10.6	11.4

The above table shows that the internal fresh milk production is much lower than the demand.