SECTION II: KEYNOTE PRESENTATIONS

SYSTEMS EXPERIENCE RELATED TO LIVESTOCK

HUBERT G. ZANDSTRA
IDRC CANADA

(The prepared text of the paper given by Hubert Zandstra can be found in Appendix 11. Following is a transcription of his delivery and the discussion which followed it).

INTRODUCTION

First, I wish to thank the co-sponsors of this meeting for giving me the opportunity to discuss some aspects of agricultural research about which I have been concerned for some time. This certainly is the kind of audience I prefer to speak to. You are all involved in various aspects of agricultural research that directly relates to farmers. Second, I am not a specialist on animal traction, so you will have to deal with me in the way you deal with farmers. We have to combine our experiences to make what I say useful. I also want you to think about questions you wish to ask me at the end of my talk. These questions should focus on the problems you see in applying some of the design and testing methods about which I will be talking.

I am going to depart from the text of my paper prepared for this workshop and deal with the same information in a slightly different way. Feel free to refer to the tables and text as I proceed. In farming systems research, there are the steps of area selection, diagnostic analysis, design, testing, pilot introduction of recommendations and production programmes. As I alluded to earlier, I will focus on the design and testing phases. Design is one of the least-stressed and -practiced aspects of farming systems research. It is also the more difficult one in terms of concepts. Testing is by far the most demanding in terms of time and money, and in the case of livestock, testing can be extremely difficult. Operationally, on-farm testing with bovines is exceedingly difficult and we need to gain more experience and exchange existing experiences.

Farming systems research is designed primarily to improve resource productivity on the farm. The workshop coordinator has already described farming systems research and extension (FSR/E) and I would like to approach it from the negative side for a moment. I want to stress that it shouldn't be limited to a commodity, for that brings with it the danger of ignoring possibilities for interventions or evaluating the impact of interventions on the rest of the farm enterprise. Neither should FSR/E be implement-driven. That is, many of us have been fascinated by an analytic technique or by a certain implement. For example, I am in an unenviable position to review projects which are constructed around amino acid analyzers or some such things. That is an extreme example, but in the case of farming systems research and technology development for farms, we should not allow our thinking to be driven by a commodity, factor or implement. So much for the negative side. There are many positive things that can be stressed.

In this talk I will focus on research. I realize that you are an audience which is strongly dedicated to introducing animal traction in a given system. That is good and by focusing on research, I am not implying that one should not continue to dedicate oneself to the introduction of research results or of animal traction specifically.

THE DESIGN OF ALTERNATIVE PRODUCTION SYSTEMS

(Refer to Fig. 2 at the end of Appendix 11).

The design process is characterized by being a synthetic activity of recombining information. In so doing some conceptual and operational difficulties may be encountered. The purpose of the activity is to bring to bear on a selected production system information about that system and about alternative management techniques and/or land use that might improve the system. This requires an interdisciplinary approach by a group of people who contribute their knowledge about the specific production system and about agricultural technology in general.

Refering to Figure 2, there are nine steps which were identified by a group of livestock production systems researchers in Latin America. The group has interacted as a group for three years and references are provided in the full paper. Their experiences are offered here as one approach to the design of improved technologies for systems in which livestock is involved.

ELEMENTS OF THE DESIGN PHASE

1. Understanding the existing system and what has lead to its evolution.

This is an important element of the analysis for animal traction.

2. Consideration of the development objectives of the nation and/or the region.

Certain conditions may be imposed on land use that may compete with the alternatives being considered and help explain what is evident in the present production system.

3. Focusing on selected systems or sub-systems which one may wish to modify.

The analysis starts with exogenous factors such as incidence of disease or the potential supply of animals for draft purposes. Then the analysis considers such structural elements as herd size and composition, pasture availability, equipment and cropland. Finally, the analysis considers how the farm functions. This analysis can be greatly helped by finding what the most important limiting factors of production are. One should also be able to explain why certain apparently desirable developments did not take place (why did animal traction not become adopted earlier? why is there no history of planted forages? etc). One may refer to the diagnostic phase and note an inconsistency or oddity before proceeding. There is no stronger analytical tool in farming systems research than identifying anomalies or inconsistencies between what we think about the production system and what we see in fieldwork.

4. Understanding the farm type.

Previous analysis leads to a level of knowledge and understanding of the farm type. Subsequently, the technologies that can be applied to the general region are identified, extrapolating what can be used in future research activity and specifying what is referred to as the adaptive domain. This can be a contiguous or non-contiguous area of land with certain characteristics. It can also be a condition and thus one should feel free about specifying the adaptive domain. Should a cultural factor differentiate farm types, it should be used as a stratifier in defining the adaptive domain. Another example might be bush fallow and the number of years following fallow which may influence the type of production system one would generate for a specific crop.

5. Identifying technical interventions useful to develop alternative production systems.

These are listed in terms of merit and interactions within the system. This leads to an analysis of what the design team feels are promising alternatives. The focus can be on the total farm system or limited to one enterprise such as a crop or a single factor such as animal traction. However, modification of one component may affect others or the total system.

6. Understanding of technical coefficients of each intervention to be applied.

This is referred to as an ex ante analysis. If technical parameters are not known, then a best estimate must be developed by the team. Ex ante analysis uses the costs in terms of cash, time and the benefits of animal traction. In other words, one estimates how the proposed intervention will behave. At the simplest level such an analysis will allow the application of partial budgeting techniques to predict the economic viability of each alternative. Theoretically this may not be enough, because one should take into account foreseen interactions with other parts of the farming system.

7. Evaluating an alternative production system.

This step implies a needed comparison which can be accomplished by comparing an alternative with the one that is being replaced. It is also the best way to evaluate results in the testing phase which is discussed in the next section. Where there are no viable enterprises (such as in some resettlement areas), one will have to use common measures of economic performance of enterprises in the region, such as what might be the return for a day's labor or what expectation might there be for return on money, or rental rates for land.

8. Listing of assumptions arising from the design process.

Important assumptions concerning such things as rainfall, crop duration, input responses, operation time and imputed costs, infrastructural support and presence of credit or markets should be listed. We often make these assumptions without considering the possibility of a less favorable environment or input response. Also the team should show the requirements being placed on infrastructure in terms of inputs required at the farm level.

9. Identifying research priorities.

Finally, the team will determine what research is needed and arrive at a set of research priorities. Also an assessment of further information needs, such as market or climatic information (which can be descriptive), may be made. It is important to do this right after the design of alternatives, since information gaps and their relative importance will become apparent during the design process. Note that research needs are not only experimental work, but may refer to further diagnosis or survey work.

ELEMENTS OF THE TESTING PHASE

Testing of livestock and related activities refers to experiments used to evaluate the performance of technological alternatives (see Appendix 11 for greater detail).

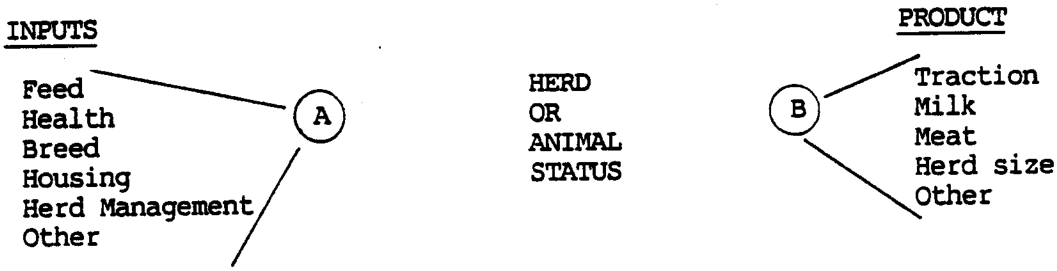
1. Testing objectives.

For this presentation, these are designed to measure on-farm, not on-station, performance of alternatives. Often there are large differences between the two, with on-station yields being 35 to 50 percent greater than on-farm yields. Another objective is to be able to compare the formulated alternative with the existing production methods. Additional resource requirements need to be identified. For example, the number of hours an animal works compared to what was projected at the design stage will need to be recorded. Finally, resource conflicts need to be identified at the farm or community level. We know that livestock on mixed farms can create resource conflicts related to land use, labor for tending animals and, at times, cash for feed. Trade-offs between meat and milk production or between milk production and traction can occur.

2. Testing Interventions.

Measurements commonly used in livestock systems that relate directly to or are a function of interventions include feed availability, carrying capacity, reproductive efficiency, health, herd composition, breed or type and product mix. Measurement possibilities for testing may be illustrated as follows:

POSSIBLE POINTS OF MEASUREMENT



The decision as to where one locates the measurement is important and depends on the questions asked. For example, if planting of a browse species leads to an increase in feed availability to the farm animals, the measurement can be done at POINT A. If the question is whether the additional feed led to some increase in output, such as the ability for the animal to supply power or produce milk, then one would need to measure at POINT B. I wish to stress that we know much about what happens in the animal and in the herd and about the effect of some of these interventions on the performance of the herd. With that kind of knowledge our measurements at POINT A are much more manageable than having to measure the effect of an intervention at POINT B. This is a trait of working with livestock that one should exploit. Variation, for example, in pasture yield responses to changes in pasture or stocking rates are great betweeen locations and years; therefore the responses are difficult to measure. But once one has a certain quantity of pasture available to the animals, one knows pretty well what it will contribute to the status of the herd or individual animals.

For on-farm research, several stratifications are possible. Experiments can be designed on an animal basis where individual, pairs of animals or a sample of animals are studied. Split herd techniques can be used for measuring supplemental feeding regimes or disease controls. In other cases, one may want to look at herd composition. This will require studying the whole herd or flock over time. Other variables can be studied on a field basis, like pasture establishment or fertilizing a crop to increase by-products for animal feeding or comparing times of operations for implements. The point is not to refrain from doing on-farm research with animals because of the reputed design or execution difficulties, but rather to break the task into elements to be researched or interventions to test, and then think about the difficulties. Usually one will find that 80 per cent of the tests are not that difficult, that they have been done elsewhere and they can be done by using available on-farm research techniques.

As to replications, this can be quite a problem with large, animal-based interventions. The questions are do we need to replicate and what do we replicate for. One must look at the objectives of the research. For example, if one is to test the use of crude rock salt compared to a balanced mineral mix, then one deals with a treatment-to-treatment comparison. That can be done on a farm or one may want to do it elsewhere.

If you wish to sample a farm type, then replication at each location is less important. More important is securing a decent sample of that farm type. For herd-based or field-based interventions one should select a number of farms which are representative of the adaptive domain.

Typically, the experience in farming systems research projects has been using six individuals in a system or sub-system. Thus, monitoring 12 farms will allow comparisons of the existing system to one alternative on those farms. Some researchers prefer to start with few replications and then expand to more as time progresses. For example, one may look at six systems (and existing alternatives) on 12 farms the first year, then at three the second year and maybe two the third. This narrowing down of alternatives will give a reasonable number of observations and will have eliminated a number of alternatives that initially appeared useful.

Another tool is the survey technique, used to solve some of the testing problems by capitalizing on situations that exist in regions in which one is working. This is most effective where some farmers are experimenting with alternative systems or where there is a wide range of performance of a system. This technique is often used by farm management specialists and social scientists, but can just as well be used to improve our agronomic or bilogical insights into a system.

TESTING ANIMAL TRACTION ON FARMS

In on-farm testing of animal traction a number of questions may be the object of research. These need addressing before the research is started and the experimental technique is identified. For example, to answer the question of whether a farm can "carry" two or more animals or whether animal traction is a good idea for a given farm type, one will have to use methods that require more time and a more sophisticated research design. On the contrary, if one is looking at health care or housing alternatives or an implement type, then the design is more straightforward. Thus it is important to start by breaking down livestock-based research into specific questions to be addressed and then move to the matter of how to do the experimentation.

Though I will approach the next topic from a research point of view, I would like to discuss the non-research side of the introduction of animal traction. The question of whether or not animal traction is right for an area will have to be answered through on-farm testing. This will require much time for training farm families to care and use animals properly, particularly where there is no livestock tradition. This may require a couple of years to stabilize valid testing before it can start. To evaluate animal traction, other topics to be addressed include: implement use and monitoring; evaluation of feed provided; the health and nutrition status of the animal; the costs involved in the purchase and maintenance of animals and equipment; labor requirements for the maintenance of animals (realizing animals save labor but also require labor); the frequency of animal work; the number of hours of work and the seasonality of the work cycle; the type of implements and their application to animal traction in that farm unit; and the benefits from animal traction in terms of labor savings, area planted and yields or sale of animal produce.

In summary these abbreviated points seem most important in conducting on-farm tests of multifactor interventions:

1. Farmer participation; the farmer's motivation; the personal relationship between farmer and researcher.

2. Measuring the right thing; focus on measures that directly indicate performance of interventions and allow one to compare with the existing system.

3. Effects on the system; evidence of conflicts and trade-offs within and between enterprises or at the family or community level.

4. Always compare to the system being replaced if it exists.

5. Economic analyses; costing out alternatives as measured by farmers; comparing with existing systems; using indexes of the productivity of major constraints.

6. Evaluation; using sensitivity analysis. Contemplate what conditions will change upon substantial adoptions. Will labor constraints become apparent, will markets or veterinary support become limiting? Is there an equipment maintenance capability in the community?

QUESTIONS DIRECTED TO DR. ZANDSTRA FROM PARTICIPANTS

Q. How useful are models and linear programming relative to sensitivity analysis?

A. I was thinking of less sophisticated approaches. The same thing applies to the whole farm impact of limited interventions. Sensitivity analysis can be done at the partial budget level. For economic analysis of on-farm research partial budgeting is still the most useful tool. Modeling does not always return the cost in time and effort used in the design or evaluation alternatives.

Q. What is the best way to use animal pairs?

A. Unless one can relate to a farmer who completely understands the testing, agrees with it and is not fearful of any damaging effects from the treatments, one doesn't have much hope of effective comparisons between paired animals. In such cases it is better to use different farms, some for testing an intervention and others as the control. Using pairs on the same farm is a great tool and a most effective means of reducing variation but a lot of farmer preparation is needed to establish the required confidence and trust.

Q. Do you recommend using certain models like linear programming?

A. Yes, if you are using whole farm enterprises and dealing with entirely new production systems in a region it is a good research tool, but not for the "run-of-the-mill" application of on-farm research.

Q. From this workshop, do you have suggestions for a common theme or activity that can be presented for practioners?

A. I cannot answer this now, as I think it is an objective for this workshop. Because projects and conditions vary so much, even with animals used for traction, it is dangerous to extrapolate to all projects. There is one thing that we all can work on and that is to find ways to improve our ability to get answers from farmers so that farmers can become effective participants in on-farm research.

Q. Is there a predominate factor on which research can be focused?

A. The identification of such a factor can become the result of on-farm production systems research, but should not be the starting point. If after a good diagnostic analysis a certain factor related to animal traction appears to be one that can make a major contribution, then I would channel research efforts in that direction. But it would be wrong to say that we must study animal traction without going through the process of careful diagnosis which asks if indeed traction power is a key constraint and animal traction is the most appropriate solution. There may be other ways to supply or reduce traction requirements. There may also be more valid reasons for introducing animals into the system. These should be considered. This is what I meant when I said that interventions should not be factor-driven or implement-driven. If in the design stage it appears that the introduction of the plow and traction animals will make a contribution that cannot be easier or better achieved by another alternative, then the intervention should be incorporated in the on-farm research.