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Participation by Farmers, Researchers and Extension Workers in Soil Conservation

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PARTICIPATION BY FARMERS, RESEARCHERS AND EXTENSION WORKERS IN SOIL CONSERVATION

One of the most widely recognised environmental problems in the humid tropics is the loss of forest resources, with consequent watershed degradation, soil erosion and nutrient depletion. Strategies intended to conserve forests have included regulation of logging, reforestation, banning forest settlement, and prohibiting shifting cultivation. However, continued settlement in the uplands by small farmers has made it necessary to seek environmental sustainability within a context of agricultural land use. As a result research and development projects in the uplands are now trying to work with farmers to improve cropping systems and resource management. Yet so far adoption of new soil conserving technologies has been disappointingly low.

This paper describes examples from several projects, including an effort by the International Rice Research Institute (IRRI) to develop methods for national programme use by which farmer adoption of soil conservation technologies can be made widespread and sustainable. The critical component is participation: farmer participation in this research and extension is a necessary condition for adoption to occur, and this participation should be built into the whole process from problem definition to technology development and transfer.

Technology Failure

Over the years many different approaches to conserving upland resources have been tried. Some have generally failed, such as policies to prohibit forest settlement; and some have been expensive and limited in the area covered, such as reforestation programmes. Agroforestry or social forestry approaches, on the other hand, have tried to develop technologies by working with the farmer occupants of the uplands to improve systems sustainability.

These agroforestry and social forestry soil conservation technologies include:

1. combinations of alley cropping,

2. different forms of terracing and contour farming to reduce soil erosion, including contour ploughing, contour bunds and ditches, and contour hedgerows (Young 1986), and

3. use of grasses or forage legumes and trees, especially fast-growing, N-fixing species, to produce green manures for improved N cycling and additional organic matter (Sanchez 1987, Young 1987).

In general, the goal of these farming systems research activities has been narrow, namely to increase the productivity of component and cropping systems. Yet these technologies also appear to have failed: farmer adoption of these technologies has been neither widespread nor sustainable. It would appear that limited adoption mostly results from a lack of farmer participation at three critical stages: a) problem definition and technology choice, b) technology generation and adaptation, and c) technology transfer.

Farmer Participation in Problem Definition and Technology Choice

Problem identification requires sound analysis by physical and biological scientists (e.g., Hamilton 1983, Johnson 1988 for soil erosion), together with social scientists and the farmers themselves. Farmer participation at the diagnostic stage encourages the viewing of problems in a systems context and ensures that farmers' perspectives regarding the problems are incorporated in initial choices of potential problem-solving technologies. Such an incorporation of farmer perspectives implies a certain understanding of existing practices, of technical knowledge underlying these practices, and in particular, of farmers' own problem solving efforts.

But where diagnosis is inadequate, the technologies chosen for farmers may be inappropriate and rejected. Here are some examples:

* A World Bank-Philippine Government project promoted Leucaena leucocephala strips for erosion control and improved N cycling in South Cotabato. Upland farmers, however had no use for the space-consuming hedgerows: they grew maize for

sale using chemical fertilizers on relatively fertile volcanic soils showing little erosion.

* The government of Madagascar tried to stop upland pasture burning (a cause of soil erosion) by developing improved forages. But a reevaluation of the problem indicated that farmers burn not only for regeneration of grasses, but also to harvest water for early rice transplanting.

* A USAID-Government of Indonesia project offered bench terracing to farmers who nonetheless rationally invested most of their labour in their lowland rice rather than upland fields. The same project also targeted Java's volcanic slopes, which have few soil erosion problems, rather than its eroded and erosion-prone limestone hills.

* An FAO-Government of Laos project wanted shifting cultivators in Northern Laos to adopt permanent cultivation and bench terracing in order to decrease deforestation and soil erosion. Commercial logging, however, was largely responsible for deforestation; sedentary agriculture probably would have increased environmental damage; and weeds and lack of labour for weed control, rather than soil losses, were the main farmer problems.

These projects, by inadequately considering both key technical variables and farmer perspectives at the diagnosis and design stage, addressed the wrong problems (northern Laos), ignored intervening problems (Madagascar), were located in the wrong environments (Java; Philippines), ignored key aspects of the whole farm system (Madagascar; Java; Philippines), or pre-selected innovations, bench terraces or hedgerows, regardless of diagnostic findings (all projects).

If the farmers' perspective angle is correct, then diagnostic work ought to lead to the choice and development of appropriate technologies. The World Neighbours project in Cebu, Philippines is a fine example. The project: a) elicited farmers' definitions of key problems, in this case soil erosion, b) verified who and what areas were affected, c) identified traditional cooperative work groups as a vehicle for introducing innovations, d) offered a range of possible problem-solving technologies, e) initiated work with groups of farmers who had identified the problem, and f) worked with farmers to adapt technologies to local conditions.

At another site in the Philippines, an eroded acid upland site at Claveria, Misamis Oriental, the International Rice Research Institute is conducting research to improve both productivity and sustainability. Seeking the goal of increased rice production, work was initially conducted on the small proportion of flatter land in the area. But further diagnostic work involving the inclusion of farmer participation clearly identified greater needs, resulting in better differentiation among local agroecosystems, and shifting research to sloping land.

Considering similar projects from around the world, soil conservation technologies appear to make the most sense and have the highest potential for adoption in upland areas characterized by a number of common features:

a) permanent plough agriculture,

b) high population density,

c) closed land frontiers,

d) a largely subsistence economy,

e) lack of such alternatives as lowland rice,

f) farmer awareness of the problem,

g) soil erosion as a problem.

Shifting cultivators, at moderately low population densities, may be following the best strategy for resource conservation; and commercial vegetable farmers using high amounts of manure and inorganic fertilizers may be uninterested in what otherwise would be significant soil erosion.

These kinds of diagnostic approaches demonstrate the need to build upon an understanding of farmer practice and technical knowledge in agricultural development (Brokensha et al., 1980;

Richards, 1985; Warren and Cashman, 1988). Such indigenous knowledge is vital for sustainable development, and is central to diverse diagnostic approaches such as Rapid Rural Appraisal (KKU, 1987), Agroecosystem Analysis (Conway, 1986; McCracken et al., 1988) and Diagnosis and Design (Raintree, 1987).

Farmer Participation in Technology Generation and Adaptation

Research to develop and adapt soil conservation technologies can and must combine inputs from researchers and farmers. Building upon lessons learned by the Cebu project, IRRI scientists and farmers who reported soil erosion as a major problem have worked together on the local adaptation of farmer-selected conservation technologies.

Research started with understanding farmer practices. Farmer technical knowledge about soils, lands, and erosion was elicited, and interestingly, farmers lacked contour farming methods for sloping lands. Farmers carefully categorised their lands and soils; matched crops and management practices to different land-soil resources; were quite aware of technical aspects of soil erosion and soil nutrient loss; and several mentioned that contour farming methods were needed. Finally, farmers described problem solving efforts, including planting grassy strips to slow erosion, planting perennials in erosion gullies, and construction of diversion ditches. Table 1 lists some of these statements about erosion and erosion control.

To summarise, farmers with sloping land were aware of soil erosion as a major problem and were partly aware of contour farming technologies.

Through farmer-to-farmer training, farmers learned about:

a) use of the A-frame transit to establish contour lines. This is a simple structure shaped like an "A" and made of three pieces of wood or bamboo, nails, twine, and a rock or other weight;

b) the use of contour ditches, bunds, and hedgerows planted to trees (Gliricidia sepium) and grasses (Paspalum purpureum).

IRRI researchers and participating farmers have since adapted, modified, and expanded the "package" to fit local needs and constraints. Such joint adaptive research on the hedgerow technology has included:

* testing alternatives to the overly vigorous P. purpureum,

* testing seedlings and methods to promote seed germination in place of using G. sepium cuttings,

* testing perennial cash crops (e.g., coffee) in the hedgerows,

Table 1. Statements by farmers about soil erosion and nutrients in Claveria, Philippines

Crops and soil nutrients

"Cassava adds to soil acidity and gobbles up soil nutrients."
"Rice is more tolerant of acidic soils than is maize."
"Rice is more vigorous on an area previously planted to tomato."
"The effect of decomposed rice straw is like that of lime."

Observations of nutrient depletion

"Soil fertility has been used up and this soil is weak"
"Soils are over-trained."
"The soils are getting older."
"Poor, but not used up."

Effects of field fallows

"The decomposing leaves of the weeds help to enrich the soil."
"The land is resting so the soil can store some nutrients."
"Fertility is added and the soil is made cool."
"The soil is slightly enriched if left a short time."

Soil nutrients and weeds

"Rice was harmed by cogon (Imperata cylindrica) roots."
"The soil is poor and acidity increases where cogon dominates."
"Digitaria longiflora and cogon consume nutrients and destroy soil quality."
"Fertility is added and the soil is made cool" (re Calapogonium spp.)
"Soil is good where there are weed/grasses with nodules."

Soil erosion

"Soil slides down and floats away."
"Nutrients are drawn down."
"Plants are eroded along with soil."
"Soil was drawn down and fertility was washed out."
"The land was shaven and eroded after trees were removed."
"Fertilizer is collected (on lower plots) due to rain."

Erosion control

"Banana and coconut are good because they hold the soil."
"Contour plowing reduces downslope erosion losses."
"Weedy strips can decrease erosion effects."
"Trees planted above and below fields can decrease erosion effects."
"Banana planted above and below fields can decrease erosion effects."

* testing different forage legumes and grasses on the bunds combined with the use of goats for manure production, and

* testing establishment and effectiveness of weedy contour strips formed from weed and crop residues.

Adaptive research was necessary for various reasons. Sometimes technology components did not work. For example, where P. purpureum was locally too vigorous it was rejected, and the testing of forage legumes followed; and where cuttings suffered from termites and high mortality G. sepium seedlings were tested. Where labour was in short supply, farmers tested grassy strips established from weed residues as a less labour demanding alternative to dung-ditch-hedgerow establishment. And rejecting green manures, farmers tested tree crops in place of N-fixing trees plus mulching or incorporation of the leafy biomass.

Of course, not all research involved joint farmer-researcher efforts. Researchers investigated crop sequences in the alleys, soil erosion rates for contour bunded and unbunded areas, and long-term effects on rice and maize yields of contour bunding and green leaf manures, and farmers informally experimented with a range of management choices to further adapt technologies to local and personal circumstances. These examples describe the need for flexibility in approaches to technology adoption and transfer.

This genuine participation by farmers in research, particularly in the adaptation of technologies, is fully reviewed by Farrington and Martin (1987). These approaches can be highly successful. Take the example of seed potato storage technologies: Rhoades (1984, 1987) recounts how coordinated inputs by farmers and researchers led to the development and transfer of such technologies to farmers in more than 50 countries.

Farmer Participation in Technology Transfer

Methods to extend soil conservation technologies to farmers can be combined and include the recommendation of technology packages by extension agents, sometimes as "verification" trials; sometimes on demonstration farms; sometimes by training of farmers by "experts"; sometimes by farmer-to-farmer training; and sometimes by provision of farmer incentives. Adoption is often also spontaneous once innovations are locally introduced.

Verification trials are usually relatively rigid in content and result in little technology adoption.

Demonstration farms established by the Java and Laos projects and by the Baptist Rural Life Center, an NGO in the southern Philippines, have also had limited effects on farmers' practices in nearby areas. The Laos project gave food incentives to adoptors of a crude and ineffective form of contour ditching; and eventually adoptors would do no further work without such payments. The demonstration farm in the Philippines has been used as a farmer training centre, but the extent of at-home adoption by trainees is unknown. Farmers in the area near one of the demonstration farms in Java adopted contour bench terracing for cassava production, but not the grassed terrace faces and cropping patterns promoted by the project.

The Cebu and IRRI projects have taken another course, and relied on farmer-to-farmer training. Initial IRRI contour hedgerow adoptors were trained by Cebu project participants. Those who returned to adapt further the technology have since trained additional groups of farmers. This next generation of farmer-to-farmer training was first conducted in the IRRI project area, but has since spread to neighbouring provinces after requests by groups of farmers and Department of Agriculture technicians from those areas.

Technology adoption by new groups of trainees has been encouraging, as has been the continued adaptation of technologies. A key IRRI project goal is to develop methods by which each group adapts technologies to local conditions and at least replicates itself by training new farmer groups. Spontaneous farmer adoption of different types of contour hedgerows is taking place and is being viewed as an indicator that innovations being jointly developed by the farmers and researchers are hitting the mark.

This type of farmer-to-farmer technology transfer is described by Rhoades and Booth (1982) and Jintrawet et al. (1985).

Conclusions

Researchers and farmers can work together to develop and extend soil conservation measures to the benefit of all. It is increasingly being recognized that the process must include some or all of the following elements:

a) problem definition based on agroecosystem analysis (with technical assessment of soil, soil nutrient losses, loss potentials) and on understanding farmer practice and underlying adaptive knowledge;

b) work with farmers who identify and have tried to solve the problem of soil erosion;

c) identification of potential technologies based on both researchers' alternatives and farmers' experimental problem solving experiences;

d) a combination of rigorous experimental research by scientists and experimentation by farmers to develop and then locally adapt a flexible range of component technologies;

e) farmer-to-farmer training as a method to transfer technologies to other farmers wanting solutions to the same problems;

f) continued feedback between farmers and researchers;

g) spontaneous farmer adoption as a check on the process; and

h) adaptation of these technology generation and transfer methods for use by national programmes.

The priorities for the model would thus be as follows: farmer knowledge and researcher experience can be used to set research priorities; farmers and researchers can then participate in the design, testing and adaptation of technologies. Finally, with the organizational infrastructure and technical support of a committed national research and extension programme, such knowledge can be efficiently and widely shared via farmer-to-farmer technology transfer.

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