
A prospective view of animal recording

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A review was presented on the objectives, scope and current size of the field recording business of ICAR member organizations. In the second part of the paper the on-going trends in animal recording including recording for farm management purposes, quality assurance and breeding purposes are discussed. In the final section, an outlook is given into future recording systems with special reference to ICAR. This includes the scope of farm management aid and the recording of milk and meat producing animals for breeding purposes. Finally, the emerging structures of future farm animal recording organizations is discussed.

The intensification of livestock production systems over the last hundred years has been accompanied by a tremendous increase in performance recording in livestock. On the one hand, animals are being tested in central stations in order to measure their performance in a standardised environment, on the other hand, field records are taken and analysed to assist farmers in managing their herds more effectively and after correcting for environmental influences, to carry out more effective genetic selection programmes. The observed growth of the recording business and tremendous and sometimes still increasing productivity increases are proof of the justification of record keeping and analysis.

Summary

Objectives of animal recording

Improvement of performance and cost-effectiveness

Herd management recording

The growth of herd sizes in most developed countries and the availability of cheap electronic farm management aids have supported the development of performance recording on farms with the objective of better control of the input-output relationships in animal production enterprises. The livestock producer nowadays has effective management tools at his disposal which were not available before for more rational feeding schemes, appropriate mating and culling programmes and better health management.

Genetic selection

Increased data collection by farmers or recorders employed by neutral recording organizations and the possibilities to adjust for systematic environmental influences contribute effectively to genetic progress in production, reproduction, conformation, other performance traits and disease resistance.

Quality assurance programmes

A new, but important field of animal recording is the participation in quality assurance programmes, originating from the BSE crisis in Europe. Quality assurance is spreading to other parts of the world and from cattle to other meat producing livestock species. This results in a requirement for all meat producing animals to be individually identified and their movements to be traceable.

Benchmarking

Livestock productivity records from farms also provide important information for livestock producers to compare their operations and effectiveness with that of other producers. They can identify where their production process could be improved and be made more profitable. This information is important both for the individual farmer and for the extension worker.

Statistical utilisation

For the farming community and the community as a whole it is important to gather accurate statistics, both for reporting and planning purposes. General statistics are frequently not precise enough to fulfil these tasks. For example, the statistics given in Tables 1-9 are helpful in showing the different availability of milk and meat to the people living in different continents. They describe the contribution of the different animal species and continents to world meat and ruminant milk production as well as the varying productivity of animals in different countries. However, for project planning, farm management assistance or genetic evaluation, these data are not precise enough.

Organizations which have so far taken an interest in ICAR are mainly involved in the recording of milk and meat producing ruminants. Work is carried out by field, station and event recording, the latter for instance, gathering information in auction sales or slaughter houses. Methods of recording are in constant development including automatic farmer and recorder recording.

The backbone of the on-going recording activities in ICAR-related organizations lies in productivity recording of dairy cattle. Data are being collected for yield, nutritive value of the milk including butterfat, protein and solids, as well as the hygienic value, in particular, somatic cell count and the bacteriology of the milk.

Expansion to other milking animals such as buffaloes, sheep and goats has so far, been less successful.

The biological statistics are also collected to measure the reproductive and productive lives of the animals and the incidence of dystocia. Conformation is a further set of traits. In northern Europe, disease recording increases the number of traits that are being observed.

Outside ICAR there are several other fields where recording of animals takes place, but these are either not intended for transparency, in particular in breeding companies for meat and eggs in poultry, for meat in pigs as well as for wool in sheep or recording activities for horses which are meant to be transparent in the same way as the recording of ruminants but which are carried out by special interest groups such as the World Breeders' Federation of Sport Horses (WBFSH) or by respective global organizations for race horses and trotters and have little or no common interest with ruminant livestock producers.

Although ICAR's membership has risen to over 40 countries, the proportion of the world's ruminant population being recorded by member organizations is relatively small. For example, about 22 million recorded dairy cows constitute less than ten percent of the world dairy cow population of the 184 countries listed by the Food and Agriculture Organization of the United Nations (FAO). In the other species it is impossible to estimate the proportion of recorded milking females because of lack of statistical data. In dairy cows more than half of the recorded cow population is kept within the European Union. Other large recorded populations are situated in the United States and Canada, New Zealand and Australia, Japan, Switzerland, Norway, the Czech Republic and Poland. The density of recording in Latin America, Asia and Africa is rather low.

Scope

Ruminants

Other recording activities

Current size of the field recording business

While dairy recording of sheep and goats is carried out in 10 and 13 countries, respectively, the bulk of the numbers recorded comes from France.

The recording of meat producing ruminants is limited to cattle. About one million head are recorded in 21 countries including performance and progeny testing in stations, herd recording and the recording of auction sale and slaughter-house data.

Trends in animal recording

On-farm recording

The fact that since 1998 every calf born in the European Union has had to be earmarked and traced from birth to slaughter and that the data have to be recorded in central national databases, this has fundamentally increased the farm recording business in Europe. Cattle producers in Eastern European countries that aspire to join the European Union and beef exporting countries which want to sell into the largest consumer market on earth, have to follow equivalent rules in order to stay in the market. To cope with these additional tasks, farmers will need the support of competent service organizations.

With respect to on-farm recording for management purposes, growing farm sizes necessitate more record keeping. Increasing farm mechanisation and computerisation also permits easier record keeping and on-farm analysis of data and thus, in turn, may lead to less intensive linkages between the farm and the recording organization. Furthermore, the increasing cost consciousness of livestock producers will lead to the separation of simple recording for farm management purposes from the more complex recording for breeding purposes.

Quality assurance programmes

To existing animal recording organizations, quality assurance programmes constitute major opportunities and challenges, as other service organizations or organizations from other parts of the meat industry may want to exploit these new opportunities as well. One possibility is to integrate traditional recording and quality assurance recording into one database covering all the animals in a country, such as in Denmark. Another strategy would be to establish separate systems for each requirement as in the UK. A third opportunity would be to have a division of tasks into farm-related work for the existing regional recording organization and the database work at central level, such as in Germany. The main task for decision-makers is to envisage solutions for sustainable systems after initial government subsidies have been withdrawn.

Recording organizations

A distinction has to be made between those organizations recording for breeding purposes only and those organizations which also support farm management extension work.

In recording schemes which solely serve the breeding industry there is a trend to use more farmers' data and to carry out less frequent milk sampling in order to reduce recording costs, especially wages for the recording personnel. In addition, breeding organizations are interested in additional traits than just milk and milk constituents. In order to obtain these, there is an increasing variability of sources and accuracy of data. Agreements have to be found at the ICAR or INTERBULL level regarding the criteria to be met for data to be acceptable for national or international genetic evaluation.

In rendering services to the manufacturing industry and to farmers, the enormous costs of laboratory equipment and the diminishing State subsidies call for increasing size, complexity and throughput of the laboratories. This will be a driving force for the integration of smaller regional units or the separation of tasks into decentralised field work and centralised laboratory work.

Regarding cattle producer extension, the recording organizations must make up their minds whether to exploit the opportunity of backstopping services or whether they leave this to private software houses, farm management consultants or accounting firms. Their role in participating in the certification of quality management of livestock enterprises and their own accreditation and certification has to be decided.

In dairy cattle, breeding organizations are expanding data collection for further traits, in order to guarantee sustainable selection programmes. This trend will continue because of the complex task to avoid antagonistic developments in the functional traits.

Genetic evaluation

Against tradition, cross-breeding in cattle is likely to expand because at the producer level the problems of vitality of high-yielding cattle may be resolved more easily through cross-breeding in dairy cattle and commercial crossing of bulls with dairy cows than by selecting in pure-bred populations. Breeding organizations entering this field need to test the suitability of lines for cross-breeding before selling them to the farmers.

Judging from the trend of the last 15 years, the expansion of international genetic evaluation will continue. The major dairy cattle breeds are now integrated into INTERBULL, but international evaluation for beef cattle is still missing. This is a disadvantage especially for the breeds used in artificial insemination. There is a demand for global evaluations for a global semen market.

On the other hand, production conditions are not as similar worldwide as they are in the advanced dairy countries that are currently involved in genetic evaluation. There is a need for further studies on possible genotype/environment interactions answering the question whether there is a global bull or only a zonal one.

Outlook into future recording systems

Scope

Milk recording

Dairy cow recording will continue to be the mainstay of organized animal recording with decreasing cow numbers in the highly developed dairy countries because of yield increases under quota conditions.

There are still many areas in the temperate zone, the arid subtropics and the tropical highlands which would sustain production systems and dairy cattle breeding programmes of the *bos taurus* dairy breeds, e.g. any country of Eastern Europe and Central Asia, most countries of the Middle East and Northern Africa, South Africa and the tropical highlands in Africa, South America and Asia. Overall, the number of recorded cows should increase.

More important for the growing human population is the expansion of dairy cattle recording in developing countries situated in the hot and humid tropics and subtropics. Cattle extension and breeding schemes depend on reliable recording under existing production conditions. As high-yielding dairy cattle of the temperate zone are not always suitable under tropical and subtropical environmental, management and economic conditions, more efforts have to go into this field. Considering the time and effort it has taken to develop milk recording schemes in the highly developed dairy countries, it is high time to get moving in order to:

- find the technical answers to the appropriate genotypes in the different environments; and
- form the basis of relevant breeding programmes.

At the same time, recording programmes have to be enlarged for buffaloes so that meaningful selection programmes will be possible for this rapidly expanding animal species.

Regarding sheep and goats, simpler milk recording practices will have to be agreed upon to be of any assistance to herd management and selection programmes. Apart from recording schemes in France and some other Mediterranean countries, the unsatisfactory density of recording prohibits faster genetic progress. The fact that artificial insemination is the exception in sheep and goat breeding, reduces the possibilities of testing and multiplication of superior breeding stock.

The importance of quality assurance in future recording programmes has already been described. Provided that these data will be accessible for breeding programmes this would give a sound basis of breeding plans for cattle, buffaloes, sheep and goats. Otherwise, costly meat recording schemes will only be justifiable in breeding plans serving the AI industry, while selection for natural service animals will have to be simple and cheap.

Meat producing animals

Whether ICAR member organizations will also find an entry into quality assurance programmes in pigs and poultry is an open question. For breeding purposes ICAR transparency is not required because of the competitive breeding structures. The recording of horses has too few linkages with the ICAR-related recording business so that there may be limited scope.

Other recording

To stay in business, recording organizations must become more strongly involved in back-up services, for example, checking milk measuring equipment, supply of software, as well as providing data from a central database. Costly laboratory equipment must also be utilised more effectively, for instance in the field of animal health management, such as mastitis control and the eradication of diseases. Whether ICAR member organizations will be able to render the necessary back-up services or whether this will be taken over by software houses, farm consultants or accounting firms, is an open question.

Structures

Farm recording

With public subsidies and the unfolding separation of recording schemes for farm management and genetic selection purposes, there will be structural changes in the recording organizations. The influence of the breeding industry in the recording business will probably be strengthened because governments will hand over their involvement increasingly to industry and the breeding section of the industry appears to be the strongest client. Various models of development, however, are likely because of different cultural backgrounds and present attitudes:

Recording organizations

A) “farmer cooperative model”:

- the farmer cooperative closely integrates with the breeding industry, with almost total dominance in the recording business. Examples are Denmark, Holland and New Zealand;

B) “farmer extension model”:

- the farmer cooperative is organizationally separate from the breeding industry, but with strong linkages to specialised extension services, e.g. for dairy farmers. Examples of this are France and to some extent Germany;
- the “free market model”: this appears to be favoured in countries with dairy farms of a larger size, such as the UK, the USA and Australia.

No matter what the organizational structure will be, cost-saving mergers of adjacent organizations or the take-over of less efficient organizations by the more successful ones is likely. This development will not be stopped by political boundaries, especially in the case of smaller countries, but it will be strongly influenced by historical and cultural factors.

Whether global solutions in productivity recording will emerge or should be pursued is an open question. There appears to be a lesser need for globalisation in the recording business than in genetic evaluation and the quality control regarding the validity of results that national governments may exert throughout their recording organizations should not be underestimated.

Table 1. Share of the world's human population, milk production and ruminant meat production by continent.

	Human population	Milk production	Ruminant meat production
Africa	12.7	4.4	8.2
South America	5.7	8.3	14.0
Asia	60.7	27.4	25.6
Developing Continents	79.1	40.1	47.8
North/Central America	8.0	16.8	20.5
Europe	12.4	39.2	26.6
Oceania	0.5	3.9	5.1
Developed Continents	20.9	59.9	52.2
World	100.0	100.0	100.0

Source: Derived from FAO Production Yearbook, Vol. 52, 1998.

Table 2. World milk production by species and continent, 1998.

<i>Old World</i>					
Africa	3.9	3.3	21.3	19.1	4.4
Asia	17.8	96.3	57.6	46.6	27.4
Europe	44.7	0.4	18.4	33.9	39.2
Subtotal	66.4	100.0	97.3	99.6	71.0
<i>New World</i>					
NC America	19.5	-	1.2	-	16.8
South America	9.6	-	1.5	0.4	8.3
Oceania	4.5	-	-	-	3.9
Subtotal	33.6	-	2.7	0.4	29.0
% World milk production	85.7	10.5	2.3	1.5	100.0

Source: FAO Production Yearbook, Vol. 52, 1998.

Table 3. World ruminant meat production by species and continent, 1998.

<i>Old World</i>					
Africa	7.1	14.5	22.9	7.8	8.8
Asia	18.7	44.4	70.6	92.1	27.5
Europe	23.7	20.2	2.8	0.1	21.1
Subtotal	49.5	79.1	96.3	100.0	57.4
<i>New World</i>					
NC America	27.4	2.1	1.3	-	22.0
South America	18.4	3.4	2.1	-	15.1
Oceania	4.7	15.4	0.3	-	5.5
Subtotal	50.5	20.9	3.7	-	42.6
% World ruminant meat production	73.7	10.3	5.0	4.0	100.0

Source: FAO Production Yearbook, Vol. 52, 1998.

Table 4. Productivity of cattle in the major cattle producing countries, 1998.

Country	No. of cattle (Mio.)	Meat/head/year (kg)	Milk/head of cattle/year (kg)	Milk/milking cow/year (kg)
India	209	9	141	877
Brazil	161	32	134	810
USA	100	115	716	7 767
China	96	37	77	1 638
Argentina	55	42	179	3 900
Sudan	35	7	85	480
Russia	32	69	1 009	2 286
Ethiopia	30	8	25	209
Colombia	28	24	191	982
Mexico	26	62	331	1 287

Source: FAO Production Yearbook, Vol. 52, 1998.

Table 5. Range of productivity of cattle by country, 1998.

	Highest		Lowest	
Meat per head in herd (kg)	Italy	122	Sudan	7
Milk per head in herd (kg)	Israel	3.027	Benin	14
Milk per milking cow (kg)	Israel	8.615	Ghana	130

Source: FAO Production Yearbook, Vol. 52, 1998.

Table 6. Productivity of buffaloes of the major buffalo producing countries in 1998.

	No. of buffaloes (Mio.)	Meat/head/year (kg)	Milk/head/year (kg)
India	91.8	15	386
Pakistan	21.2	28	776
China	20.8	12	110
Thailand	4.0	17	-
Nepal	3.4	34	214
Egypt	3.2	73	600
Indonesia	3.1	17	-
Philippines	3.0	17	6
Vietnam	3.0	36	11
Myanmar	2.3	9	45

Source: FAO Production Yearbook, Vol. 52, 1998.

Table 7. Range of productivity of buffaloes by country in 1998.

	Highest		Lowest	
Milk per head in herd (kg)	Bulgaria	1 091	Thailand	0
Meat per head in herd (kg)	Egypt	73	Myanmar	9

Table 8. Productivity of sheep in the major sheep producing countries in 1998.

Country	No. of sheep (Mio.)	Meat/head/ year (kg)	Milk/head/ year (kg)	Wool, greasy (kg/head)
Australia	120	5.7	-	7.8
China	118	8.6	10	2.4
India	56	3.8	-	0.8
Iran	53	5.2	9	1.2
New Zealand	48	11.6	-	14.3
UK	44	8.5	-	1.5
Sudan	42	3.4	11	0.7
Pakistan	32	10.3	2	1.8
Turkey	30	9.8	27	1.5
South Africa	30	4.0	-	1.8
Spain	25	9.1	12	1.2

Source: FAO Production Yearbook, Vol. 52, 1998.

Table 9. Productivity of goats in the major goat producing countries in 1998.

Country	No. of goats (Mio.)	Meat/head/year (kg)	Milk/head/year (kg)
China	138	8.6	2
India	121	3.8	26
Pakistan	49	10.3	17
Sudan	37	3.4	31
Bangladesh	34	3.7	40
Iran	27	5.2	15
Nigeria	25	2.3	-
Ethiopia	17	3.7	6
Brazil	13	4.1	11
Somalia	13	2.9	92

Source: FAO Production Yearbook, Vol. 52, 1998.