



**AGRICULTURAL ADMINISTRATION
(RESEARCH AND EXTENSION) NETWORK**

NEWSLETTER 24

ISSN 051-1986
June 1991

CONTENTS

	PAGE
I News from ODI	1
II News Items on Agricultural Research and Extension	6
III Papers With This Issue	18
IV Papers Received and Publications of Interest	24
V Research Note: "Experimenting with Honduran Farmer-Experimenters"	31

V RESEARCH NOTE

Experimenting with Honduran Farmer-Experimenters¹

By Jeffery W Bentley
and
Werner Melara²
Dept. of Crop Protection
Escuela Agrícola Panamericana
Apartado Postal 93
Tegucigalpa, Honduras

Abstract

Anthropologists often assume that peasant agricultural technology is simply part of the cultural lore of each people, ignoring the creative role of the individual. Several recent authors have argued that small farmers are creative and often invent technology and practices. Taking off from this point, several writers have suggested that agricultural scientists should collaborate with farmers to take advantage of their creativity, and thus develop appropriate, indigenous technology. While this seems useful, farmer-scientist interaction is difficult because the methods and purposes of farmer experiments are quite different from those of scientists. This paper summarises the results of two years of observations of agronomist-farmer collaboration for technology generation. Problems, advantages and future directions of this collaboration are discussed.

¹ An earlier version of this paper was presented in Spanish at the Semana Científica, Universidad Nacional Autónoma de Honduras, October 19, 1989, and will be published in *Ceiba* under the title "Experimentos por Agricultores Hondureños".

² This work was supported by the Department of Crop Protection, Escuela Agrícola Panamericana, El Zamorano, Honduras, with USAID/Honduras and ROCAP funds, and by a GTZ grant to support Werner Melara's studies. Abelino Pitty, Keith L Andrews and Paul Richards read and commented on earlier versions of this paper.

BACKGROUND

For many years anthropology was almost the only discipline studying traditional agriculture. Publications covered the origin (Coe, 1962; Struever, 1971; Flannery, 1976; MacNeish, 1964), ecology (Netting, 1981; Lee, 1969; Conklin, 1957; Barth, 1956; Durham, 1979), social (O'Neil, 1987; Evans-Pritchard, 1940) and religious aspects of agriculture (Rappaport 1968) among other topics. But no one studied individual creativity in developing new practices. Anthropology gazed steadily at community and culture (and not at the individual³), and when the distinguished anthropologist Allen Johnson (1972) wrote about experiments by small farmers, his stimulating paper gathered more dust than interest.

By the 1980s there was an awakening about farmer experiments in many disciplines due especially to the work of the British geographer, Paul Richards (1985, 1986, 1989), who demonstrated that small farmers of Sierra Leone experiment regularly. According to Richards, Mende farmers have an explicit concept of experimentation which they compare overtly to practices prevailing in an agricultural research institute. Even when receiving outside technology, villagers must adapt it to their own resources and environment (Richards, 1985). He estimates, on average, that a medium-sized village is likely to make one or two new selections from spontaneous rice crosses each human generation (Richards, 1986)⁴.

Many have suggested that agricultural scientists could collaborate with farmers to take advantage of their creativity and develop appropriate, indigenous technology (Ashby, 1986, 1987; Ashby et al., 1987; Baker et al., 1988; Chambers and Ghildyal, 1985; Farrington, 1988; Farrington and

³ There were certain exceptions, especially among American anthropologists of the culture and personality school, but these early, psychological accounts were more concerned with sex, deviance and early childhood traumas than with changes in farm technology (eg. Simmons, 1942; DuBois, 1944). Oscar Lewis painted many vivid portraits of individuals, families and daily life, though mainly of city dwellers. His account of Nahuatl-speaking Mexican peasants has agricultural detail, but the only reference to an individual invention is the case of a man who figures out how to load a heavy beam onto a mule without help. The mother of the invention is that the man lags behind the other muleteers and the rope around the beam breaks, forcing him to figure something out (Lewis, 1964: 317).

⁴ Many other authors have written about spontaneous farmer experiments (Richards, 1985, 1986; Box 1988; Brammer, 1980; Rhoades, 1987; Rhoades and Bebbington, 1988; Johnson, 1972; Kerr and Posey, 1984; Lightfoot, 1987; Bentley, 1989a, 1989b).

Martin, 1987; Kean, 1988; Knipscheer and Suradisastra, 1986; Lightfoot et al., 1988; Maurya et al., 1988; Norman et al., 1988; Rhoades and Booth, 1982; Sumberg and Okali, 1988; Villarreal and Galván, 1987). We believe that farmer participation with scientists can be fruitful, but most of the above cited authors have simply worked in technology adaptation or on-farm technology validation. This paper discusses an attempt to generate technology with campesinos⁵.

GALERAS - THE FIRST YEAR

Early in 1988 the authors, an anthropologist (Bentley) and an agronomist⁶ (Melara) began an intensive study of Honduran farmer participation.

We picked the contiguous villages of Galeras (Department of el Paraíso) and Lizapa (Department of Francisco Morazán) in the foothills of Cerro la Crucita in the south end of the valley of the Yeguaré - 11 kilometres from the Escuela Agrícola Panamericana (EAP). While boundaries between villages are ill-defined, Lizapa holds about four square kilometres of essentially dry land, while Galeras has about two well-watered square kilometres. The fertile valley floor North of Lizapa lies at just under 800 meters and is mainly owned by the EAP, large commercial farms and a few farmers' cooperatives carved out of a large, expropriated hacienda in the agrarian reform movement of the late 1970s (CEDOH, 1988). Galeras is at about 900 meters but the surrounding mountains, used as a watershed and for cutting firewood and grazing cattle, rise to over 1600 meters. These two villages are the only communities in the Yeguaré Valley where maize and bean subsistence farming is very important. Other local villages depend on wage work at the EAP, at several orphanages, on haciendas or farmers' cooperatives in the valley, in one of several small brick and tile yards (*tejerías*), a commercial poultry barn and other businesses. Nearly a dozen weekend homes in Galeras and Lizapa are owned by military officers, an entertainment personality, a physician and businessmen from Tegucigalpa. Owners of these *casas de campo* hire at least a watchman, sometimes servants as well. Galeras and Lizapa are not representative of more isolated, rural villages. They are near a prestigious, international agricultural

⁵ We will use this Spanish word for small farmer or peasant farmer to avoid overusing the term "farmer".

⁶ *Agrónomo*, a graduate of a three-year, university-level vocational agricultural college.

school, where locals have sometimes worked for wage, picked up seed and new ideas (like using horses as draft animals). The villages are only 45 kilometres from the capital city of Tegucigalpa, the best market in Honduras for selling agricultural produce. For three years, until about 1987, the twin villages were home to a Native American farmer from Guatemala who worked as an extensionist for World Neighbors, a non-governmental organisation with a model programme in grass-roots development (Reid et al., 1988). This man taught local people how to build soil erosion devices and influenced them to stop burning crop residues.

Working with farmers so near the school allowed us to visit the farmers and be at the college for classes and meetings. The main drawback was that Galeras and Lizapa are not representative of more isolated, rural villages. We could not discount that some of the interest in innovation in Galeras came from its contact with the school. So, while not representative of all of Hondurans, the people in Galeras are reasonably like other Hondurans of the central Highlands - which is over 80% of the country (SECPLAN, 1989: 25) - in terms of cognition, world view, crops, essential agricultural technology. Locals use somewhat more agrochemicals, (except compared maybe to more intensive vegetable growers, like the cabbage-farmers around Siguatepeque, Comayagua). Easily reached by car from Tegucigalpa, Galeras has received a lot of visits by extension agents and development tourists⁷, but this often means that farmers pick up some new vocabulary without much content. Campesinos with a bean field annihilated by golden mosaic virus may say they have *roya*⁸ instead of *hielo*⁹, as they begin to use agronomists' labels for campesino categories (see also Bentley, 1989b, 1989c).

The first year we made some mistakes, which we publish in the hopes that others will avoid them. The biggest problem with the mushrooming participation literature is that most authors try too hard to give a positive image of their work - doubtlessly related to current funding needs - so the authors rarely include the nitty gritty details of their problems, blunders and hair-pulling frustrations. It is naive to expect university-educated technicians to hop out of their land-cruiser in a traditional village and easily set up satisfying, egalitarian, information-exchange relations with near-illiterate peasant farmers (see Villarreal, 1989).

⁷ See Chambers (1980) for an early discussion of development tourism.

⁸ Rust, a fungal disease

⁹ "Ice", in the word traditionally used for most leaf diseases (Bentley, 1991).

One of our mistakes as limiting ourselves to working only with farmers between the ages of 40 and 60. We thought that because farming is complicated, only mature farmers would have the experience to link up good ideas and would have the self-confidence to criticise the agronomist. In the second year one of the best ideas was from a farmer in his mid-twenties.

We placed too much emphasis on gaining rapport with people before doing experiments. So we did no experiments in the "spring" (*primera*¹⁰) of 1988; we just studied the community and its agricultural practices. In November of 1988 Everardo Villarreal (pers. comm.) pointed out that we had adopted a very conservative strategy, that one should teach the people that one's work is doing experiments by doing experiments with them.

At first we spoke of the "natural scientist", people we thought lived in each village, doing experiments and that each community knew of their experiments. We thought that we had to know many people before identifying these "natural scientists". So the first year we just picked six farmers to work with us. Now we think that almost all farmers experiment, although many just try new varieties of traditional crops. Contrary to the dominant stereotype of the conservative farmers, resistant to change, experimentation and creativity are common characteristics of most small farmers.

Our biggest mistake was that the anthropologist allowed himself to be convinced by agricultural scientists that the study would be invalid, according to the scientists, if it was not divided into treatments to allow systematic comparison. We organised six farmers in two treatments and one control group as if the farmers were sub-plots of maize.

The first treatment was called "natural scientists". Two of the six farmers were going to do experiments of their own design. Melara - the agronomist - was going to visit them about every week but without suggesting research topics. The agronomist merely answered their questions. He tried to stimulate them to experiment by asking them what they were going to do that year.

The second treatment was called "farming systems". The agronomist was going to design the experiments, asking for ideas from the collaborating

¹⁰ The first cropping cycle, immediately after the first rains, usually from May or June till September or October, generally dedicated to maize growing.

farmers. We also had an "absolute control group"; two campesinos who would get no ideas from the agronomist. They would just be evaluated at the end of the year to see what they had done.

The problems with this method sprouted as fast as weeds in a corn field after the first rains. One of the farmers developed a close relationship with the agronomist even before starting to experiment. This ingenious, ambitious, friendly man began to ask the agronomist to drop by frequently, peppering him with questions as he served him coffee and inviting him to look over the farm.

This man had already decided how to relate to us. It was absurd to think of deciding what treatment he would fall into by pulling his name out of a hat. If the man fell in the absolute control group and we didn't see him until the end of the season he would feel offended. We decided to keep visiting him but he would not be included in any of the treatments. He designed his own treatment.

Unfortunately, because we selected farmers at random for the different treatments we could not be completely frank with the people. We feared they would realise that the agronomist was treating them differently and we could not tell them "Well, we drew your name to be a natural scientist, while your neighbor is in the farming systems treatment". By trying to divide them into different treatments we could not hold a community meeting and explain our work to them. Perhaps, because of this lack of frankness, or possibly because of a lack of rapport between us and campesinos the first year, little by little two of the farmers distanced themselves from us until we could no longer work with them. In the end, instead of having four farmers in two treatments and two others in a control group, we had three farmers in three treatments, ruining our ability to make systematic comparisons between treatments.

Another snag we hadn't counted on is that farmers really like to test chemical control. This was frustrating for us because we wanted to develop alternative technology for Integrated Pest Management (IPM). Spreading chemical pest control was not on our list. Farmers quickly synthesise the new and the traditional. Campesinos find no contradiction in planing maize and beans with chemical fertiliser in a furrow opened by an ox plough even though the crops are native American, the fertiliser is modern, and the plough is Medieval Spanish (ultimately Roman) technology.

All of our experiments the first year were with chemicals from agro-supply stores in Tegucigalpa, which were novel to the farmers but which we found boring and counterproductive¹¹. One farmer tried different ways of spraying fungicides on beans, comparing spraying the top of the leaf with spraying the bottom. There were no significant differences between treatments and almost none between either treatment and the untreated group. Another farmer tested fungicide application to bean seed with and without adherents. Another farmer compared beans sown alone with those intercropped with maize, but the test plot was lost when the farmer got sick and his wife sent workers to harvest the plot without knowing about the different sub-plots (Melara, 1990).

Fortunately we also did a few things right the first year. The anthropologist went to live in the community and the agronomist, who was taking classes at the EAP, visited almost daily. We visited the farmers frequently, participating in their daily activities. We also mastered the local vocabulary reasonably well.

GALERAS - THE SECOND YEAR

Looking back at the first year's results, we changed the experimental design. If the farmers were to become our partners instead of guinea pigs, we had to start doing experiments with campesinos, not on them. Abandoning the idea of several treatments, we included more farmers in the study. Some were younger but as will be seen below, we were still doing experiments on farmers - not with them. We wanted to see if, given new, basic information, farmers would develop original experiments.

We held two meetings with farmers in Galeras under somewhat strange circumstances. Galeras has a small farmers' cooperative whose main goal has been attracting international financing (especially Canadian) to build an irrigation system which is now working. One of the officers of the cooperative asked Bentley for someone from the EAP to give lectures on vegetables which the coop planned to grow under irrigation. Bentley suggested Melara, explaining that he had two years' experience as an extension agent. The coop officer knew and apparently like Melara but was a little reluctant to schedule a meeting with him. It turned out later that the

¹¹ For more information on farmers' bias towards agro-chemicals see Bentley (in press a, 1989a, 1989b) and Andrews and Bentley (1990), Bentley and Andrews (1991).

coop was really seeking ties with another branch of the school to help with the finances of the irrigation project. They later cemented those ties without our help. So in January 1989 Melara gave one lecture on safe use of pesticides (because farmers apply more pesticides to vegetables).

In January 1989 the Crop Protection Department, where we work, chose maize ear rot (*maíz muerto*¹²) as its priority research topic. We wanted to focus our study more and make it more relevant to what colleagues in the department were doing, so we centred on maize ear rot as well. In a second meeting with farmers in Galeras on January 21, 1989, Melara asked them what some of their more important problems were. They mentioned fall armyworm (*Spodoptera frugiperda*) and white grubs (*Phyllophaga* spp.) as well as ear rot, which we seized upon, asking them how the disease was caused and opening up a general discussion. They were obviously very interested in ear rots but we did not systematically elicit them as the campesinos' priority problem. Thus, technically we worked on a problem of community interest but we channelled that interest. Melara ended the session by talking about how scientists do experiments, hoping to stimulate some interest in experimentation. About 12 to 15 farmers¹³ attended both meetings, although hardly anyone from the cooperative came to the second one, largely because coop members had already lost interest when they realised we weren't discussing money. We were disappointed that these meetings with a formal community organisation (the coop) did not improve our community relations much. The case also underscores the problems of working in a village too near the research centre. As different departments of the college began getting funding for and interest in working with farmers, many of them joined us in Galeras but without any consistent college-wide coordination or policy.

Melara continued visiting farmers in the area until he felt he had identified some he could work with. On April 22, 1989, Melara invited 14 farmers to a seminar in the department of Crop Protection's plant pathology lab at the EAP. The campesinos showed their sincerity and their developing rapport

¹² Also known as *podrición de mazorca*, in agronomists' jargon and (with some regional variation) as *maíz muerto*, *cocido*, *podrido*, *ciego*, *vencido*, *hieldao*, *helado*, *pegador* and other names in campesino argots (Bentley, 1990). It is a disease caused by a complex of fungi, especially *Fusarium* spp. and *Stenocarpella* spp. (Formerly *Diplodia* spp.). See del Río (1990) and Bentley (1990).

¹³ More precise numbers of attendants are impossible because some farmers slip in late and others leave early.

with Melara when all of them showed up on time at the rendezvous points from where we drove them to the EAP. Even the two men who previously dropped out attended.

Melara thought that even though the farmers knew and trusted him, the talk would impact more if it was given by an "outside expert"¹⁴ in the person of Luis del Río¹⁵. With our help, he prepared a talk on the basic biology of maize ear rot, using many local terms, eg. referring to the disease as *maíz ciego* ("blind maize") as it is known in Galeras. He also explained that maize ear rot is caused by a fungus and that a fungus is a plant that lives upon other plants as the tick lives upon livestock. He mentioned that just as there is great variability in the size of plants, fungi can be big - like edible ones - or small, like the ones that cause maize ear rot. The lecture was lavishly illustrated with slide photographs. The farmers actively commented and questioned. After a brief snack, the campesinos used stereoscopes to observe *picnidia* (or, as we explained it, the "fruits") of the fungus. They saw the *conidia* (the "seeds") of the fungus through microscopes. The farmers were quite taken with the notion that "blind maize" has fruit and seeds like other plants.

In an earlier meeting with some of the farmers of Galeras, Melara had explained how scientists do field tests, but to make sure everyone had this information, del Río repeated it, although he was careful not to say that the farmers should do their trials the same way. Several farmers asked how to plant two or three maize varieties without mixing them, to harvest reasonably pure seed from the test plot. We explained that they take seed from the centre of the sub-plots, but below we discuss how some of them used other means to safeguard seed quality.

We gave each participant four pounds of seed from each of two varieties of yellow maize. One was a land-race from the Department of Olancho and the other was *serena* (whose name comes from the organisation that promotes it, the SEcretaría de REcursos NATurales essentially the Ministry of Agriculture)). The farmers left the symposium talking about testing the maize varieties and evaluating resistance to maize ear rots. After the

¹⁴ A North American saying attributed to Mark Twain defines an expert as anyone over fifty miles from home. There is something to be said for the authority of a stranger whose past failings and human shortcomings are unknown and cannot be held against him.

¹⁵ MS in plant pathology, a member of our Department.

symposium one of the (nearly landless) participants migrated to work on an hacienda near Tegucigalpa. Another sold almost all the seed we gave him, keeping just a little for his own trial. But 12 planted variety trials with all the seed.

The 12 who tried the seeds took some factors into account which had not been mentioned in the symposium. For example, we advised them to plant each variety, including a control group of their own seed, in similar soil to keep a uniform environment for each seed type, which they tried to do according to their own conditions. But many of them only have very steep land, which naturally has variable soil, drainage and other factors, making it impossible to plant two kinds of seed in very similar soil. The farmers generally planted with the prevailing wind to minimize cross-pollinisation between varieties, so they could get pure seed from the trial. This reveals first that the farmers have valid goals which technicians may not have (like getting seed from a test plot). Secondly, planting with the wind makes it even harder to plant the varieties in similar kinds of earth (because odds are that the wind will run in a different direction than the soil types). Four of the collaborators separated each of their plots of maize with little strips of beans or peanut to decrease cross-pollinisation. Two planted their new varieties in different but nearby lots to preserve varietal purity.

Two of the farmers with contiguous fields tried to set up a field trial together, comparing different fertilisers. Both were going to plant their *serena* variety at the boundary of their two plots, one fertilising with chicken manure and the other with chemicals. They could not do the experiment, however, because they were not able to plant on the same day. A drought hit a few days after the first planted, so the other delayed planting for several weeks. They realised that their plots were not comparable because of the difference in planting dates. Farmer experimenters are limited by environmental conditions and by other work responsibilities.

Besides sowing the varieties we gave them, all the farmers planted their usual maizes. Their own varieties served as production, genetic bank (Rhoades, 1987) and control group for the field tests.

One of the collaborators harvested his field test to feed his cattle before we could take the data. Even though he was serious about doing the trial he could not stand having his animals go hungry to get numbers. He could have cared less about the data anyway since he had already made his qualitative comparison - and knew that both of the new varieties were good. Data gathering is the scientist's priority, while the farmer's is growing food,

forage and seed. The field test is secondary and data taking is even less important.

One of the men wanted to see where the disease *inoculum* came from. So he decided to plant maize in a parcel which had not grown maize for four years running but where neighbouring fields had had corn and had suffered from maize ear rots. He took wind direction and slope into account. The prevailing wind was from the north, while rainwater runoff generally came from the plot to the west. The farmer planned the experiment to see if there would be more ear rot on the north or the west side, to see if the disease is spread by water or wind. The experiment design controlled for the possibility of soil-borne *inoculum* because it had had no maize for four years. This experiment is strategic research, ie. a kind of background research intermediate between applied and basic (Andrews, 1989) and comparable in sophistication to scientists' experiments discussed in an International Workshop on Maize Ear Rot held just a little earlier at the EAP. Even scientists do not know if maize ear rot *inoculum* is soil, water or wind-borne (del Río, 1990; Bentley, 1990). Everardo Villarreal (pers. comm.) suggests that, due to these gaps in scientific knowledge, it is difficult to do experiments with campesinos on this topic; scientists have little useful information to offer farmers to help them design experiments.

CONCLUSION

We took off from the point of view that if we gave farmers background information they would use it to improve their own experiments. This hypothesis was partially confirmed. The campesinos tested the maize varieties we gave them more or less as we suggested, modifying the test plot design to harvest seed from the sub-plots. In fact, getting seed was more important to the farmers than comparing varieties in similar soil, since they mentally calculate the effect of soil type upon crop behaviour. But only three farmers (25%) attempted other experiments. Two failed in their attempt to do a fertilisation trial and one experimented on source of *inoculum*. We had hoped that more farmers would do experiments like this last one but none did. The farmers liked the information we gave them but it did not induce them to do many novel experiments. We did not otherwise stimulate experiments since we wanted to see how the new information alone would affect them. We gave them basic information and visited them about every week in their fields, answering any questions they had. We assumed beforehand that farmers' own experimentation is slow. Our purpose was to see if we could hasten the native research process.

We conclude that farmers are creative and that they weave new information into their experiments, but providing new scientific information in and of itself is not enough. Farmer creativity and interest must be stimulated by giving them more ideas about research topics. For example, almost all of them tried the varieties we gave them. They would have done more experiments if we had suggested trying some cultural practices, like burning crop residues, hilling up maize plants, different planting distances, harvest dates, soil preparation styles and other practices that do not risk yields.

Meanwhile, we learned the characteristics that farmers consider when deciding which variety to plant and which are often not taken into account by plant breeders: like culinary aspects, if it is a fast or slow-maturing variety, if it produces a lot of leaves for cattle forage, husk coverage, grain colour and size uniformity, resistance to lodging, to drought and insects.

Another benefit from the experience was that we learned something about the campesinos' perspective and practices so that we could better anticipate which kinds of experiments they would collaborate with in the future. We gained rapport with them and can count on their support for later on-farm experiments. We collected systematic data on planting date, seed density, harvest date and other management practices like fertilisation that allowed us to describe each lot of maize and compare them as if each lot were an experimental unit. At the end of the cycle (around January 1990) we compared ear rot incidence from each lot, taking these factors and others into consideration¹⁶.

Farmers should not be divided into different experimental treatments. Such a division is not consistent with the spirit of participatory research and it frustrates our ability to experiment with farmers as research partners. The department's 1990 research built on the Galeras experience. We are studying the resistance of native landraces of maize to corn ear rot and the relationship of certain traditional practices like burning crop residues and bending the maize plant and cutting off leaves so the ear of corn dries faster, discouraging fungus growth. We designed the tests after talking to farmers in several regions about maize ear rot. They approved the experimental designs and decided who would plant which experiment. We are now working with several replicable experiences in three parts of Honduras. We have backed off somewhat from the idea that farmers can

¹⁶ Fortunately for the farmers and unfortunately for us, the latter part of the 1989 growing season was too dry for the disease-causing fungi to develop much. There was so little loss to ear rot that none of our numbers were of much use.

provide astounding new experiments when presented with basic information; we still show farmers fungal spores under microscopes but we depend on agricultural scientists to design experiments, although often based on traditional practices. We depend on farmers to help tell us what to study and to work with us in actually carrying out the experiments in their fields, fine-tuning the technologies to their conditions.

REFERENCES

- Andrews, Keith L. 1989. "La Investigación Agrícola Aplicada es Participativa - Excepto en el Caso de los Pequeños Agricultores". Paper presented at the Semana Científica, Universidad Nacional Autónoma de Honduras, October 19, 1989. To be published in *Ceiba*.
- Andrews, Keith L and Bentley, Jeffery W. 1990. "IPM and Resource-Poor Central American Farmers". *Global Pesticide Monitor*, 1 (2 May): 1 pp 7-9.
- Ashby, Jacqueline A. 1989. "Methodology for the Participation of Small Farmers in the design of On-Farm Trials". *Agricultural Administration* 22, pp 1-19.
- Ashby, Jacqueline A. 1987. "The Effects of Different Types of Farmer Participation on the Management of On-Farm Trials". *Agricultural Administration and Extension*, 25, pp 235-252.
- Ashby, Jacqueline A; Quiros, Carlos A and Rivera, Yolanda M. 1987. "Farmer Participation in On-Farm Varietal Trials". *Agricultural Administration (Research and Extension) Network, Discussion Paper* 22. London: ODI.
- Baker, Greg; Knipscheer, Hendrick and Neto, José de Souza. 1988. "The Impact of Regular Research Field Hearings (RRFH) in On-Farm Trials in Northeast Brazil". *Experimental Agriculture* 24, pp 281-288.
- Barth, Fredrik. 1956. "Ecological Relationships of Ethnic Groups in Swat, North Pakistan". *American Anthropologist* 58, pp 1079-89.

- Bentley, Jeffery W. 1989a. "Pérdida de Confianza en Conocimiento Tradicional como Resultado de Extensión Agrícola entre Campesinos del Sector Reformado en Honduras". *Ceiba* 30 (1).
- Bentley, Jeffery W. 1989b. "What Farmers Don't Know Can't Help Them: The Strengths and Weaknesses of Indigenous Technical Knowledge Honduras". *Agriculture and Human Values* 6 (3, Summer), pp 25-31.
- Bentley, Jeffery W. 1991. "¿Qué Es Hielo? Percepciones de los campesinos Hondureños sobre Enfermedades del Frijol y otros Cultivos". *Interciencia*. 16(3), pp 131-137.
- Bentley, Jeffery W. 1991b. "Conocimiento y Experimentos Espontáneos de Campesinos Hondureños sobre Maíze Muerto". *Manejo Integrado de Plagas*. 17, pp 16-26.
- Bentley, Jeffery W and Andrews, Keith L. 1991. "Pests, Peasants and Publications: Anthropological and Entomological Views of an Integrated Pest Management Program for Small-Scale Honduran Farmers. *Human Organization*. 50(2), pp 113-124.
- Box, Louk. 1988. "Experimenting Cultivators: A Method for Adaptive Agricultural Research". *Sociologia Ruralis* 28, pp 62-75.
- Brammer, Hugh. 1980. "Some Innovations Don't Wait for Experts: A Report on Applied Research by Bangladeshi Peasants". *Ceres* 13 (2, March-April), pp 24-28.
- CEDOH (Centro de Documentación de Honduras). 1988. *25 Años de Reforma Agraria*, Second edition. Tegucigalpa: Centro de Documentación de Honduras 34: pp 1-12.
- Chambers, Robert. 1980. "Lesson No 1 for Rural Developers: The Small Farmer is a Professional" *Ceres* No 27, Vol 13 (2), pp 19-23.
- Chambers, Robert and Ghildyal, B P. 1985. "Agricultural Research for Resource- Poor Farmers: The Farmer-First-and-Last Model". *Agricultural Administration* 20, pp 1-30.
- Coe, Michael D. 1962. *Mexico*. New York: Praeger Publishers.

- Conklin, Harold C. 1957. *Hununo Agriculture, a Report on an Integral System of Shifting Cultivation in the Philippines*. Rome: FAO.
- del Río, L E. 1991. "Maiz Muerto' en Honduras Provocado por el Complejo *Diplodia* y *Fusarium*". *Manejo Integrado de Plagas*. 18, pp 42-53.
- DuBois, Cora. 1944. *The People of Alor*. Minneapolis: University of Minnesota Press.
- Durham, William H. 1979. *Scarcity and Survival in Central America: Ecological Origins of the Soccer War*. Stanford: Stanford University Press.
- Evans-Pritchard, E E. 1940. *The Nuer: A Description of the Modes of Livelihood and Political Institutions of Nilotic People*. Oxford: Oxford University Press.
- Farrington, John. 1988. "Farmer Participatory Research: Editorial Introduction". *Experimental Agriculture* 24, pp 269-279.
- Farrington, John and Martin, Adrienne. 1987. "Farmer Participatory Research: A Review of Concepts and Practices". *Agricultural Administration (Research and Extension Network, Discussion Paper* 19. London: ODI.
- Flannery, Kent V. 1976. *The Early Mesoamerican Village*. New York: Academic Press.
- Johnson, Allen W. 1972. "Individuality and Experimentation in Traditional Agriculture". *Human Ecology* 1 (2), pp 149-159.
- Kean, Stuart A. 1988. "Developing a Partnership between Farmers and Scientists: The Example of Zambia's Adaptive Research Planning Team". *Experimental Agriculture* 24, pp 289-299.
- Kerr, Warwick Estevam and Posey, Darrell Addison. 1984. "Informacoes Adicionais sobre a Agricultura dos Kayapó". *Interciencia* 9, pp 392-400.

- Knipscheer, H C and Suradisastra, Kedi. 1986. "Farmer Participation in Indonesian Livestock Farming Systems by Regular Research Field Hearings (RRFH)". *Agricultural Administration* 22, pp 205-216.
- Lee, Richard B. 1969. "Ikung Bushman Subsistence: An Input-Output Analysis". In Andrew P Vayda (ed.) *Environment and Cultural Behaviour*. Garden City Natural History Press.
- Lewis, Oscar. 1964. *Pedro Martínez: A Mexican Peasant and His Family*. New York: Vintage books. 507 pp.
- Lightfoot, Clive. 1987. "Indigenous Research and On-Farm Trials". *Agricultural Administration and Extension* 24, pp 79-89.
- Lightfoot, Clive; De Guia Jr, O. and Ocado, F. 1988. "A Participatory Method for Systems-Problem Research: Rehabilitating Marginal Uplands in the Philippines". *Experimental Agriculture* 24, pp 301-309.
- MacNeish, Richard S. 1964. "Ancient Mesoamerican Civilization". *Science* 143, pp 531-37.
- Maurya, D M; Bottrall, A and Farrington, J. 1988. "Improved Livelihoods, Genetic Diversity and Farmer Participation: A Strategy for Rice Breeding in Rainfed Areas of India". *Experimental Agriculture* 24, pp 31-320.
- Melara Ramírez, Werner Antonio. 1990. "Agricultor-Experimentador: un Estudio Participativo Enfocado a la Investigación Agrícola". Ingeniero Agrónomo Thesis. El Zamorano, Honduras: Escuela Agrícola Panamericana.
- Netting, Robert M. 1981. *Balancing on an Alp: Ecological Change and Continuity in a Swiss Mountain Community*. New York: Cambridge University Press.
- Norman, D; Baker, D; Heinrich, G and Worman, F. 1988. "Technology Development and Farmer Groups: Experiences from Botswana". *Experimental Agriculture* 24, pp 321-331.
- O'Neill, Brian Juan. 1987. *Social Inequality in a Portuguese Hamlet: Land, Late Marriage and Bastardy, 1870-1978*. New York: Cambridge University Press.

- Rappaport, Roy A. 1968. *Pigs for the Ancestors: Ritual in the Ecology of a New Guinea People*. New Haven: Yale University Press.
- Reid, Walter V; Barnes, James N and Blackwelder, Brent. 1988. *Bankrolling Successes: A Portfolio of Sustainable Development Projects*. Washington DC: Environmental Policy Institute and National Wildlife Federation.
- Rhoades, Robert E. 1987. "Farmers and Experimentation". Agricultural Administration (Research and Extension) Network, *Discussion Paper* 21. London: ODI.
- Rhoades, Robert E and Bebbington, Anthony. 1988. "Farmers Who Experiment: An Untapped Resource for Agricultural Research and Development". Paper presented at the International Congress on Plant Physiology, New Delhi, India. February 15-20.
- Rhoades, Robert E and Booth, Robert H. 1982. "Farmer-Back-to-Farmer: a Model for Generating Acceptable Agricultural Technology". *Agricultural Administration* 11, pp 127-137.
- Richards, Paul. 1985. *Indigenous Agricultural Revolution: Ecology and Food Production in West Africa*. London: Hutchinson.
- Richards, Paul. 1986. *Coping with Hunger: Hazard and Experimentation in an African Rice-Farming System*. London: Allen and Unwin.
- Richards, Paul. 1989. "Farmers Also Experiment: A Neglected Intellectual Resource in African Science". *Discovery and Innovation* 1 (1), pp 19-25.
- SECPLAN (Secretaría de Planificación y Presupuesto). 1989. *Pefil Ambiental de Honduras 1989*. Tegucigalpa: SECPLAN. 346 pp.
- Simmons, Leo W (ed). 1942. *Sun Chief: The Autobiography of a Hopi India*. New Haven: Yale University Press.
- Struever, Stuart. 1971. *Prehistoric Agriculture*. Garden City: Natural History Press.

- Sumberg, J and Okali, C. 1988. "Farmers, On-Farm Research and the Development of New Technology". *Experimental Agriculture* 24, pp 333-342.
- Villarreal Farías, Everado. 1989. "Participación de los Pequeños Productores en el Modelo Productor-Experimentador de Investigación-Extensión". Paper presented at the Semana Científica, Universidad Nacional Autónoma de Honduras, October 19, 1989. To be published in *Ceiba*.
- Villarreal Farías and Castillo, Fernando Galván Castillo. 1987. Desarrollo de un Método para Optimizar las Tecnologías Utilizadas por los Pequeños Productores de Secano, Bajo el Modelo Productor-Experimentador. Mexico: Secretaría de Agricultura y Recursos Hidráulicos, Instituto Nacional de Investigaciones Forestales y Agropecuarias, Centro de Investigaciones Forestales y Agropecuarias en el Estado de Guanajuato.