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Keynote: The Secret to Making Soil Conservation Successful: Short-Term Benefits

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ABSTRACT

Soil conservation (SC) programs among resource-poor farmers in developing nations have not achieved a very good track record, especially if measured in terms of sustainable impact. To improve this record, programs should recognize that SC will only be sustainably adopted by poorer farmers if each year's costs are more than counterbalanced by the benefits achieved that same year. Making SC profitable in the short term will only be accomplished if we avoid using artificial incentives. Secondly, we must experiment and innovate, constantly looking for better technologies.

The most promising technologies have grown out of the realization that the best ways of preventing erosion are through organic matter and soil cover, not traditional SC structures. More specifically, the highest potential lies with green manure/cover crops and improved fallows. Not only do these practices prevent erosion, they increase yields, and usually, at the same time, provide additional products of economic value, such as food, fodder, and firewood. SC technologies should also be integrated in extension programs with technologies designed to increase yields and, if water is a limiting factor, small-scale irrigation or water harvesting.

All SC extension, and virtually all research, should be done using farmer-led methodologies.

INTRODUCTION

The sustained adoption by resource-poor farmers of most of the traditional soil conservation (SC) measures has generally been disappointing. (See, for example, Pretty and Shah; and Sims, 1998a)

Nevertheless, recent technological breakthroughs in soil recuperation[1] (SR), such as green manure/cover crops and improved fallows, and in water harvesting technologies, plus not so recent improvements in extension methodology that nevertheless still lack wide dissemination, are showing considerable promise. That is, programs using the best methodologies and technologies presently known show signs of being able to achieve considerable retention or even improvement of soil fertility, as well as spontaneous dissemination of the technologies, long after program termination. (Bunch and Lopez) Thus there is reason to believe that the non-adoption of SC technologies, so often observed, can be overcome if presently known measures are adopted widely.

This paper, based on the observation of soil conservation programs among resource-poor farmer throughout much of the developing world, emphasizes the fact that virtually all the reasons for the increased success of SC efforts during the last two decades find their roots in the relative costs and short-term benefits that the promoted practices occasion for the fanner.

Increase the Economic Returns of SC Practices

It has been frequently observed that SC technologies require major investments, especially in labor or mechanization, the returns for which are spread out over many years. This statement, in turn, is often used as a major argument in favor of the subsidization of SC technologies by agricultural development organizations. Yet the accuracy of this statement depends very much on the specific technology in question and the situation in which it is applied. In the case of most of the more traditional SC technologies, it is accurate. Nevertheless, in the cases of an increasing number of newer technologies, it is definitely in error.

According to a recent review of the literature on the economic feasibility and sustainable adoption of SC/SR technologies in Mesoamerica, bench terraces, contour rock walls, contour ditches, and traditional green manuring were found to have very low levels of sustainable adoption, especially in semi-arid areas. Nevertheless, the same study found that more recent innovations in SC/SR technology, such as multi-purpose hedgerows, drainage ditches, in-row tillage done by animal traction, multi-purpose green manure/cover crops (gm/cc's), and the processing and application of coffee pulp arid sugarcane bagasse more than pay for their adoption *within one year,* either in improved productivity or in lateral benefits provided to the household (Bunch n.d.).

Of course, the particular situation in which technologies are applied will also affect their economic feasibility. In-row tillage has been found to be widely accepted in those cases where either animal traction was available or high-value vegetables were being grown, but not where it had to be done by hand and used for basic grains. (Arellanes, 1994) A similar situation occurs almost anywhere structures or gm/cc's are used in droughty areas in the absence of water harvesting. (Sims, 1998b)

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[1]The term “soil recuperation” refers to the improvement or regeneration of soil fertility achieved larglely through the application of large quantities of organic matter, almost always to the soil surface.

Nevertheless, for an increasing number of SC and SR technologies, the investment need not be major, nor the economic return years in coming.

Resource-poor farmers in developing nations cannot make major investments in soil quality, only to have the payback come years later. Poorer farmers cannot afford transition periods. *If SC technologies are to be… widely and sustainably adopted… they must bring benefits within the first year or cropping season that outweigh all the costs of adoption.* This is sometimes a difficult goal to reach, but it must be one of the goals of each and every soil conservation program.

Seven major factors should be taken into account in order to accomplish the sustainable adoption of SC technologies:

Avoid Using Artificial Incentives

Probably the most important single reason that SC technologies are not sustainably adopted is that they are introduced through the use of subsidies, food-for-work, or some other kind of artificial incentive[2]. Time and time again, studies have observed that the sustainability of soil conservation work is substantially lower in areas where programs worked with artificial incentives, than in areas where the same technologies were introduced by programs not using artificial incentives. (Giger) Whereas somewhere between 5 and 20% of certain SC technologies are maintained in program areas in Honduras of programs that used artificial incentives, the same technologies have had from 50% to 120% sustainability (percentages may exceed 100% because of spontaneous adoption) in nearby areas where incentives were not used. (Lopez, Mejia)

No systematic studies have been done to explain this discrepancy in impact, but the reasons usually given include the following:

1. Farmers come to feel that if the program paid for the construction of the SC technologies, it must have some interest in their being there. Therefore, the farmers do not maintain them because they are waiting for the program to come and pay them to maintain them.. Similar to this attitude is that of feeling that since the program paid for them, the SC measures belong to the program, and it is the program's responsibility to maintain them. Not doing maintenance work is thus sometimes seen as a way of pressuring the program to do the maintenance (especially if the village in question has been a recipient of numerous field trips).
2. Farmers develop a feeling of paternalistic dependency. Internalizing the very attitude of the development agency that they are unable to practice SC without artificial incentives, they also become convinced that they are unable to sustainably manage SC without continuing assistance.
3. Payment for SC work, whether in money or in kind, requires that certain minimum standards be set as to the exact size and nature of the practices for which the farmers are to be paid. These standards (e.g. the ditch must be at least 30 cm. deep and 40 cm. wide) obviously reduce innovation or modification. If one must dig the ditch in a certain way in order to be paid for it, no one is going to try making the ditch a different way, or look for alternatives to a ditch. Thus, if conditions change, or if the technology, for whatever reason, was not appropriate from the start, farmers will tend to abandon the technology after program termination, rather than have ready alternatives or have experience in looking for alternatives. Artificial incentives thus work to eliminate the very innovation and adaptation that are crucial for long-term sustainability (see below).
4. Artificial incentives seem to divert the attention of the farmers from the inherent benefits of the technology to the benefits received from the program. Apparently, there is a tendency to overlook some of the benefits a technology can provide when the primary motivation for having "adopted" it is what one will receive from the program.
5. Incentives motivate a large number of people who are not interested in the technology per se to "adopt" the technology. This means that many of the adopters are, from the start, only a little interested in the technology, and therefore are more likely to abandon it later. But, the presence in the group of these people who are uninterested in the technology may also negatively influence those who might otherwise have been genuinely interested in the technology on its oval merits. Their presence also induces the program to spend a lot of time and effort, not to mention incentives, on farmers who from the start did not intend to maintain the SC works.
6. Program extensionists become accustomed to just explaining to the farmers what they must do and then distributing the incentives when the job is done. Motivational subjects, field visits designed to motivate the farmers or make the technology's benefits more visible, are given short shrift, since they become, in the presence of incentives, totally unnecessary for the program to meet its goals. Thus, farmers often do not come to understand the functions of the technologies involved, nor are they fully aware of the short-term or long-term benefits that the technologies can provide. In addition, extensionists become deliverers of benefits and labor bosses, rather than educators.
7. Some observers believe that the negative correlation between the level of artificial incentives and the level of sustainable impact is due more to the nature of programs that use incentives, rather than to the nature or impact of incentives themselves. These people argue that inherently weak programs are much more likely to choose to use incentives. If the personnel of a program feel the program, for whatever reason, is going to be unable to convince farmers to adopt the chosen SC technologies or

[2]The term "artificial incentive" is used here to mean benefits a program provides to the farmer in return for the adoption of a SC practice, and which depend for their continuation on that program. These would include food-for-work, cash for work, donated or subsidized tools and inputs, and credit given at less than the market rate. Not included would be benefits brought about by the technology itself, or subsidies or payments made by governments, such as long-term payments for ecological services.

if they just do not want to put forth the necessary effort or if the technologies to be used have already proven themselves unsustainable, they will often recommend highly that incentives be used in order to be able to meet their objectives at least as long as the program exists. Although there is probably a good deal of truth to this argument, this author has observed a number of otherwise good quality programs that used incentives, and the results once again had very little sustainable impact.

In conclusion, all the arguments in favor of the use of artificial incentives are useless if we want the technologies to outlast the program. What is the point of attracting more people, or enabling the poor to participate, if the benefits do not last? What is the objective of getting a fast start if in the end the medium- to long-term impact is reduced, in spite of the costs' having been increased?

On the other hand, the arguments against artificial incentives are legion: they cause dependency, create paternalistic attitudes, create divisions within the community, make future development work more difficult, blind people to the need to solve underlying problems, are monstrously expensive, destroy the possibility of a multiplier effect, and make accurate program evaluation extremely difficult. (Bunch 1982)

Experiment, Innovate, be Creative

Of those institutions involved in the promotion of SC around the world, a relatively small number, including mostly small-scale NGO's (e.g. World Neighbors, IIRR, COSECHA, the Campesino a Campesino Prograrn/ Nicaragua, ACORDE/Honduras, the Baptist Rural Life Mission/Philippines, etc.) have been all too frequently at the forefront of the research and development of new SC/SR and water harvesting technologies. Especially in those of multi-purpose barriers, in-row tillage, gm/cc's, the use of organic matter like coffee pulp and sugarcane bagasse, and micro-catchments. At the same time, a large number of government- and UN-funded institutions, especially those using artificial incentives, continue to use the same traditional SC technologies, decade after decade. Thus, the vast majority of the institutions involved in SC, and the most generously funded, are not developing new technologies or even searching for major modifications in the technologies they are already using. Creativity and change have been largely relegated to a handful of the smallest institutions, even though they are often the least well-equipped, and least committed, to doing agricultural research. One of the few exceptions to this generalization, the Brazilian agency EPAGRI, a world leader in gm/cc use among small farmers, uses a relatively very small, one-time incentive.

That this is happening is not particularly surprising. Artificial incentives protect a program from ever having to face the unpopularity or lack of economic feasibility of its technology. Year after year, a program using such incentives can meet its objectives, build kilometer upon kilometer of impressive-looking structures, increase productivity, and seemingly transform entire landscapes, without ever perceiving that any problems exist. As long as no one goes back to find out what remains two or three years after the program closed its doors, no one (except the local farmers) ever realizes that the technology was anti-economic. Unless one scratches below the surface, no one ever realizes that the "adoption" was all part of the economically rational actions of the farmers to maximize the amount of artificial incentives they could capture. It had nothing to do with the inherent merit or lack of merit of the technology, and unless one returns years later, no one realizes that the program, over the long haul, has very likely resulted in more, not less erosion. (Pretty and Shah) Such programs feel no need to develop new technologies or find cheaper, more efficient substitutes to the tried and presumably true technologies of yesteryear.

On the other hand, programs that avoid artificial incentives must either find technologies that are inherently attractive, with immediate, visible benefits, or face total rejection by the farmers. If adequate technologies are not available, they must either close their doors or look for technologies that are. Even when their technologies are "adequate," the difficulties they face in promoting them and the often less than satisfactory adoption rates they achieve are always pushing them to find better adaptations or even totally new technologies. In SC as in life, necessity is the mother of invention.

However, in SC supported by artificial incentives, the felt need, and therefore the invention, is sadly lacking.

If we are to look for new, more profitable and less expensive SC technologies, what sorts of technologies should we be looking for?

Focus on Vegetation and Cover, Rather Than Structures

For many years, the focus of the vast majority of SC programs has been on structures designed to stop water that was already running down the surface of the soil. Most of the technologies promoted consisted of different kinds of terraces, bunds, and ditches. All of these technologies were expensive to adopt, required major amounts of costly maintenance, provided virtually no lateral benefits, and produced only very long-term direct benefits.

Increasingly, inventive SC programs are finding that erosion is better stopped at the source. Erosion is caused by a lack of infiltration. Healthy soils can virtually always soak up all the rain that falls. However, farmers using modern (and even many traditional) farming practices greatly reduce the organic matter content of their soils, destroy the structure of their soils, and thereby cause soil compaction and crusting. This unnecessary degradation of the soil is the cause of erosion. (Primavesi)

The least expensive solutions, therefore, consist of merely taking away the causes of erosion. We maintain high organic content levels of the soil; keep the soil covered; reduce, change or end tillage; and break up (if necessary) and prevent compaction.

The technologies best designed to achieve these ends are green manure/cover crops (gm/cc's) and improved fallows. In both cases, these terms include an amazing number of possible specific technologies and systems. In southern Brazil, hundreds of thousands of farmers are now using some 60 different species of gm/cc's (Monegat), while in Central

America and Mexico something between 100,000 and 200,000 farmers (the author's estimate) are using gm/cc systems. Just in Southeast Asia, farmers have developed well over 50 different improved fallow systems. The potential for creativity and innovation is phenomenal. And, with the exception of southern Brazil, farmers all over the world have stepped into the breach far ahead of the professionals. While farmers have developed hundreds of gm/cc systems from Mexico to Viet Nam and Rwanda to Peru, (see, for example, CIDICCO) and silently developed dozens of improved fallow systems, the most innovative professional researchers are in many cases merely trying to catch up to and understand what villager farmers have already done.

And the short-term, as well as long-term, net economic benefit of these farmer-developed technologies is evidenced very clearly by their spontaneous spread among thousands, if not tens of thousands, of resource-poor farmers.

Use Multi-Purpose Technologies

The second approach to making SC technologies more profitable is to use species of plants that produce secondary benefits. For instance, SC programs are increasingly finding that contour vegetative barriers (also called hedgerows) can not only form bench terraces gradually over time, with much less maintenance, but they can also produce a whole series of lateral benefits.

For instance, in Honduras, while some farmers appreciate very much the fodder provided by World Neighbors-promoted Napier grass barriers, others have pulled out many of their grass barriers in order to plant some eighteen other species, varying from fruit trees and medicinal plants to sugarcane. According to a study carried out five years after program termination, sugarcane has become the most popular of all the species, in part because of its multiple uses, as food, fodder, and cash crop. (Sims 1998a)

Obviously, this experience indicates that we should not be promoting single-species hedgerows (e.g. leucaena), and even less so, single-species hedgerows with a minimum of uses (e.g. vetiver). Rather, we should be promoting hedgerows that have a variety of species, the products of which conform to the varied and multitudinous felt needs of the farmers. Of course, the various species should be chosen and arranged in such a way that they effectively retain the soil, but that objective can be achieved while the farmers also reap a good number of lateral benefits.

Integrate the promotion of Yield-Increasing Technologies with SC Technologies

Farmers virtually everywhere comment that they cannot eat rock walls, contour ditches or contour grass barriers. Although they want to have fertile soil, what they are actually interested in is higher productivity and they need it now. Therefore, programs should see SC as only one integral factor in increasing farmers' productivity. Programs that do SC work without worrying about productivity in general will find that farmers will quickly lose interest in the program (although they may maintain their interest in maximizing the artificial incentives they can capture).

Thus, for instance, programs promoting vegetative barriers might also promote the use of chicken manure or coffee pulp to increase harvests simultaneously. Or they might teach farmers to place chemical and organic fertilizer in small amounts immediately under the seed, in the same manner as precision planting is done in developed countries. In these ways, the SC measures will become popular because of the increased yields achieved at the same time, and the relationship between to the SC practice and the yield-increasing practice is very clear: if it were not for the SC technology, much of the benefit of the yield-increasing practice would be washed down the hill.

In years past, of course, when SC programs concentrated on retention technologies such as rock walls and ditches, this separation between SC technologies and immediate increases in productivity was almost total. Today, with multi-purpose vegetative barriers, and especially with multi-purpose gm/cc's, at least some increases in productivity are provided by the technologies themselves. Nevertheless, SC programs should constantly be looking for ways to integrate SC and yield-increasing technologies. After all, the economic return of every single SC technology depends in large part on how much food, income, or other benefits the farmer is able to produce as a result of the SC technologies. And almost always, the most cost-effective way to make those technologies more beneficial is not that of modifying the technical details of the SC technologies themselves, but rather that of increasing the productivity or income generated by the crops being grown on the conserved or recuperated soils.

Where Water is Limiting, Solve that Problem, Too

Once again, since the benefits that accrue to farmers as a result of SC are relative to the harvests farmers achieve, SC technologies will not be adopted if a lack of water, or the irregularity of rains, is significantly reducing yields. If, for example, half a farmer's harvests are lost because of irregular or inadequate rains, then the economic benefits provided by a SC technology are cut by half. Few SC technologies will be economically feasible (especially in the short term) if we reduce the benefits by 50%. Thus, it is of paramount importance that water harvesting or irrigation be introduced in those areas where the pattern of rains is a major limiting factor. We should remember that with global warming and increased deforestation worldwide; rains will very likely become more and more irregular as time passes.

Very simple water harvesting technologies that individual farmers can adopt and that will hold water for up to six or eight months are being developed in Central America (Bunch 1998). Although the technologies are still rudimentary, and a lot more needs to be learned about how they should be adapted to differing circumstances, farmers are amazingly enthusiastic about them. The technology consists of making a series of micro catchments, each capable of holding from 1/2 to 2 m^3 of water. These are usually lined up across the field on a line at a 1/2 percent slope, so that when one micro-catchment fills up, the excess water will flow along a narrow terrace to the next one. Sources of water include run-off from the farmer's roof or patio, from the field, from roads or trails, or from natural waterways that exist during each rainfall.

Each m^3 of water can irrigate approximately 200 m^2 of land once. Thus, an entire ha would require 40 such micro catchments. Nevertheless, with just US $ 15, the farmer can make one 1 m^3 catchment, and thereby begin to increase his/her food security, or start moving to higher value crops that are more demanding in terms of water. The increased income thus achieved can allow the farmer to continue spreading the technology as he/she wishes.

This water harvesting promotes SC not only in that it increases dramatically the payback for SC efforts in drought-prone areas, but it also motivates farmers to lay out their land and construct 1/2% slope terraces or ditches for the purpose of water control-frequently a more urgent felt need than that of SC. The addition of vegetative barriers above these drainage terraces or ditches can also be advantageous because they can shade the water, thereby decreasing evaporation. In-row tillage will have advantages in holding the conserved water in the area around the crops' roots. Thus, SC not only conserves the soil, but many of the best SC technologies also serve to conserve harvested water. This added stimulus for the adoption of SC technologies seems to be creating a renewed interest in these technologies on the part of villager farmers.

Use Adequate Extension Methodologies to Promote SC

The standard used to judge the success of SC work is considerably higher than that used to judge the same work 20 years ago. Whereas in the past, programs were only expected to sustainably increase adoption of technologies over time *in* the presence of ongoing extension work, most SC programs are now expected to create the conditions for permanent and even growing adoption of technologies in the absence further interventions. This second goal is not just more difficult, but brings into play a whole series of issues and factors with which programs working toward the first goal never had to deal. Whereas previous programs only had to achieve a certain level of "transfer of technologies," programs are now being asked, nay expected, to develop, within the community, a whole self-managed process of ongoing agricultural development.

Of course, one could argue that such is not the case. All that is being asked is that the adoption of introduced technologies be sustained. Nevertheless, as is explained below, permanent adoption is not only a virtually impossible goal; it is not even a desirable one.

To understand this last statement, we must ask the question, "What is the nature of sustainability in agricultural development?" Or, more precisely, "How can villager farmers carry on the process of agricultural development independent of outside intervention?" Often it is assumed that merely helping the people organize themselves into some kind of farmer organization will bring sustainability to the agricultural development process. Although a rudimentary organizational capacity is a necessary condition for that sustainability, it is far from a sufficient condition.

COSECHA has carried out several field-level studies to look at farmer productivity and technological adoption five to fifteen years after program interventions ended, with the objective of determining what factors are necessary to make the impact of agricultural interventions permanent among villager farmers. (Bunch and Lopez)

The results of these studies are very important, and somewhat surprising. First, specific technologies are not the source of sustainability. Virtually all technologies, even those most popular with, and beneficial for, the farmers, and which had very good initial adoption rates, either are abandoned or modified almost beyond recognition, within only a few years after program termination.

That is, we estimate that the "half-life" of even the best technologies is approximately six to seven years. This means that, six to seven years after adoption, half of the very best technologies taught have largely disappeared.

But if technologies do not last, how can there be any sustainability? But if the technologies that brought about an increase in yields during the programs' existence were abandoned, how is it that the farmers' yields were maintained, not to mention increased?

What is, in fact, sustainable, is a process of farmer innovation--one in which farmers continually experiment, looking for better ways to do things, trying out new technological ideas, modifying or abandoning some technologies in the face of changes in their circumstances, new technologies, new market niches, new cropping possibilities, etc.

This process is necessary precisely because the modern world is changing so fast. New markets are created or have emerged, new technologies come into being, input prices increase and agricultural product prices vary, new pests and diseases arrive, new roads are built, or the competition becomes more efficient or productive. All of these changes and many more affect the farmers' environments daily.

Given this level of constant change, the only way farmers can survive economically or in terms of their own food security is to innovate, constantly and rapidly. Only through a process of constant experimentation and change, do farmers have any chance of maintaining or increasing their net incomes, or of protecting their natural resources. Thus, an agricultural program's only hope of achieving sustainability of impact is to achieve a process among the farmers of constant technological innovation. But the question before us is: what must be done in order to achieve this process?

Nine essential factors have been identified as those that must exist in a community or group of communities in order for this process to occur:

1. The motivation on the part of the farmers to continue this innovative process.
2. The self-confidence to realize that they are capable of carrying on the process by themselves.
3. The ability to organize and manage experiments, constantly trying out new techniques, crops, and inputs, in order to adapt to new circumstances, solve problems that inevitably arise, and respond to new opportunities.
4. Medium- to long-term use rights over a certain minimum of productive resources, so they will reap the benefits from their own efforts at technological innovation.
5. Access to or ownership of adequate financial resources to continue experimenting (i.e. risking) and investing in the

improvement of their agricultural resources and productivity.

6. A certain minimum of basic knowledge of biological, agronomic, and ecological processes, in order to know in which directions they should orient their experimentation to have the highest possible potential of success.
7. A diversified agriculture, in order to weather market downturns and have experience in the basics of such activities as fruit, vegetable and animal production.
8. The ability and motivation to share information. No one farmer can learn enough through his or her own experimentation to raise his or her yields or income over time. It probably requires at least twenty or thirty farmers who are experimenting and sharing the results of their experiments to generate enough information to overcome the constant problems that arise and achieve higher and higher productivity and incomes over time.
9. The capacity to modify or build organizations. With constant innovation, new needs and opportunities will present themselves. Either old organizational structures must be modified, or new ones created, in order to deal with these new problems and opportunities.

Achieving these nine factors should be among the very most important objectives of any agricultural development program that hopes to have a sustainable impact.

But trying to achieve them by trying to inculcate in the villagers each and every factor through some sort of classroom training would be highly time-consuming, costly, and unnecessary. These factors can, by and large, be achieved in a learning-by-doing manner, merely by using an adequate methodology of extension. Very little effort need be made in achieving these factors, as long as we use an adequate methodology of agricultural extension.

To achieve these factors almost automatically through the use of an extension methodology, that methodology must utilize the following principles:

1. Motivate and *teach farmers to experiment, so* they can adopt and adapt technologies and even develop new ones. In Colombia and Europe, this principle is frequently known as "participatory technology development".
2. Utilize rapid, recognizable success to motivate people and to avoid the use of artificial incentives.
3. Use appropriate technologies -those that are inexpensive, simple, and based on locally available resources.
4. Initiate the process with a very limited number of technologies: one or two, if that is enough to achieve recognizable success.
5. Train the best-motivated villager farmers to become extensionists. This principle, presently quite widespread in Central America and Asia, is commonly called "farmer-to-farmer extension." (Bunch, 1982)

These principles, when applied in an agricultural extension program, constantly reinforce virtually all of the factors of sustainability listed above. The relationship can be illustrated graphically by the following diagram (Fig. 1), in which each arrow indicates a causal relationship (i.e. ways in

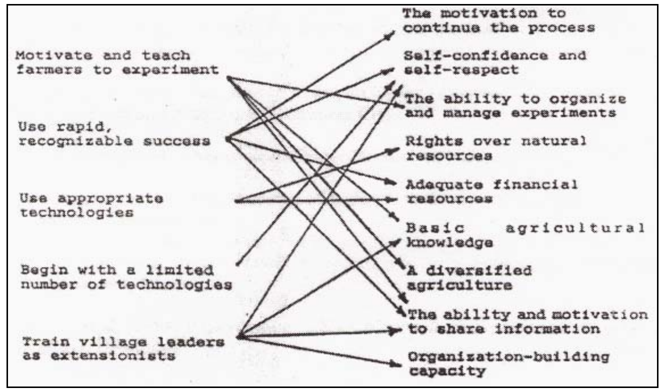

Figure 1.

which one of the principles regularly strengthens one of the factors of sustainability).

It is worth noting that the traditional "transfer of technology" systems, including the T & V system, include none of these principles, and therefore have not been capable, by and large, of bringing about sustainable development. In fact, the very goal they have, of "transferring technology," still assumes that the sustainability of agricultural development depends on the sustainability of the adoption of certain technologies. This goal, as we have said, is a mistaken, if not deleterious, goal to have in an agricultural development program desiring to achieve local sustainability.

For the above reasons, an adequate extension methodology for achieving the sustainability of the agricultural development process must include the above five principles. Anything less cannot be expected to achieve such sustainability. Luckily, the above principles not only are capable of achieving sustainability, but make the entire extension process both much more farmer-led (rather than merely participatory) and cost-effective.

CONCLUSION

The suggestions made in this paper would mean major changes in most SC programs around the world. But practical experience in dozens of countries has shown that these changes can increase the sustainable impact of SC programs many times over. The lack of impact and sustainability of past SC efforts among resource-poor farmers is not going to be overcome by tinkering here and there; major changes, and many of them, are needed, and urgently.

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