Visualising the diversity of their strategies allows farmers to evaluate their practices and allows researchers and extensionists to better guide farmers in improving these practices. Monitoring of crucial parameters based on farmers' criteria may further help to finetune extension programmes and policies.

Photo: Thea Hilhorst

Analysing the diversity of farmers' strategies

Toon Defoer, Thea Hilhorst, Salif Kanté, Souleymane Diarra

In Southern Mali, fallow periods to regenerate natural soil fertility become increasingly rare. Although income from cotton (combined with credit facilities), has made fertiliser investments possible, substantial soil fertility mining has been reported since hardly any fertiliser or manure is applied on cereals (Van der Pol, 1992). Moreover, the minimum organic matter level of the soil needed to protect soils from irreversible degradation is actually threatened. Maintenance of soil fertility demands more intensive management strategies to guarantee sustainable productivity.

Flexible research needed

Changes in the production system also increase differences between farming households. The large variation in soil fertility management practices partly reflects the diversity in access to resources such as good quality land, labour, livestock and knowledge (ESPGRN, 1994). Increasing diversity of farming systems places higher demands on research and extension. Technologies proposed as recipes for the "average" farmer become less and less relevant. Therefore, effective tools to analyse the differences between farmers' management practices are urgently needed. Farmers, as resource managers, will have to play a major role in this. A participatory research-action approach has therefore been developed by ESPGRN (Equipe Systèmes de Production et Gestion de Ressources Naturelles). It enables farmers, together with researchers, to analyse and understand farmer strategies and practices of soil fertility management and to identify sustainable technologies. The aim is to guide farmers in improving their practices (Defoer and Diarra, 1994).

The analytical phase

This research-action approach is implemented in those villages that reported soil fertility maintenance to be one of their major concerns. The analytical phase in the field, using Participatory Rural Appraisal techniques, consists of four steps and takes three days. Step one, two and four take place in village meetings, while the third step is implemented at farm level. First, the diversity of fertility management practices among farms is explored through mapping and analysis of present resource use. Then a village map is made by a small group of villagers of both sexes. At the same time farmers' criteria identifying and explaining the diversity of fertility management practices are identified. This is done separately by older farmers, women and younger farmers. Researchers have suggested this division, but in the end, villagers define the groups. After each group has prioritised the criteria, the outcomes are brought together in a list of key criteria.

Secondly, with the help of a number of well-informed farmers a rapid census is done to determine the values of the key criteria for each farm. The name of each household head is written on a separate card. On the back of the card, a value for each key criterion is written.

Then a representative group of farmers is invited to classify all farming households according to the level (quality) of soil fertility management (see box). The farmers decide on the number of classes and their definition. Generally, they create three classes: good, average and bad. The cards are then taken one by one. The names of the household heads are read and farmers decide together in which class the card should go. After being classified, the cards are turned. The values written on the back are compared between farms of the same class and between classes. Discrepancies are intensively discussed. The cards are then placed on the village map. At least two farms are chosen from each class, preferably with clear differences in soil type and key criteria, for farm level discussions the next day. Selection is done by the researchers in consultation with the farmers. The management of women's private fields is also discussed with women of the selected households. These farmers, both men and women, will eventually become "pilot" farmers.

Thirdly, resource flow models are made by the pilot farmers in order to analyse their fertility management practices. After a walk around the farm, the members of the household are asked to draw on a large sheet of paper different farm components such as fields (common and individual), grain and fodder stores, animal pens, compost heaps, etc. The types of soils, acreage, erosion spots and erosion control works are also marked. On each field, both present and preceding crops are marked. Then farmers draw arrows to represent resource flows between fields and other farm units. The utilisation of last year's crop residues of each field is depicted and estimated, which indicates the level of recy-

cling. The number of carts transported is noted and the part of the residues used is estimated using pie diagrams. Then fertiliser (organic and inorganic) application on present crops is visualised as well as other resource flows entering the farm. This visualisation and analysis of soil fertility management and the level of integration enables farmers together with researchers to identify improvements adapted to the farmers' conditions and strategies. The same exercise is done with women on their private fields.

Finally, pilot farmers from different classes present the resource flow models during a village meeting, their conclusions and possible improvements. After that, the researcher/adviser gives some feedback on the concepts and the technical implications of the recommendations proposed, for each of the classes. The aim is to increase the recycling of residues while taking into account the farmer's productive resources and strategies. This presentation aims at stimulating other farmers (of the same classes) to consider similar improvements, taking into account their possibilities and limitations. A separate meeting is organised with the women of the village, and the same discussion is held.

Photo: Thea Hilhorst

Maps and resource flow models are presented and discussed during a village meeting. This stimulates other farmers to consider similar improvements.

The planning phase

A farmer workshop, exchange visits, and participation in demonstrations are then organised. Farmers are exposed to new technologies and to the experiences of other farmers. Then each pilot household discusses and visualises their plans for the next season. A new resource flow map of their farm is drawn. These individual plans, based on farmers' production objectives and available resources, are intensively discussed between farmers and researchers. Given the emphasis on regular feedback to the entire village, the proposed plans are also presented in a village meeting, followed by a discussion on the technical implications.

The monitoring phase

For research purposes, all information on the maps is transferred through monitoring sheets into a data base (D-base and analysis in SPSS (Statistical Package for Social Sciences)). These data include household characteristics, farm features (crop acreage, soil types, livestock, etc.) and the flow of resources (estimated use of residues, fertiliser, organic matter, etc). Some data such as labour and yield are collected afterwards. Following villagers identification of key criteria determining differences in soil fertility management, crucial parameters towards sustainable management have been selected. These parameters are mainly related to the degree of crop-livestock integration, nutrient recycling and available productive resources. These data enable ESPGRN to monitor changes regarding soil fertility management for the different classes in the test villages and to identify major constraints. Later, this will be translated into a monitoring system for farmers and extensionists.

Some results

Only some results of the different steps of the research-action approach are presented here. For more information on the use and analysis of resource flow maps, the reader is referred to Lightfoot et al. (1994). Criteria to identify differences in soil fertility management are mostly related to the level of resource recycling. The way different groups (older men, women, younger men) reasoned was quite comparable. Their lists are generally complementary although the final prioritisation may differ. According to them, methods to produce organic manure, crop residue use in cattle pens and the amount of compost produced and transported to the fields differ substantially between farms. Also anti-erosion measures and application of recommended chemical fertiliser doses vary greatly between farms. The groups indicated several causes for these differences. Access to productive resources such as family labour, cattle and carts play a major role. Also the need to pay attention to maintenance of soil fertility seems to play a role: farms that have few fallow land available and soils of bad quality are likely to put more emphasis on manure production. Also knowledge, courage, as well as the decision making structure of a household are mentioned (see also Vierstra, 1994). Finally, prices affect soil fertility management as shown by the priority given to cotton.

The reliability of farmers' classification could be analysed by computing the values of the key criteria, obtained through the rapid census. This analysis shows a clear relation between management practices and available resources. In Southern Mali, farmers are thus aware of the management strategies of their colleagues and able to point out the major differences.

The combination of analysis and exposure to information on new technologies motivates farmers to take action. Pilot farmers as well as their neighbours are indeed planning a more intensive use of crop residues. In one test village, half of the farmers have stored considerable amounts of fodder and many new compost pits are made. This happened in a period of six months after the first analysis. An essential element of the approach is the regular feedback of pilot farmers' results and reflections to the village. These group sessions allow for a comparison between farmers with the same resources and objectives and may also result in communal decisions such as limiting the clearing of new fields in sensitive areas, or a more rational use of communal pastures.

The research-action approach allows for the monitoring of changes, their effects and limitations. The parameters used are based on the key criteria selected by the villagers, which facilitates communication between farmers and researchers. This was possible since farmer criteria are in line with researchers criteria for the evaluation of soil fertility management. However, researchers need more precise values, opting for quantification when possible. For farmers, a more general estimation seems to be sufficient for decision making. ESPGRN intends to validate farmers' criteria and to "use" the complementarity with researchers' views and parameters, to guide farmers in improving soil fertility management.

Eventually, this monitoring will result in recommendations to different groups of farmers and the extension service on the most optimal and sustainable use of their resources from an ecological and economi-

cal point of view. Also, the insight gained on farmers'decision making regarding soil fertility management may become relevant for policy makers. It allows for predictions on possible reactions of the different classes of farmers towards new technologies, certain incentives or changes in the macro-economic environment. As such the methodology may also help to bring decision makers and farmers closer together.

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Analysis of the classification

Soil fertility management practices per class of farmers

	class I	class II	class III
Compost production	3	0.7	0.3
Litter use	3	0.8	0.4
Erosion control	3	2	1.3
Fertiliser dose applied	1	1	0.8

(figures are averages from values attributed to farms for each class; 3 is the highest value per farm and 0 the lowest; for "fertiliser dose applied": 1 = dose applied and 0: dose not applied).

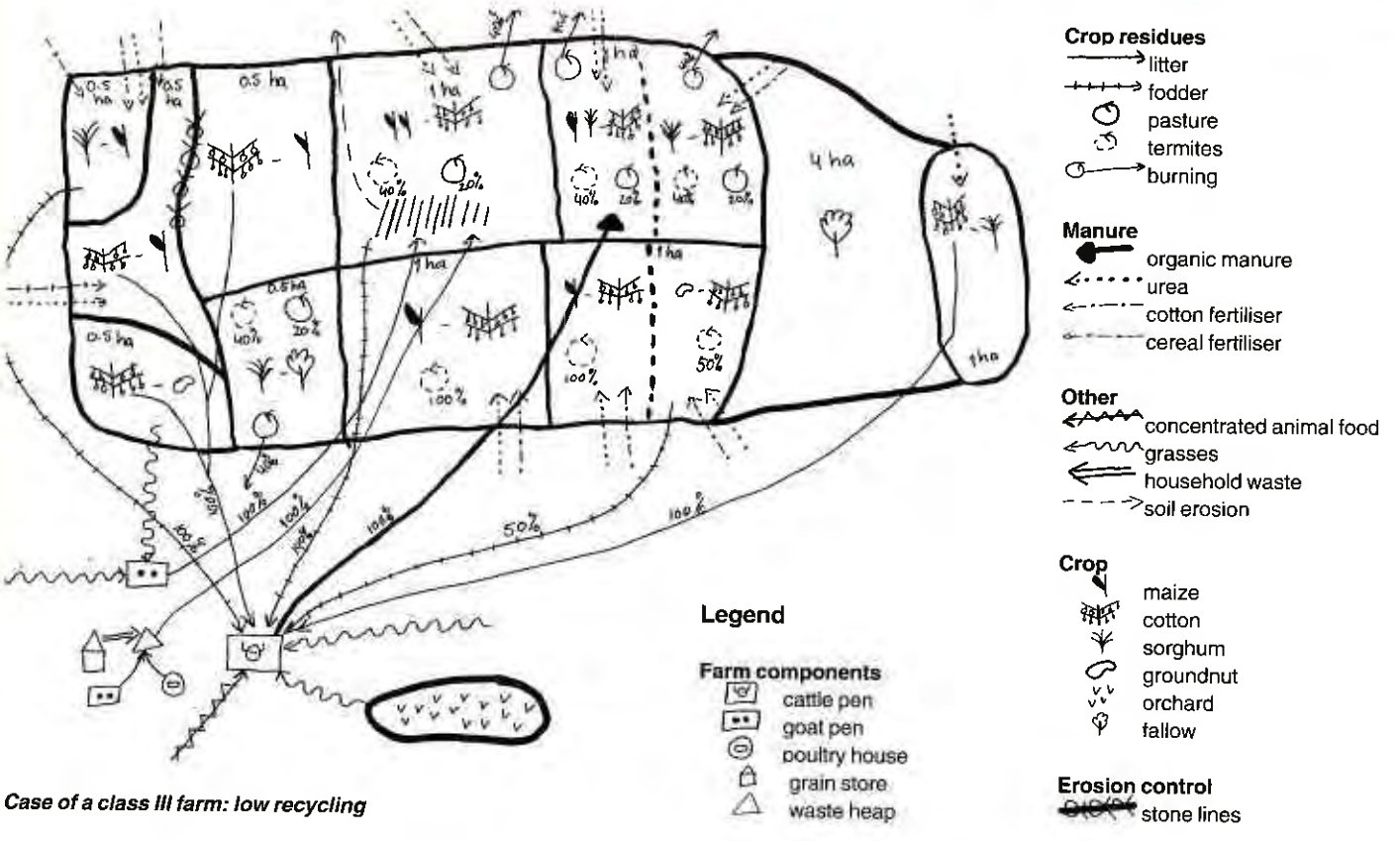
Compost production, litter use and erosion control are substantially higher for farms of class I, compared to class II and III.

Causes of differences in soil fertility management practices per class of farmers

	class I	class II	class III
Cattle (Nb)	25	8	2
Family labour(Nb)	7.4	3.7	1.8
Acreage (Ha)	17.2	8.5	5.0
Cattle/Ha	1.6	1.0	0.5
Ha/family labour	2.4	2.3	3.3
Carts (Nb)	1.2	0.9	0.2

The number of cattle, family labour and the acreage is highest for class I. The number of cattle/ha, an indicator of the acreage that can be manured, is also the highest. The acreage cultivated per family labour of class III is considerable higher than of the other classes; a high acreage/active does not seem to allow a satisfactory soil maintenance and fertility management.

Comparing sub-classes of the good managers: the best ones do not have the highest livestock number, neither the highest number of family labour; farms with high livestock numbers have multiple systems of animal pens and are less effective in producing manure, compared to farms with less livestock. It's possible that in big farms, decision making becomes very complicated, with less "room" for introducing new technologies. The maximum acreage seems to be around 20 ha, above which fertility management becomes less efficient. Finally, other factors are often mentioned as important but are difficult to define: knowledge (training), motivation, courage and internal household organisation.



Case of a class III farm: low recycling