A number of research projects are implemented in Kerala which can be considered under the headings of post-Green-Revolution agriculture, low-external-input agriculture or sustainable agriculture. These are implemented by many people like scientists of government departments and research stations, activists and the technical staff of non-governmental organisations and concerned and innovative farmers. These projects conducted in Kerala can be classified into four types: conducted in controlled situations in research stations or demonstration plots; conducted by scientists in farmers' fields; conducted at the level of villages or watersheds; conducted by farmers on their own farms. Based on case studies, this article discusses certain limitations of these types of research.

Photo: Coen Reijntjes

Research on sustainable agriculture compared

V. Santhakumar

The experiments conducted by scientists in experimental stations provide rigorous quantitative data on certain practices. For example, Kerala Agricultural University has conducted a series of experiments during the eighties comparing the performance of organic manure and inorganic fertilisers. The ranking of yield rates for different sources of manures for different seasons, as shown by these experiments, are listed in Table 1. Based on these data, the following three modest conclusions can be made:

- "Organic manure alone" is consistently superior than "inorganic manure alone".
- Organic manure, if necessary, can be used to replace the chemical fertiliser.
- Complete non-use of organic manure is definitely an inferior practice, even in terms of the yield rate.

Thus this study clearly showed the need for using organic manure. However, the basic limitation of this study is that it does not address the questions of the cost and the availability of organic manure. In order to compensate the use of chemical N, the study used 18,000 kg/ha of cattle manure or green leaves. What is the source for this large quantity of organic manure? What would be the cost of organic manure compared to chemical fertilisers? How do subsidies on chemical fertilisers affect this cost comparison? Considering the biomass resources available to the farmers of Kerala, what would be viable combinations of organic and inorganic fertilisers? All these questions are left unanswered. Thus the basic limitation of this study is that it is conducted in a situation which does not reflect the realities of day-to-day life of farmers in the region.

Scientists study farmers' fields

Knowing that this humid-tropical region sustains a well-developed form of homegardens in its dryland, scientists of the Kerala Agriculture University recently made a number of attempts to study the problems and potentials of this type of cultivation. This study is part of the Farming Systems Research in the university. Conventional scientists faced a crucial problem of methodology. Homestead cultivation sustains a large number of trees and plants yielding a variety of commodities. A few of these products are not so commercially valuable but very useful for home consumption. The homestead generates inputs like organic manure and ash to be used for subsequent cultivation. Certain commodities like timber for house construction are produced over a long time-cycle. All these peculiarities of homestead cultivation are not easily amenable to the methods of the scientists who were dealing mainly with the inputs and outputs of a single crop plantation or who were well versed with statistical data collection through questionnaires. Instead of using methods of participatory appraisal, scientists resorted to the statistical data collection which ultimately left out many important features of the household cultivation. The fact that the researchers who did these studies were mainly trained in natural science (and agronomy) or economics and not in anthropological methods might have contributed to this situation.

Village level studies by NGOs

Recently a number of NGOs started to conduct village or community level projects to study and formulate strategies for the sustainable management of natural resources like land and water. They use participatory methods, incorporate farmers' viewpoints and consider socio-economic, cultural and technical factors together in a holistic manner. However, based on a few case studies in Kerala, I would argue that these studies also have several limitations.

A micro-watershed project is implemented in the Nellaya village of North Kerala by an NGO (Kerala Sasthra Sahithva Parishad). The project's objective was to develop appropriate strategies for the sustainable use of land and water resources. Instead of bringing the watershed under a major irrigation project, they designed alternative plans to use locally available water efficiently and develop sustainable landuse plans which are in tune with this. The NGO used several strategies to elicit farmer's viewpoints. A number of small group meetings were conducted. Group activities in which local people and project activists did physical labour together were also organised to reduce to communication gap. The political, religious and other

The homestead generates many important inputs, like manure, that are invaluable for farmers, but not always counted by scientists.

group leaders were consulted and asked to help in getting the support of the villagers. Local people were motivated to prepare non-technical maps of local resources like ponds, streams and forests and of the problem areas like highly eroded patches, to develop "resource consciousness" in their minds. The project activists collected information on the meteorological and hydrological parameters of the region. They also collected data on the existing landuse pattern of the area and on the socio-economic status of the villagers.

Limitations

Though the whole effort yielded quite a lot of useful information on the watershed and its inhabitants, I do feel in retrospection, that the collected information and the development programmes formulated on the basis of this information have several limitations.

There was an implicit objective in the project to maximise agricultural production in the watershed (of course, on a sustainable basis). Increasing agricultural production significantly (in conventional terms) implies a change in land use, which presently supports a wide variety of plants and trees, into small-scale plantations of a few crops which yield large benefits according to the present market situation. Having done a study on agriculture in the area, the project staff and the NGO felt bad about not recommending strategies for increasing agricultural production in monetary terms.

The NGO subscribed to an attitude in development planning in which most of the investment for rural development has to come from the government. The preferences of the local people were highly influenced by the fact that they did not have to bear the cost of the projects. In a state like Kerala where the educational status of the villagers is relatively high, there is a widespread awareness on the "providing" ability of the different agents of the government and other organisations. The participatory approaches used in this case were unable to delineate these biased preferences of the villagers.

It was difficult for the NGO, project staff and the local people to accept the fact that there are "natural limitations" to increase the yield to the level achieved in other regions of India where green revolution was successful (in increasing the yield). Agricultural science literature has pointed explicitly and the individual experiments conducted in Kerala have shown implicitly that the characteristics of the humid-tropical regions (such as low sunlightduring monsoons, monsoon-dependant cultivation in major part of the area, heavy and uncontrollable runoff through the fields) limit the yield rate of paddy. However, accepting that there are certain "natural constraints" is totally against the widely held notions on the ability of science and technology. The prevailing hope that the technological package of the Green Revolution (or Post-Green Revolution) will eventually be successful in Kerala in increasing the agricultural productivity considerably, distorted the thinking of the project staff and local people.

Countless value

Like the farming system studies of the university, this study also faced the problem of accounting non-monetised commodities like organic manure, fuelwood, non-marketable medicinal plants and those commodities which are produced over a long-term period such as timber. How to advocate the replanting of trees yielding timber once in fifty years, plants yielding organic manure and medicinal parts and trees like jack (which supply a part of the staple food during a lean season) when most varieties of jack fruit fetch very low prices in the market?

The distortions existing in the market for several commodities further complicate the accounting problem. What is the real value of fuelwood when kerosene is supplied with a direct subsidy? What is the relative advantage of using organic manures when chemical fertilisers are being supplied at heavily subsidised rates? What is the incentive for continuing an indigenous multi-food crop system when a particular grain is supplied through the controlled market? The impact of these market distortions prevail even after they cease to exist. The habitual changes of the people and the long-term impact on the land-use pattern brought about by these distortions will continue to prevail for a long time. The NGO study described here could not consider these external economic factors adequately.

What is clear from this study is that the use of participatory approaches and the closer interaction of the project agency with people by itself does not guarantee a better understanding of the problems of the agricultural system or an easier planning for sustainable agricultural development.

Effort of innovative farmers

A number of farmers in Kerala today practise innovative methods of sustainable agriculture. As they constantly interact with their agricultural system, their understanding is more holistic. Since agriculture directly contributes to their life, they can value the non-monetary benefits offered by the system. However, the generalisation based on these experiments are very problematic. The size of the farm is an important factor. In general those farmers who practise some form of sustainable agriculture are relatively large land owners. They can afford to ignore a part of the monetary income. The contribution from other sources of income like jobs, business, etc. can also make it easier for farmers to afford sacrifice part of the monetary benefits generated through the adoption of a plantation-based system of marketable crops.

The objective of this article is not to neglect the importance of all these experiments of sustainable agriculture. All of them provide important information, evidence and morale boosting for building a sustainable agricultural system. However, knowing their inherent limitations would help us in making our objectives and action plans more realistic. ■

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Table 1 Effect of organic and inorganic manures
Ranking of sources in the order of yield rates

Source	Year and Season* of Experiment												
	79A	79B	80A	80B	81A	81B	83A	83B	84A	85A	85B	86A	86B
P	2	1	1	1	1	1	1	1	1	1	3	1	2
Q	1	8	5	8	2	5	5	7	7	5	5	5	5
R	4	2	2	3	3	2	3	2	3	2	2	3	4
S	7	7	8	7	5	8	6	8	8	8	8	7	8
T	3	3	3	2	6	4	2	3	2	3	1	2	1
U	8	6	7	5	7	7	8	5	6	6	7	8	6
V	5	4	4	4	4	3	4	4	4	4	4	4	3
W	*6*	*5*	*6*	*6*	*8*	*6*	*7*	*6*	*5*	*7*	*6*	*6*	*7*

Sources and Doses:

P: *Cattle Manure (CM) 18000 kg/ha*
Q: *Green Leaves (GL) 18000 kg/ha*
R: *CM+GL 9000 kg/ha each*
S: *N Fertiliser 90 kg/ha*
T: *CM 9000 kg/ha + N 45 kg/ha + P 45 kg/ha + K 45 kg/ha*
U: *GL 9000 kg/ha + N 45 kg/ha + P 45 kg/ha + K 45 kg/ha*
V: *CM+GL 4500 kg/ha + NPK (45+45+45)*
W: *NPK (90+45+45)*
A: First Season
B: Second Season