Performance Recording in Dual Purpose Cattle in Venezuela

R. Vaccaro & L. de Vaccaro

Universidad Central de Venezuela,
Facultades de Ciencias Veterinariasy de Agronomía,
Maracay, Venezuela

1. Introduction

Venezuela lies in the north of South America, bordering the Caribbean sea. It stretches from 1º to 12º North and from 60º to 70º West. The Andes occupy a small area in the north west, which consequently has a temperate climate, but most of the country is lowland tropics with a rainy season of 5 to 10 months a year and between 600 and 2 000 mm of precipitation annually. Mean maximum, minimum and overall temperatures are 35º, 16º and 31ºC, respectively.

With a population of 21.4 million people, only 11% of the economically active are in the rural sector. The country has a deficit of food and depends on importation to satisfy demand. In 1994, food importation (excluding fish) reached a value of US$ 886 100 000. Of foods of animal origin, milk has one of the highest deficits. The large negative balance of agricultural imports and exports is made possible by Venezuela's production of oil.

According to the Central Bank, the overall economy suffered a contraction of 8.3% in 1989, with agriculture reduced by 5.1%. Despite overall growth of 4.4% in 1990, agriculture again fell by 1.3%. In the animal production sector, reductions occurred in milk (-3.4%), pigs (-15.3%), poultry (-1.9%), eggs for consumption (-22.5%) and hatching (-l.6%). Similarly, in the period 1980-90, the production of milk per capita fell by 2% annually, while the population grew at a rate of 3%, according to the 1990 census. Milk consumption per capita fell by 4.9% annually in the same period, due to the reduction in real income and despite the policy of consumer subsidies. The supply of milk decreased from 140 litres to 85 litres per capita between 1980 and 1990, and the tendency continues to date. The milked cow population was estimated at 1.3 million in 1994, with an average yield of 1 268 kg milk/cow/year. A large area of the country is devoted to pastures (17.4 million ha.). To satisfy the demand in 2 000, it is postulated that yields per cow will need to be increased to 1 800/litres/year, with a population of 2 427 000 cows in milk, an increase of 1.2 million hectares of grassland (1 AU/ha.) and a volume of 1 456 000 MT of concentrate feed (600 kg/cow-calf/year). Unless an improvement is made in current technology, the requirements will be for 3.5 million cows in milk and an increase of 2.2 million hectares of grassland (Montenegro, 1992). The low

carrying capacity of the pastures (0.79 AU/ha.) presently limits animal production, but on the other hand offers important opportunities for improvement through rational utilisation and management.

2. Official milk recording service (ROPL)

Between 1956 and 1994, the country had an official national milk recording service. It was initially run and financed by the Ministry of Agriculture and Breeding (MAC), but was limited to the central-western states and data were processed manually. By 1972, electronic processing was introduced and the work carried out under agreements with two of the largest universities in the country. Information was obtained from the farms by an authorised supervisor, collected together by technical personnel from the Ministry and sent for processing to a central computing office (MAC-BAP-IAN). The resulting reports were then returned to the various regional offices for distribution to the farmers. The producers who requested the service had to meet certain conditions, as a result of which the herds included had above average levels of management. The processing methodology and report format closely followed temperate climate models.

Table 1 shows trends in numbers and yields of cows and farms enrolled in the service. The relatively large herd size is a notable feature. It may also be observed that yield per cow/day increased only 0.8 kg between 1972 and 1986. From 1980 onwards, an incentive of US$ 0.02/litre was given for herds in the system which led to a significant increase in the number enrolled, so that by 1984 more than 2 000 herds were included in the service with over 350 000 cows. The same year, herds were obliged to use artificial insemination in order to receive the monetary incentive. This new requirement led to a decrease in herd numbers. By 1989, it was estimated that 25% of the dairy herds in the country and 28% of the national dairy herd was enrolled in the service, producing 35% of the country's total milk yield (F. Salvador, personal communication).

Table 1. Number of herds, cows and milk production in the official milk recording service.

Year	1972	1981	1986
Number of herds	32	456	1 236
Number of cows	11 402	111 297	273 997
Cows per herd	356	244	222
Total milk production (kg)	44 032	389 558	1 270 537
Milk/cow/day (kg)	3.8	3.5	4.6

Modified from Hahn (1988).

In 1993, the Ministry terminated the contracts with the two universities and the service was discontinued. The government's decision was partly due to costs, but also attributable to:

- delays in processing the data and returning the information to the farms (several months after data collection);
- the fact that little or no use was made by the farmers of the monthly reports, partly because the reports were so late and partly because most farmers were not sufficiently knowledgeable to interpret them;
- lack of technical assistance to the farmers.

On the other hand the veracity of the data was frequently questioned, especially once the incentive was paid per litre, because so little supervision was given to the monthly weighings. Also, limitations in the data collection and herd management on most farms meant that the records were not usable for estimating the breeding value of bulls through progeny testing.

3. Dual purpose cattle recording

Work on the performance recording of dual purpose cattle was started in 1990 as part of a research project on the evaluation and genetic improvement of this type of cattle (Vaccaro *et al.*, 1996). The project was financed by the IDRC of Canada with the Universidad Central de Venezuela, and carried out in private dual purpose herds (production of milk and a calf for beef) which expressed particular interest in the research. The phase of the project which is of particular interest in the context of this Workshop had the following objectives:

- definition of traits to be measured in dual purpose cattle for describing productivity and genetic improvement through selection
- development of methods appropriate for field recording under tropical conditions
- development of computer programmes for data processing with a view to:
  - providing farmers with timely information for taking decisions on the management and feeding of their herds
  - listing cows in each herd according to their estimated genetic merit for production, and encourage the use of the information for selection
  - helping with other aspects directly related with the genetic and phenotypic evaluation of the cattle used in this production system, on the basis of the information obtained.

4. Choice of co-operator herds

The herds were chosen on the basis of the production system (because of its predominance in Venezuela and throughout tropical Latin America), the interest of the owners in participating in the research, the type of cattle used (crossbred *Bos taurus x Bos indicus*) and the number of cows in milk (at least 40). Each farm contributed information required to meet at least one of the project's objectives. Because of the progressive attitude of the farmers and large herd size, the herds cannot be considered typical, either

nationally or regionally. However, they are considered to be representative of the dual purpose system as found throughout the tropical region, in terms of feeding, milking system (usually by hand with restricted calf suckling), general management and the absence of performance recording.

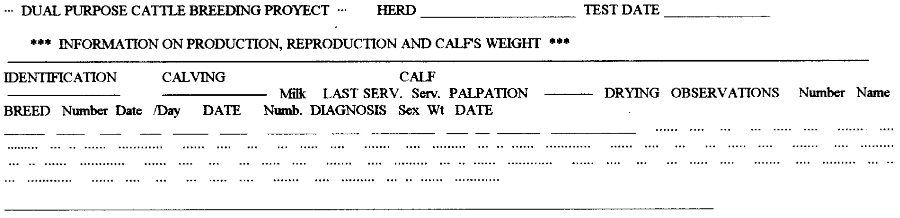
5. Project operation

Co-operator herds were located in four states, at between 198 and 748 km distant from the headquarters in Maracay. The number of farms varied between 12 and 20 over the years, with between 1 552 and 3 077 cows under monthly performance recording. Initially, milk and calves were actually weighed by project staff, with the help of farm workers but later clock balances were bought and the farm workers assumed the responsibility, with occasional supervision from the project. Rectal palpation was carried out every three months initially by the project, but after the third year the farmers themselves did the pregnancy diagnosis at intervals of approximately six months in most cases. An aspect of vital importance was the monthly visit of the project technician, as well as frequent visits from thesis students and the university professors responsible. The calendar of farm visits was adhered to rigorously over the years. The herd located furthest away from headquarters (748 km) was visited every three months after the third year, and then every six months. In the intervening periods, data were exchanged by fax and courier.

At every visit, the project technician carried out the following duties:

- supervision of the milk testing, and collection of data recorded by the farmer (dates of calving and drying off, services, deaths/sales, etc.)
- direct recording of some of the data (e.g. calf weights)
- delivery and explication to the farmer of the previous month's report
- discussion of the work programme for the immediate future

The following sheet was used for field data collection:



··· DUAL PURPOSE CATTLE BREEDING PROYECT ··· HERD ____________ TEST DATE __________

*** INFORMATION ON PRODUCTION, REPRODUCTION AND CALF'S WEIGHT ***

IDENTIFICATION CALVING CALF
Milk LAST SERV. Serv. PALPATION DRYING OBSERVATIONS Number Name
BREED Number Date /Day DATE Numb. DIAGNOSIS Sex Wt DATE

With the computer programme which was actually used, it was considered important that:

- all information collected on a given cow at each visit should be written on a single sheet (not different sheets for different types of information), because the data were transcribed into the computer according to the identification of the animal, not the type of information (e.g. milk weight or calving date).

- a master sheet for data collection should be prepared which can be photocopied or printed, with all cows and heifers in service listed in order, instead of preparing a new sheet each time different cows enter or leave the herd in milk.

6. Computer programme

The commercial programme used permits the processing of the field data with certain limitations with respect to speed. It offers multiple options for calculations, but these have to be done using combined functions. It also permits the management of the information in numerical or alphabetical order. Information is transcribed for each animal using windows or the presentation of each field in sequential order. The calculations made in the processing of field information for each cow include:

- Milk yield (kg) in the last period.
- Accumulated milk yield in the present lactation.
- Accumulated days in milk in the present lactation.
- Expected calving date for cows reported pregnant.
- Number of days open.
- Accumulated milk yield in the first 244 days of lactation.
- Calf weight adjusted for sex and age at 120 days.

7. Monthly reports

These reports contain the following sections:

*Cows in milk: I*dentification, breed group code, calving number, calving date, days in milk, test day milk yield, accumulated milk yield in current lactation and up to 2 44 days, service date, number of services, expected calving date, calf sex, 120-day calf weight, days open and observations. Cows are listed in increasing numerical order.

Dry cows: Identification, breed group code, last calving number, last calving date, last service date, number of services, expected calving date, days open, observations. Cows are listed in increasing numerical order.

Cows with above average daily yield: Identification and basic data. Cows are listed in increasing order of last test day milk yield.

Cows to calve in next 90 days: Identification and basic data. Cows are listed in increasing order of expected calving date.

Cows with over 150 days in milk and not pregnant: Identification and basic data. Cows listed in increasing order, according to identification number.

Cows reported dry in previous month: Identification and basic data on last lactation. Cows listed in increasing order of calving number.

Monthly summary: Herd; recording period; numbers of heifers, cows in milk and dry cows; average yield of cows in milk; average days in milk per cow; number of cows reported pregnant; services/pregnancy of heifers, first calf and older cows; number of cows with over 150 days in milk and not pregnant; number of days open per cow pregnant; average calving interval; average days open for first calf and older cows; number of cows reported dry; mean days in milk and mean milk yield per lactation of cows reported dry; request for missing information or clarification of apparently abnormal data.

8. Estimated genetic merit listings

Every six months, farmers receive a list of their cows with estimated genetic values for milk yield per lactation, days open and 120-day calf weight. Cows are listed in increasing order of merit for milk yield. The calculations are made using a programme especially designed by the project. It assumes hypothetical heritability values for the three traits, and makes use of available information from all calvings of each cow. Corrections are made for calving number, year and season. The decision to include estimates for days open was based on the evidence of reasonable heritability values for female reproduction traits in American zebu populations, and the negative genetic correlation between milk yield and fertility found in the project's cow population. The genetic merit listings are accompanied by a table which gives the herd's mean values for each trait, according to calving number, year and season. A list is also supplied which summarises performance data of all cows (live and dead) in the project data base for that herd, ordered by cow identification number. It includes actual yields and the corresponding deviations from contemporary means for each trait. Finally, a simple text is included, explaining how the calculations are made and how the information should be used for selection and culling.

9. Project staff

The work is carried out by one university professor who dedicates about half time to the project, with the occasional support of two more professors. One technician is primarily responsible for all field work, with one or two research assistants, depending on the number of herds at the time. The research assistants transcribe, process and analyse the data, not only for the farm reports but also for different aspects of the research carried out. They also prepare texts for publication and have minor administrative responsibilities. However, all members of the team share the work in a flexible manner which contributes greatly to the ensuring strict and punctual coverage of the work calendar. A decisive factor has been the level of training of the technical team. All of them have undergraduate degrees in animal production, two finished their Masters' degrees while working in the project and two more took graduate level course work. All of them were ex-students and had been tutored by one of the project's professors for their undergraduate thesis work. This is believed to have helped greatly in the selection of suitable candidates, and to have contributed to the excellent team spirit.

10. Equipment

The project has a four-wheel drive vehicle for the exclusive use of the field technician. The first one had to be replaced after three years. The total distance travelled in seven years was 387 552 km.

Work started using an IBM microcomputer with 12 Mhz, 1 MB of RAM memory and a hard disk of 60 MB. The acquisition of faster machines became necessary partly because of the difficulties encountered in repairing the machines in use, and partly to accelerate data processing. In the fourth year, the project bought an Epson 486 with 99 Mhz, 4 MB of RAM memory and a hard disc of 210 MB, and in the sixth year a Compaq Presario 5226 Pentium was acquired with 100 Mhz, hard disc of 1 GB and 16 MB of RAM memory. On average, it has been necessary to have two computers operational all the time in order to meet deadlines without exception. Poor public transport facilities and major problems of personal security make it impossible to work routinely by night as well as by day.

11. Operational costs

The project was financed completely by the IDRC for four years. As external funding decreased, the farmers unanimously agreed to contribute to costs and have, without exception, done so from the fourth year on. In the sixth year, additional support was received from the University. The total annual budget is presently about US$ 27 000

Total operating costs are estimated as US$ 0.80/cow/month, of which the farmers presently pay US$ 0.33/cow/month, besides offering food and lodging to the field technician. It is important to emphasise that the project is not simply a field recording service, but has specific research objectives. Thus, in the period 1990-96, a total of 60 scientific publications were generated, as well as extension materials for the co-operating farms and others.

12. Project impact

Twelve project farms participated in the project throughout the whole period. Between 1990 and 1995, national average milk yield/cow/year decreased 1%. On the project farms, mean milk yield/lactation increased 6%, days open decreased 10%, 4-month calf weight rose by 9% and calf mortality fell by 22%. This gave a total increase of 10% in '(milk + calf)/cow/year' in six years. The four most progressive farms increased milk yield/lactation by 22-83%, and yield of (milk+calf)/cow/year by 38-79%. However, in four herds, yields fell. This was attributed to the closure of the local milk plant due to falling demand, continued changes in farm personnel and, importantly, to the irregular presence of the owners on the farms due to security problems. It was concluded that major progress could be made in many other dual purpose herds in the region, through the co-ordinated use of technologies already available in the fields of genetics, feeding, health and management. However, factors beyond the farmers' control are often responsible where progress is not made.

13. Lessons from the project

Traits to be measured. It was concluded that milk yield/lactation, calving interval, calf weight and survival are the minimum required for herd monitoring, breed group evaluation and selection programmes for dual purpose herds. The high repeatability of milk yield suggests that selection decisions can be taken after the first lactation for milk yield, though more records are preferable for selection for fertility and calf weight. The frequency of abortions and stillbirths was so low and subject to so little variation, that these traits may not usually need to be recorded.

Milk recording. Monthly sampling led to unacceptable errors in the prediction of lactation yield, where cows are milked by hand with restricted suckling of calves. Weekly samples or two weighings every two weeks are recommended, particularly where the objective is to distinguish between cows of different productive capacities.

Editing of milk records. The proportion of lactations of zero days duration was 9%, and 19% lasted less than 100 days. Fifty four percent of cows whose calves died, went dry within 30 days. It was concluded that the frequency of short lactations is so high in all breed groups, including high grade European crosses, that they cannot be considered abnormal. Their exclusion from data analysis can lead to serious errors in the evaluation of systems, farms, breed groups and individual animals.

Body weights and measurements. Calves up to 200 kg were routinely weighed with a spring balance, and adults with a portable electronic one. Serious problems were encountered in taking body measurements on some zebu-type cows, even in the milking herds. Weights of calves and adults could be predicted quite accurately from body measurements.

Data processing. Experience led to the recommendation that the possibilities should be explored of using available commercial programmes for data processing, rather than writing a new one.

Farmer co-operation. One of the outstanding results of the project was the uniformly high degree of co-operation given by the farmers. Some of the reasons may be extrapolable to recording programmes in other developing countries. First, great importance is attached to the initial selection of the farmers, according to their interest in participating in research. This process was facilitated in the present case by contacts through students and old alumni, which is a particular advantage of any university. Second, it is vital that farmers participate in setting the research agenda, and that the latter includes studies which will produce useful results in the short, as well as longer, term. Third, useful services and technical assistance must be provided to the farmers, in order to maintain their interest and support. The ability of the field technician to establish communication and links of respect and co-operation is of key importance. In the present case, the monthly herd reports, the lists of cows in order of genetic merit, the annual reports of time trends in each herd and the summaries of the research

results, written in simple language, are also considered to have played an important role. Fourth, it is considered essential to carry out the work calendar strictly as planned, without exception. The difficulty of doing this under typical conditions in the tropics should not be underestimated. In our case, the problems included violent civil disturbances, danger of assaults and robbery, strikes, frequent and prolonged suspension of electricity and communication services, extreme climatic conditions which complicated travelling, and mechanical faults in the vehicle and computing equipment. Overcoming these types of problem depends on having a very highly motivated, versatile team, with a high sense of responsibility and initiative. Human qualities probably contribute even more than technical qualifications under such circumstances. On the other hand, the economic support of IDRC made it possible to establish good working conditions for the technical staff. This contributed importantly to stability and the development of an excellent team spirit.

14. Constraints and the future

There is presently no governmental organisation of milk recording. This is mainly due to the absence of infrastructure required to organise it efficiently, and to reduced public spending in agriculture. Technical assistance work is reluctantly being taken over by producers and the private sector is struggling to revert this attitude. A sustainable recording service should depend partly on support from the beneficiaries. A basic point is therefore to ensure and to demonstrate the value of the service to the producers. Local programmes with reduced coverage, such as that described here, have increased in number, often with partial funding from institutions such as universities and from the farmers. These have a research as well as a service function. Their success will depend on their efficiency and the benefits obtained by the producers.

Future genetic improvement programs in third World countries should be incorporated into field performance recording programs. Uncontrolled mating makes emphasis on female evaluation the more important as a tool for genetic progress. The use of a test day animal model analysis with a relationship matrix based on the maternal line is an alternative developed at Cornell University which is being explored in Venezuela.

15. Acknowledgements

The research described in this paper was financed by IDRC (Canada) and the Universidad Central de Venezuela. Special thanks are expressed to the participating farmers for their constant support and enthusiasm.

16. References

Hahn, M. 1988. Resultados del registro oficial de producción de eche (ROPL). En: Ciencia y Tecnología de Venezuela (2) 1988. Genética de Bovinos en Venezuela. CONICIT, 27-29.

Montenegro, J. 1992. Algunas consideraciones sobre el circuito agroalimentario de la leche y el comportamiento del mercado en el período 1970-90. En: II Ciclo de Conferencias sobre la Producción de Leche. Universidad Cenrtral de Venezuela, Facultades de Agronomía y Ciencias Veterinarias, 1-27.

Vaccaro, L., Vaccaro, R., Verde, O., Alvarez, R., Khalil, R., Mejías H., Pérez, A., Ríos, L. & Romero, E. 1996. Dual purpose cattle breeding (Venezuela), Informe Técnico Final 1990-1996.