

A REVIEW : LIVESTOCK ON-STATION AND ON-FARM TRIALS ¹

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INTRODUCTION :

Scientist working in international livestock research are expected to be familiar with an interdisciplinary systems approach, and to work in multidisciplinary teams. The argument for this approach is that :

- Discipline specialists are not equipped to understand the relationships between the components they focus on and the systems as a whole.
- If the specialist operates in isolation from the other discipline, he/she is operating in isolation from the system and so the results may be irrelevant or, if applied, actually have a deleterious effect on the systems.

- Therefore, the specialist must understand the system through a systems approach, a systems person, or the activities of a team.

Applicants hoping to work in international livestock research are expected to have had project experience in the tropics, where the environment, culture, facilities and infrastructure may be very different from that in Northern Europe. The purpose of this course is to familiarize student with the multidisciplinary or interdisciplinary systems approach and to prepare them for their field projects in the tropics. (*Indon. J. Anim. Prod. Vol. 01 (01) : 36 - 42*)

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- examples

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¹ These topic are part of the course content of the Multidisciplinary Research in Tropical Animal Production System especially on Field Project in Agro-Pastoral and Intensive Systems. Prof. Dr. Erich W. BRUNS, expert on Biometrics Science in Institute für Tierzucht und Haustiergenetik Georg-August-Universität Göttingen Germany as a speaker.

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A. LIVESTOCK ON-FARM TESTS (LOFT)

Characteristics of Livestock On-Farm Test

1. On-farm performance testing and recording :
 - Experimental unit : Individual or farm.
 - Frequency : one or repeatedly, single observation or averages.
2. Objectives :
 - Identification of production systems or function.
 - Identification of production factories (supporting or limiting).
 - Estimating herd productivity.
 - Identifying individual animal performance (phenotype) : reproduction, growth, milk, fitness.
 - Estimating phenotypic parameter (var., cov., rep.)
=> Documenting regional performance such as conditions or constraints of production, means for improving performance and productivity (management, feeding, breeding).

3. Time : Depends on objectives;
 - Reproduction > 1 – 2 years
 - Reproduction cycles > 2 - 3 years.
 - Production > 1 year.
4. Type :
 - Diagnostic : identifying systems, production factors.
 - Comparable : testing interventions in management, feeding, and breeding.
5. Examples :
 - Resistance to gastro-intestinal parasites.
 - Determination of pasture intake by cattle on natural pasture.
 - Comparative analysis of constraints to full utilization of animal traction in Niger.
 - Feed resources for smallholder dairy production in coastal sub-humid Kenya.

Sample Size of Livestock On-Farm Tests

Expected standard error of the difference between means of two breed.

No. of breeds	No. of farm / breed	No. of animals / farm	Standard error difference of means unit of σ_p			
			Hierarchical		crossclassified	
2	5	20	0.26	0.41	0.11	0.14
2	10	10	0.23	0.30	0.11	0.14
2	20	20	0.15	0.21	0.05	0.07
2	40	10	0.11	0.15	0.05	0.07
(Se ²) var. within farms			0.60	0.60	0.60	1.00
(Sb ²) var. between farms			0.20	0.40	-	-

Hierarch. design = on-farm trial, crossclassified design = on-station trial

Conclusion :

- Hierarchical structure common in Livestock On-Farm Tests.
- Low precision of means or differences of means (*large SE*), more farms improves precision, reduces SE, large variance between farm = more farms.

Examples :

- $SED = 0.30 \Rightarrow LSD \approx 0.75 \sigma_p = 7.5$ kg (150-days weight sheep $\sigma_p = 10$ kg)
- $SED = 0.11 \Rightarrow LSD \approx 0.28 \sigma_p = 2.8$ kg (150-days weight sheep $\sigma_p = 10$ kg)
(*SED = standard error of difference, LSD = least significant difference, $\alpha = 5\%$*)

Problems of Livestock On-Farm Tests

Problem	Solution
• Representative sample of farms and animals	• Start with baseline study
• Variability of management (between farms)	• Sufficient large sample many farms
• Limited control of experimental units (design)	• Sufficient large sample to neutralize larger error variance
• Length of production cycle	• Large sample, correcting or selecting data
• Asynchron production	• Regular monitoring
• Mobility of animals (farms)	• Frequent monitoring
• Small farm size	• Grouping (clustering) of farms
• One male (sire) per farm	• Exchange of sires between farms genetic parameters from maternal components
• Unknown parentage	• Increased error variance • Large sample
• Unknown / multiple ownership	• Information and feedback
• Support by owner	• Information and feedback

Examples of Livestock On-Farm Tests

Thrust : SMALL RUMINANT MILK AND MEAT.

Theme : Breed evaluation and improvement.

Full Title : Genetic Variation in Resistance to Nematode Endoparasites in Small Ruminant.

ILCA Activity : Animal Breeding.

Location : Ethiopia, Kenya, West Africa.

Starting Date : 02/1991.

Ending Date : 12/1997.

Thrust : CATTLE MILK.

Theme : Feeding and management systems.

Full Title : Feed Resources for Smallholder Dairy Production in Coastal Sub-humid Kenya.

ILCA Activity : Nutrition.

Location : Subhumid - Kenya.

Starting Date : 09/1988.

Ending Date : 12/1993.

Thrust : ANIMAL TRACTION.

Theme : Introduction of traction.

Full Title : Comparative Analysis of Constraints to Utilization of Animal Traction in Niger.

ILCA Activity : Land management

Location : Selected village in Niger.

Starting Date : 01/1991.

Ending Date : 06/1992.

B. LIVESTOCK ON-STATION TESTS (LOST)

Characteristics of Livestock On-Station Tests

1. On-farm performance testing and recording :

- Testing (station) environment unequal production environment
- Recording : special variables in production, reproduction, adaptation, quality of products.
- Experimental unit : individual or farm.
- Frequency : one or repeatedly or intensively, single observation or averages.

2. Objectives :

- Testing alternatives of production systems : changes in feeding, husbandry, management.
- Recording special performance data reproduction, growth, milk, quality.
- Recording performance ability in special environment, special adaptability (disease, heat, water, feed).
- Estimating genetic parameters (var., cov., her.)
 - = > Documenting genetic potential of animals or population.
 - = > Documenting experimental possibilities for improving perfor-

mance, productivity, adaptation.

=> Develop breeding programmes (nucleus, MOET).

3. Time :

Depends on objectives, generally shorter than Livestock On-Farm Tests;

- Reproduction 1 – 2 years
- Reproduction cycles 2 - 3 years.
- Production 1 year.

4. Type :

Experimental : developing and testing of new technologies in management, feeding, husbandry.

5. Examples :

- Effect of wet season supplementation on productivity.
- Effect of genotype and endoparasite infection.
- Alternative source of draught animals or use of crossbred cows for traction.

Sample Size of Livestock On-Station Tests

Expected standard error of the difference between means of two breed.

No. of Breeds	No. of farm / breed	No. of animals/farm	Standard error difference of means unit of σ_p			
			Hierarchical		crossclassified	
2	5	20	0.26	0.41	0.11	0.14
2	10	10	0.23	0.30	0.11	0.14
2	20	20	0.15	0.21	0.05	0.07
2	40	10	0.11	0.15	0.05	0.07
(Se^2) var. within farms			0.60	0.60	0.60	1.00
(Sb^2) var. between farms			0.20	0.40	-	

Hierarch. design = on-farm trial, crossclassified design = on-station trial

Conclusion :

- Crossclassification structure common in Livestock On-Station Test.
- More precision of means (*small SE*) even if variance within station is large.
- Limited scope

Examples :

- $SED = 0.30 \Rightarrow LSD \approx 0.75 \sigma_p = 7.5$ kg (150-days weight sheep $\sigma_p = 10$ kg)
- $SED = 0.11 \Rightarrow LSD \approx 0.28 \sigma_p = 2.8$ kg (150-days weight sheep $\sigma_p = 10$ kg)
(*SED = standard error of difference, LSD = least significant difference, $\alpha = 5\%$*)

Problems of Livestock On-Station Tests

Problem	Solution
<ul style="list-style-type: none"> • Sample of animals on station genetically related, few sires, uniform • Variability in age, weight etc. • Asynchron production • Management or environment standardized, controlled. • Station environment = farm environment 	<ul style="list-style-type: none"> • <i>Sample progenies from all available sires, record parentage, scope genetically limited</i> • <i>Grouping (experimental design), covariable (experimental analysis)</i> • <i>Biotechnical intervention timely controlled birth</i> • <i>High precision but limited scope.</i> • <i>Depending on experiment objectives : ignore for developing interventions; narrow gap for testing applicability of intervention</i>

Examples of Livestock On-Farm Tests

Thrust : SMALL RUMINANT MILK AND MEAT	Full Title : Effect of Wet Season Supplementation on Productivity of Bunaji Cattle.
Theme : Reproductive Wastage	ILCA Activity : Animal Nutrition.
Full Title : Effect of Genotype and Endoparasite Infection on the Reproductive Performance and Productivity of Ethiopian Horro and Menz Sheep.	Location : Keduna - Nigeria.
ILCA Activity : Health Management	Starting Date : 08/1991.
Location : Debre Berhan	Ending Date : 07/1992.
Starting Date : 01/1991	Thrust : ANIMAL TRACTION.
Ending Date : 12/1994	Theme : Introduction of traction.
Thrust : CATTLE MILK AND MEAT	Full Title : Alternative Source of Draught Animal -- Use of Crossbred Dairy Cow for Traction.
Theme : Feeding and management systems	ILCA Activity : Animal Science.
	Location : Holetta IAR Research Center.
	Starting Date : 01/1989.
	Ending Date : 06/1992.

C. INTERACTION BETWEEN LIVE-STOCK ON-FARM TESTS AND LIVESTOCK ON STATION TESTS (LOFT x LOST)

• Study whole farm situation	LOFT
• Identification of production constraints	LOFT
• Developing interventions for improving production	<i>LOST</i>
• Testing applicability of interventions	<i>LOST</i>
• Verifying applicability of interventions	LOFT
• Changing interventions (develop, test, verify)	LOFT <i>LOST</i>
• Study effects of interventions	LOFT

SOURCE :

Lecture on "Multidisciplinary Research in Tropical Animal Production Systems" at George-August-Universität Göttingen Germany, June 18, 1996.