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Social Sciences in Agricultural Research: An Animal Science Perspective

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Social scientists are advised that moving from no or low to "in" or "of" involvement in agricultural research can and will require time, despite any legislative actions by Congress. For meeting human food needs, alleviating malnutrition, and stimulating economic development, the sacred cow in agricultural research for over three decades has been the technical aspects of crop production, with plant breeders playing a dominant role.

History reveals that there is good reason for an emphasis on cropping. In what could be termed "Phase 1" of U.S. involvement in international agricultural R&D, seeds, fertilizers, and livestock were successfully exported to Western Europe in the late 1940s, and they served to combat hunger in Asia. However, unrecognized problems of livestock and crop disease, as well as poor responses to prevailing soil conditions, led to a short life for this model of assistance to low-resource countries. Phase 2 therefore emphasized the control of crop and livestock diseases. During these first two phases of assistance, feedback on social issues came mainly from expatriate representatives of various organizations, including religious orders serving as missionaries. These organizations focused on such "crisis solutions" as medical assistance and donations of food, seeds, and animals. Their members' technical training in either agricultural or social science was low or nonexistent. Generally, the religious workers felt themselves capable of handling any cultural constraints, since often their aim was to "westernize" local peoples.

In the early 1970s, Phase 2 was replaced by an emphasis on rapid rises in food production. The World Food Conference of 1974 sought 2% and 4% annual growth in grain production in countries and developing countries, respectively. The general thesis was that technology could be made available, whether by exporting technicians skilled in agronomic practices, by developing more appropriate plants for grain production, or by directly transferring technology (e.g., importing bull semen to upgrade cattle by crossbreeding). At the same time, U.S. agricultural universities, almost exclusively, became the trainers of foreign nationals in aspects of agronomy.

Phase 3 saw greatly increased support from governments and donor agencies for programs like the green revolution. But the green revolution triggered concern among social scientists over inequities in the distribution of benefits from agricultural R&D. Animal scientists in particular were criticized because many social scientists believed that livestock programs promoted competition between humans and animals for food. In principle, the social sciences had some valid points. But evidence shows their judgments about smallholders' failure to adopt recommended cropping practices was hasty and lacked an essential variable: it did not appreciate the fact that most smallholders engage in mixed crop/livestock operations, with these two subsystems fulfilling equally important roles (McDowell 1986).

Because the interdependence of the two subsystems went unrecognized, such social criticisms lacked full validity. Both then and now, smallholders' low adoption of improved plant varieties was largely a result of their dependence on crop residues for animal feed. As plant breeders selected for dwarfing and higher grain yields, the feed value of residues declined through increases in the low digestible plant fraction (hemicellulose) and the indigestible fraction (lignin). Coupled with some rise of phenols in stems and leaves in order to enhance plant resistance to disease, increases in these fractions made the crops unacceptable to smallholders practicing mixed farming. Critical on-farm services rendered by animals, namely traction and manure, were likewise ignored.

Crop scientists insisted that their priorities in plant selection did not conflict with smallholder needs. It was not until late 1987 that crop and animal scientists gathered to discuss the problem. This was a timely meeting, as evidence showed that certain plant cultivars with high grain yields maintained acceptable feeding value in their residues; therefore, decline in feed value was not always a necessary outcome of improving food crop yields.

Coupled with shortcomings of the green revolution, a long drought in the early 1970s in Sahelian Africa stimulated a reassessment of agricultural R&D policies. In addition to other lacks, it was recognized that not enough was known about traditional agricultural systems, social institutions, smallholders' objectives, the economic environment, and the constraints under which these systems were operating. This triggered Phase 4 of technical assistance: farming systems research (FSR).

In this phase, a methodology to account for the complex interactions between socioeconomic and technical factors emerged. Better understanding of socioeconomics has proved useful both in the United States and overseas. In the United States, some examples of important issues raised by FSR include the social impact on dairying of bovine growth hormone to stimulate milk production, and the effects of recommendations from animal science research in intensive systems as these relate to animal welfare. Overseas, increased knowledge of traditional systems has enhanced the potential usefulness both of international technology and of more locally appropriate technology.

As in the three previous phases of U.S. technical assistance, however, donor agencies are showing some disenchantment with FSR. Growth in agricultural production is now challenged on a cost-benefit basis. Most development professionals give high scores to FSR because of its more holistic approach. Unfortunately, what might be considered unrelated events are undermining support for FSR. Among these are political pressures arising from grain surpluses in the United States and elsewhere. An example is the decision to forbid use of U.S. funds to support research overseas on crops produced in surplus in the United States.

This brief historical review of technical assistance leads to two conclusions. First, biologists and social scientists got off to a stormy start, but many problems have since been resolved. Second, collectively, all the sciences need to exert more effort to achieve a coordinated focus and to reinstate support for agricultural research in developing countries.

SOCIAL SCIENCE INPUTS TO ANIMAL SCIENCE R&D

Social scientists have made some extremely important contributions to livestock research. These can be illustrated from experiences at the International Livestock Center for Africa (ILCA), established in 1974, with headquarters in Ethiopia and field teams in numerous countries. During its first five years, ILCA focused almost exclusively on studying traditional production systems in the semi-arid, subhumid, humid, and highland zones of Africa. In 1974–1975, few personnel with multidisciplinary experience were available. Nevertheless, for the field studies, teams of four to six members were formed, composed of at minimum one social scientist (anthropologist, sociologist, or economist), one agronomist, and one animal scientist.

Contrary to DeWalt's comments (this volume) on the IARCs, ILCA organized a policy group led by senior staff, which included economists and other social scientists. This group worked to ensure that the social sciences directly participated in research planning. Component research was increased in 1980, with social scientists continuing as team members. The multidisciplinary field teams' evaluations of traditional systems made it clear that, almost invariably, introducing technologies put forth in initial hypotheses would have failed. Some examples will serve to illustrate how this partnership between social and animal sciences contributed to ILCA's program.

ILCA joined with Ethiopian government agencies to develop a milk program for small farms in the highlands. The government planned to distribute crossbred cattle, but ILCA team surveys showed that the 2.8 ha farms were already heavily stocked with an average of one donkey, one cow, a pair of bullocks, one young head of cattle, and seven sheep and goats. Plans were to lower stock numbers so as to improve feed resources. Technicians chose the donkey and small ruminants for removal, but farm women refused to forgo either. Drawing upon social scientific insights, the bullock team was replaced with two cows for work and milk. This strategy permitted the milk program to move forward.

With crossbred cows, milk volume per farm was high. But women did not relish processing 10-20 liters of milk per day. Also, they liked to keep the crossbred cows constantly tethered because this facilitated manure collection (dung cakes are used for cooking and heating). Another problem was that as national economic conditions deteriorated, government milk collections were reduced from 365 days per year to 130 in order to correspond with the number of fasting days when animal products are not to be consumed. With social scientists' help, improved methods of butter making, home preparation of cheeses, management of tethered animals, and assistance in marketing thus were introduced. These steps made it possible to maintain the whole program.

Also in Ethiopia, ILCA introduced the use of ox-drawn scoops for constructing ponds to store water for both human and animal use. Farmers agreed to use their own oxen in pond construction. However, as social scientists on the field teams discovered, the farmers feared loss of prestige if they accepted public, in-village training in handling the scoop. On-station training in scoop operation resolved the problem.

In ILCA's semi-arid program in Mali, social scientists demonstrated the interdependence between pastoralists and cultivators in exchanging manure and milk for grain. This insight helped resolve conflicts over land use infringements. Social scientists also helped to show that high pea-yielding varieties of cowpeas were unacceptable to smallholders because of decreased forage yields. This led to a program emphasis on dual-purpose cowpeas instead of high grain-yield varieties.

In Nigeria and other countries, alley-cropping of leguminous trees and food crops is spreading rapidly, mainly thanks to social scientists. They showed that, while the technology is sound, its method of on-farm use must be quite flexible. In ILCA's subhumid program around Kaduna, Nigeria, intercropping of forage legumes to provide dry-season feed and reduce weed problems required large inputs of social scientific information in order to become effective.

In sum, ILCA is proof of the importance of disciplinary integration. The major reason ILCA teamwork is effective is mutual agreement on objectives, interactions to identify problems arising in ongoing research, and annual program reviews.

PROBLEMS IN INTEGRATION

McCorkle (this volume) and other Small Ruminant CRSP studies provide excellent examples of how social science research is important in targeting agricultural R&D thrusts. But from an animal scientist's perspective on the strong needs for sustained integration of crops and livestock in small farm systems, problems still remain in melding the different disciplines.

For example, the SR-CRSP's 5-year summary (Blond n.d.) cites examples of social science contributions to understanding small ruminant production. However, these are not reflected in the three major research thrusts of the SR-CRSP's strategic plan for 1990 2000: (1) hair sheep production systems; (2) agropastoral production systems; and (3) animal health. None of the three enunciates social issues as an objective. The only suggestion for social science inputs is found in the implementation plan for hair sheep production, which includes characterizing the social, economic, and biological activities of traditional farming systems. This sounds suspiciously like nothing more than the usual surveys. Similarly, economists' possible inputs are vague. Such potentially marginal roles do not represent real progress in interdisciplinary integration.

In the chapters in this book dealing with the Sorghum/Millet, Bean/Cowpea, and Peanut CRSPs, FSR is frequently mentioned, but, in fact, only studies of cropping systems are presented. There is no mention of crop residues and problems of smallholder adoption of new plant-crop varieties when their animal feeding value is less than or equal to that of traditional varieties. A useful social science contribution would be to determine possible trade-offs between increased grain yields and farmers' acceptance of decreased animal feedstuffs. Already in Africa, smallholders are slow to or do not adopt new bird-resistant varieties of sorghum because of the lower animal feeding value of both the grain and the stovers from these varieties.

In the chapters on plant crop and nutrition CRSPs, plant breeders are criticized for not paying sufficient attention to qualities such as taste, cooking quality, and storage. Such statements assume that all desirable plant traits are positively correlated. Plant breeders sometimes give the impression they can select for almost any trait, but they may not always make clear what the trade-offs may be. For example, maize that stores well on farm (such as some traditional varieties) fetches a low market price because it does not process well in commercial systems. Illustrating from animal science, cattle can be bred to produce milk with over 4% protein, but doing do decreases total yields of milk, calcium, vitamins, and lactose by about 50%. Markets will not support the high protein milk, nor will farmers tolerate sharp declines in total yields. The point here is that social scientists should carefully review trade-offs before they criticize their biological/technical colleagues.

Another social issue is recognizing that when new technology is introduced into production systems, not all people will benefit equally. Some will gain and others will lose. Social scientists need to help biologists decide whether overall benefits exceed losses. To give a hypothetical example, what if 10 poultry enterprises could produce all the eggs usable in a market at lower-than-usual prices, but at the cost of diminishing household income for 100 traditional producers? Would such a poultry program be warranted in social terms? From the animal science standpoint, the 10 more efficient producers are acceptable.

Implied in several chapters and explicit in one is the thesis that livestock and poultry compete with humans for food. With poultry production expanding in almost all developing countries, this thesis is gaining more adherents, despite the fact that data are seldom put forth to support it. Animal scientists are skeptical because this competition theory ignores a farmer's own, valid economic decisionmaking.

An example comes from Mexico, where sales of maize by smallholders is declining. Smallholders who adopt recommended practices for growing new varieties of maize find they are at a price disadvantage in the commercial market (Hart and McDowell 1985). Those with some water available instead cultivate small plots of alfalfa, which is harvested almost daily and sold to urban poultry and pig raisers. Smallholders grow native varieties of maize for household food needs mainly because native maize stovers sell for up to four times more than stover from improved varieties (McDowell 1988). The lesson is that when grain prices are low smallholders will seek alternate crops and markets.

Therefore, an alternative thesis is that grains going to feed poultry and swine may stimulate total grain production. Data from India and countries in Africa show a positive correlation between increases in grain and livestock production mainly because of increased feed from more crop residues. An additional reason for a positive correlation between rises in grain yield and more livestock is market demand. As human population grows in size and wealth, there is greater demand for more and better food.

ILCA investigators have consistently shown that sales of livestock and their products furnish the capital for improving crop production. Cash income is low because most agricultural produce is consumed within the household, and funds for fertilizer, seed, or pesticides are scarce. In the absence of adequate credit mechanisms, grain output increases only when there is cash to purchase inputs. Cash from selling livestock products serves as a catalyst for the farm system. Another type of crop livestock association is the sale of cattle for draft power. Work oxen are often a pivot in farming.

These associations highlight the need to recognize mixed farms as having two major subsystems, crops and animals. Both contribute to family welfare. However, there remain major concerns in building complementary linkages. Western perceptions of the use of animals and their products for human foods is often ethnocentric. Harris (1985) shows that many non-Western cultures use far more types of animals and parts of animals (viscera, blood, marrow); thus, livestock in these societies contribute relatively more to supplementary needs in protein, minerals, and vitamins. Seemingly, the social sciences should be primary advocates of the strong crop–livestock associations characteristic of mixed farm operations.

Finally, nowhere in this volume is mention made of the need for joint training at the university level between the social and biological sciences as a means of strengthening interactions. How many CRSP-sponsored trainees in the social sciences have been encouraged to take courses in agriculture and animal science, and vice versa? Most campuses now agree that this is a pressing need. Still other major problems remain, such as convincing national agriculture research services to allocate some of their limited resources to support social science components. The bottom line is that social science inputs are essential to agricultural R&D, but they must be made in a "progressive" rather than a "digressive" fashion, as has occurred so frequently in the past.

REFERENCES

Blond, R. D. (ed.). n.d. Partners in Research: A Five Year Report of the Small Ruminant Collaborative Research Support Program. Davis, CA: SR-CRSP ME, University of California–Davis.

Harris, M. 1985. *Good to Eat: Riddles of Food and Culture*. New York: Simon and Schuster.

Hart, R., and R. E. McDowell. 1985. Crop/Livestock Interactions as Determinants of Crop and Livestock Production. Cornell International Agriculture Mimeo No. 107. Ithaca: Cornell University.

McDowell, R. E. 1988. Importance of Crop Residues for Feeding Livestock in Smallholder Farming Systems. Proceedings of a Workshop on Plant Breeding and Nutritive Value of Crop Residues, p. 12–21. Addis Ababa: ILCA.

———. 1986. An Animal Science Perspective on Crop Breeding and Selection Programs for Warm Climates. Cornell International Agriculture Mimeo No. 110. Ithaca: Cornell University.