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Participatory Research Approaches and Social Dynamics that Influence Agricultural Practices to Improve Child Nutrition in Malawi

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Abstract: The Soils, Food and Healthy Communities project in Malawi uses an interdisciplinary participatory approach to improving child nutrition with resource-poor farmers. The overall research question is: Can legume systems improve soil fertility, food security, and child nutrition? Over 2000 farmers are now experimenting with legume systems in the region. While this article examines the social issues that mitigate the potential success of legume options tested by the farmers, it does not aim at discussing extensively the complex web of interactions between soil fertility, food security, and nutritional status of children. Instead, its focus is on the research process, and more specifically on the social dimensions and participatory approaches, which influenced farmers' adoption of organic matter technologies and legume options. The Farmer Research Team was critical in mobilizing community interest in changing agricultural practices to improve child health, but faced challenges in village politics and workload. The linkage with child nutrition was a major reason for increased adoption of legumes, and gender relations played a key role in the adoption. A deeper understanding of the limits of participatory approaches helped to develop innovations that may be replicated elsewhere, such as inclusion of grandmothers and a farmer apprenticeship program.

Key words: legumes, food security, participatory research, soil fertility, child nutrition

Introduction

Food insecurity and malnutrition are widespread and persistent problems facing poor households in the Ekwendeni catchment area in northern Malawi. In 1996, over 70% of households did not have enough food stocks to last the entire year (Young, 1997; Bezner Kerr, 1998). Almost half of children under 5 suffer chronic undernutrition in Malawi as reflected in stunting levels in 1991 and again in 2000 (NSO and Macro, 2001). There has been no improvement in nutritional status for young children in the last 10 years.

There are multiple, complex, and interrelated ways in which food insecurity and malnutrition in Malawi is intimately linked to soil fertility. An ecosystem approach to human health was utilized in this research to try to understand these linkages and to apply them in a participatory research project (Fig. 1). The ecosystem approach takes a holistic approach to understanding how humans interact with their environment, and the implications for human health (Forget and Lebel, 2001). The Soils, Food

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and Healthy Communities (SFHC) research project attempts to improve child nutritional status through use of different legume options which can improve the quality and quantity of food available within the household as well as provide organic inputs to improve soil fertility (Fig. 1). The end goal is to improve food security, soil fertility, and child nutritional status. This article focuses on the social dimensions and participatory approaches, which influenced the legume choices made by farmers.

Most Malawian households rely on their own agricultural production to meet household food needs, with maize as the primary staple. Soils in Malawi are low in nitrogen, in part due to the inherent soil characteristics of the region and very low inputs of fertilizer and organic sources (Snapp, 1999; Snapp and Blackie, 2004). Most crops require nitrogen additions for adequate growth. Low inputs are common throughout sub-Saharan Africa, estimated at 10 kg/ha, and lower in poor countries such as Malawi (Snapp and Blackie, 2004). Fertilizer use in Malawi has remained low for over a decade, due to rising living costs and removal of fertilizer subsidies; one study found that approximately 30% of households apply fertilizer to crops (Snapp et al., 2002).

Legume cultivation (e.g., groundnuts) has been low for many decades. Reduced legume production means lower meal diversity and fewer organic inputs into the soil, which in turn reduces soil fertility. Low soil fertility leads to low agricultural production, which means reduced food intake for poor farmers. A variety of "legume options" such as intercropping or rotating nitrogen-fixing plants with maize are promising nitrogen-input alternatives for smallholder farmers in Malawi (Snapp et al., 1998; Kamanga et al., 2001). In addition, edible legumes provide a nutritious food source, as they are higher in protein, oil, and some micronutrients than maize (Salunke et al., 1986).

The SFHC project, based at Ekwendeni Hospital in northern Malawi, tests the hypothesis that legume options improve soil fertility, food security, health, and nutrition of resource-poor households, particularly in children under 5. The legume options selected by farmers in the SFHC project were previously tested on-farm for soil fertility enhancement in Malawi (Snapp et al., 2002; Snapp and Blackie, 2004), but did not examine social dynamics that may influence effects on child nutritional status. The SFHC project employed a farmer participatory research framework to test the efficacy of the legume options for resource-poor farmers for improvement of soil fertility, food security, and child nutrition. The legume options are: 1) maize

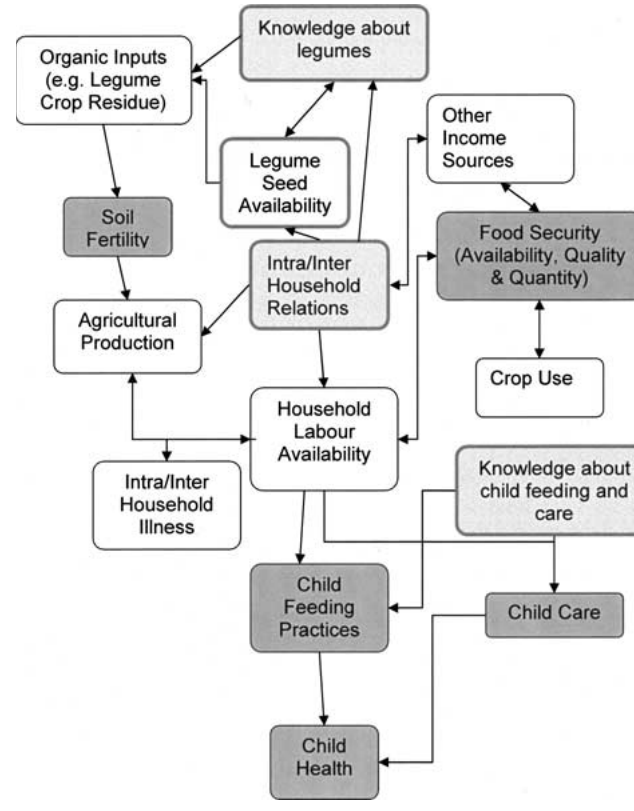

Figure 1. Conceptual map of linkages between soils, food, and child health in Ekwendeni, Malawi. Boxes with darker borders and light shading are areas in which the SFHC project has actively intervened; the boxes with darker shading are areas which the SFHC project hopes to change. SFHC, Soils, Food and Healthy Communities.

(*Zea mays*) intercropped with pigeon pea (*Cajanus cajun*); 2) pigeon pea intercropped with soybean, then rotated with maize; 3) pigeon pea intercropped with groundnut then rotated with maize; 4) *Mucuna pruriens* rotated with maize; 5) *Tephrosia vogelii* intercropped with maize.

The critical linkage between food security and malnutrition, however, does not mean that increasing production alone will lead to improved child nutrition. An ecosystem approach to human health examines the multiple linkages between environmental aspects such as soil fertility and human health. In the case of improving child health, household relations and power dynamics in extended families may be critical (Fig. 1). This article will discuss social dimensions within households and communities that need to be taken into account when addressing linkages between soil fertility and child nutrition. Different social and community issues influence whether different legume options can have a positive effect on human health. In addition, the article considers the participatory approaches used, challenges and benefits from this approach,

and implications for other participatory research projects. The focus of the article is the qualitative and participatory research related to the legume intervention with some illustrations generated by data from various research activities.

Fieldwork Setting

Malawi is a highly rural country, with approximately 80% of the population living in villages with less than 1000 people (Benson et al., 2002). The research reported here was conducted in a rural area of northern Malawi, 15–20 km northeast of Ekwendeni, a town of approximately 10,000 people. In the study region, over 90% are subsistence farmers although they also have other livelihood activities, such as small businesses, labor on other people's farms, and cash crop cultivation (Bezner Kerr, 2004b). Tobacco is the primary cash crop of the area. Households grow maize during the rainy season as the staple crop, in addition to beans, squash, groundnuts, sweet potatoes, and other crops.

Seven villages were selected for the research project, five of which were known to have higher than Ekwendeni-average levels of child stunting, and two that had a higher level of anemia. Growth faltering is a good measure of overall health status for a given population. The village sampling technique was purposeful sampling (Patton, 1990) as these two village areas represent characteristics of particular health problems (malnutrition and anemia) related to the broader phenomenon of food security. The SFHC project is not representative of Malawi, or even northern Malawi, but rather is an intensive case study that attempts to understand the linkages between soil fertility, food security, and child health and nutrition.

Research Approach and Methods

This article focuses on the participatory and qualitative research carried out in conjunction with the Farmer Research Team (FRT), which is a group of farmers selected by the community to do research. Participatory rural appraisal methods (e.g., seasonal calendars) were undertaken to understand current agricultural practices, perceptions of soil fertility, household labor, gender relations, food security, and perceptions of child health (Slocum et al., 1995). Semi-structured interviews on agricultural practices, household division of labor, and perceptions of soil fertility were conducted with 30 farmers by the sociologist (Bezner Kerr, 2004b). A food security ranking exercise was carried out to understand local indicators of food security. Annual participatory evaluations of the legume systems were carried out by SFHC staff and the FRT, using small group discussions (Slocum et al., 1995). Semi-structured interviews on legume seeds were carried out with 100 community members.

The research team is made up of a nutritionist, sociologist, agronomist, community development specialist, and community members. Using participatory approaches meant researchers relied heavily on input from the Farmer Research Team and village committees. Participating farmers also embraced the multifaceted nature of the project and emphasized the links between soil fertility and child nutrition in meetings, training sessions, and workshops. The assumption is that resource-poor farmers have valuable knowledge to contribute to the assessment of organic matter technologies for improving food security and health. The different needs and priorities of various groups in a community, however, are also recognized (Guijt and Shah, 1998). Community-based indicators of health, food security, and soil fertility were identified, in order to evaluate and monitor the trials from different perspectives (McAllister and Vernooy, 1999).

Farmer participatory research has been tested in many parts of the world, and is now recognized as an important way to develop and improve agricultural technologies as well as disseminate knowledge in a meaningful way (Ashby et al., 1997; Gubbels, 1997; Rocheleau, 2004). The use of a ''farmer research team'' replicates other participatory efforts in Africa and Central America, where small farmer groups carry out research for the broader community (Ashby et al., 1997; Hagmann et al., 1997). Other reports of farmer participatory research have noted that village-level research teams are often made up of the better-off, male members of the community, and at times the tested technologies are not spread far beyond the research teams (Guijt and Shah, 1998; Humphries et al., 2000). In order to make the selection process as participatory as possible within the constraints imposed by differing access to wealth and power, the SFHC team asked the villagers to select a ''representative'' group of people. (The term ''representative'' is not meant in the statistical sense, but rather in the more general sense, that is, representing different groups within a community. Interviews with all members of the FRT in 2000 confirmed that there was a considerable range of levels of food security, age, types of marital status, and a

ratio of 11 women to 18 men [Bezner Kerr, 2004b, pp 10–11].) For example, communities could select some women, some men, some married people, some nonmarried, some poor, some better off, some food-insecure, and some food-secure members.

As a result of the selection of the FRT, there were several active members who saw child nutrition and improved household food security as the priority of the project. Two of the leaders of the FRT are very food insecure, and made gender relations, child nutrition, and household food security a priority. Thus, the inclusive participatory approach addressed some of the power and gender issues faced in other participatory programs, where men tend to be dominant, and less food-secure households do not have their technological options favored (Guijt and Shah, 1998).

The FRT first visited farmers in central Malawi and were trained by a Malawian agronomist about the different legume options. The FRT then presented the information to villagers at community meetings, and indicated that anyone in the village could do on-farm trials with the legume options. The link with child nutritional status was emphasized by the FRT from the beginning of the project. The FRT felt the goal of improved child nutrition through legume consumption was critical for the success of the legume options and discussed the issue in farmer meetings, trainings, and farm visits.

Results and Discussion

Participatory Approach and Legume Use

The FRT visited farmers to provide agronomic advice and to carry out participatory research on the trials. Thus far, the project has found that Farmer Research Teams are effective means to promote and test agricultural innovations. From a community development perspective, the project has been highly successful in disseminating knowledge about legumes as a source of soil fertility, food security, and child health. The 1st year of the project, there were 183 participating farmers from seven villages, 49% of whom were female-headed households (FHH). (Female-headed households are here defined as those where the head of the family are widows, divorced or separated women, or the second wife of a polygamous man. Female-headed households are locally defined.) The following year, 456 participants came from 11 villages, and 72% were FHH. In the 3rd year, there were 1800 farmers from 18 villages, and in 2003–2004 (the 4th research season), almost 3000 farmers from 77 villages participated in the project. In essence, the spread of legume use was almost 100-fold; from 30 farmers of the FRT to 3000. Qualitative research, survey results, and consideration of the legume choices suggest that the motivation for adoption was the use of legumes primarily as a food source, rather than as a soil fertility enhancer or a source of income. The most popular legume option selected by farmers has been pigeon pea and groundnut, relay intercropped with maize, followed by pigeon pea and soya bean, relay intercropped with maize. Less than 10% of farmers selected mucuna after the 2nd year of the project. Further discussion of legume choice is below.

In the 2nd year, the Farmer Research Team was unable to supervise all the participating farmers, and asked for help from the villagers. Village committees were formed to assist the Farmer Research Team, resolve community conflicts related to the project, and to report back to the communities. The committees were elected by villagers themselves. Most of the members selected were from female-headed households, with 70% of the village committee members being women. The emphasis by project staff and the FRT on the links between soil fertility, food security, and nutrition seemed to appeal more to women, who cited the link with nutritional outcomes as a primary motivation for joining the project. In turn, the high proportion of women within the project led to increasing interest by project staff and FRT members on improving nutrition education and measuring nutritional outcomes.

Community Assessment of Legumes

Local indicators were developed by participating farmers in consultation with the SFHC research team to assess the legume options from a community perspective (Table 1). The majority of the indicators are based on observation and qualitative data, rather than quantitative data. The food security and child nutrition indicators seemed to be the most important in legume choice, as discussed below. The gender relations focus on child care, household labor and decision-making, and these different aspects will be discussed in light of the linkages with legume production and consumption.

Once the indicators were developed, each village developed an action plan, and all 1800 participating farmers were visited to assess the legume options using the local indicators. The Farmer Research Team and SFHC staff

Table 1. Local Indicators for Soil Fertility, Food Security, Health, and Gender Relations

Indicator	Soil fertility	Food security	Health	Gender relations
1	Soil is dark colored like manure	Full granaries	Family members are usually not ill	Child care and feeding done by both parents
2	Vigorous growth of crops	Amount of yield at harvest	Family eats many different types of food	Household responsibilities shared
3	Soil forms "clumps"	Time that the maize stock run out	Children are strong and playful	Decisions made by both men and women
4	Vigorous growth of weeds	Having three meals a day	The agricultural labor on the farm is done on time	
5	Availability of worms or other soil biota	Amount of time you have to do labor for food (*ganyu*)	Children are able to complete their education	
6		Number of livestock		
7		Happy family		
8		Frequent visitors		
9		Family has money		
10		Children grow well		

met 1 month later to discuss the results. The strengths and weaknesses of each of the technologies were assessed using these local indicators (Table 2). The method used was qualitative, not quantitative. Farmers verbally reported to project staff their perceptions of the different legume options, using local indicators for health, food security, and soil fertility.

Farmers rated the legume system of intercropped pigeon pea and groundnut rotated with maize as the most effective at improving food security and nutrition. Pigeon pea provides a legume late in the harvest period, at a time when there are limited supplies of other quality foods available. As a consequence, it provides a healthy protein and iron source at a time when food resources are scarce. In addition, pigeon pea is considered labor-saving because harvest occurs during the dry season, lessening the harvest requirements during the busy rainy season. Groundnuts are utilized in numerous local dishes, and the higher-yielding, improved variety (CG7) used in the trials contributed to family meals. They are high in oils and protein, and provide important energy and growth sources for young children. In addition, groundnuts are an important market crop and can provide income to food-insecure families, although increased income does not always improve nutritional status, as discussed below.

Mucuna was considered the most effective at improving soil fertility. Farmers growing mucuna found an improvement in soil fertility based on local indicators such as maize growth and soil color. A few farmers successfully used mucuna as an alternative to commercial fertilizer, applying no fertilizer to their maize the following year and getting reasonable yields. Farmers noted, however, that since mucuna could only be eaten if it was cooked for more than 6 hours, it tended to have limited use as a food source. Women did not like the added labor of cooking mucuna or the high fuelwood use. Furthermore, since mucuna is poisonous if not cooked enough, people were suspicious of it, and there was some indication that it was associated with witchcraft. In follow-up interviews to understand the low adoption rates of mucuna, the research team found several instances where grandmothers threw out the stored seed, for fear of grandchildren eating the seed. Power dynamics between a younger married woman involved in the project and her mother-in-law were at play in some of these instances. Qualitative research and participatory workshops revealed that paternal grandmothers are powerful decision-makers within extended families, in terms of household labor, resource use, and child care practices. If a mother-in-law disagrees with her daughter-in-law, she has the right to take the child away from her, and can even cause divorce. These power dimensions are critical to understand if the end goal is child nutrition, and they interact in numerous ways with agricultural activities, food security, and child nutrition.

There were also labor problems associated with a recommended agronomic practice for optimal effects on soil

Table 2. Farmer Assessment of Legume Options in Terms of Soil Fertility, Food Security, Child Health, and Nutrition, and Social Issues

Legume option	Soil fertility	Food security	Child health and nutrition	Social issues
Groundnut and pigeon pea intercropped, maize grown the following year	Limited improvement of soil fertility. Pest problems (i.e., beetles) limit yields and biomass. More effective if p/pea grown as improved fallow for 2nd year	Good food source. High yields of groundnuts, which can be used in many recipes. P/pea available late in the dry season when other food not available. P/pea source of firewood	Groundnuts and pigeon pea can be used in porridge for young children. P/peas are a source for medicine for earaches and diarrhea	Two crops produced on one field which reduces labor. Source of cash, however men tend to sell groundnuts and use cash for nonhousehold use. Both crops good sources of gifts and bartering. P/pea remains in field and is eaten by livestock
Soybean and pigeon pea intercropped, maize grown next year	Limited improvement of soil fertility. Pest problems limit yields. Soybean variety used grows poorly and produces very little biomass. More effective if p/pea grown as improved fallow for 2nd year	Good food source. Soybeans used in many recipes. P/pea available late in the dry season when other food not available. P/pea source of firewood.	Soybeans considered very nutritious for young children. P/peas are a source for medicine for earaches and diarrhea	Both crops are good sources of gifts and for bartering. Two crops produced on one field which reduces labor. P/pea remains in field and is eaten by livestock
Maize and pigeon pea intercropped, rotated with maize the following year	Very low soil fertility improvement. Pest problems (i.e., beetles) limit yields and biomass. More effective if p/pea grown as improved fallow for 2nd year	Good food source, and get primary food crop from field (maize). P/pea available late in the dry season when other food not available. P/pea source of firewood	P/pea can be used in porridge for young children. P/peas are a source for medicine for earaches and diarrhea.	Two crops produced on one field which reduces labor. P/pea is a good source of gifts and for bartering. P/pea remains in field and is eaten by livestock
Tephrosia voglii intercopped with maize, rotated with maize the following year	Good soil fertility improvement	Get primary food crop from field (maize), but limited yield of one crop. Tephrosia leaves can be used as an insecticide in vegetable gardens, and can be used to treat seed and protect from weevils. Tephrosia is a source of firewood	Limited direct effect on child health and nutrition, although use of tephrosia as an insecticide in vegetable gardens may increase vegetable sources for young children	Considered a "tree" so it is controlled by men, who control the land
Mucuna spp. rotated with maize	Best soil fertility improvement. Improves soil moisture retention. Improves soil structure	Cannot eat crop without cooking it for a long time. Vigorous growth means cannot be grown with other crops	No clear link with child nutrition, although increases maize growth the following year	Smothers weeds so reduces labor. No market for the crop. Need to bury crop residue at labor peak, and high biomass production means burial is hard work

P/p, pigeon pea.

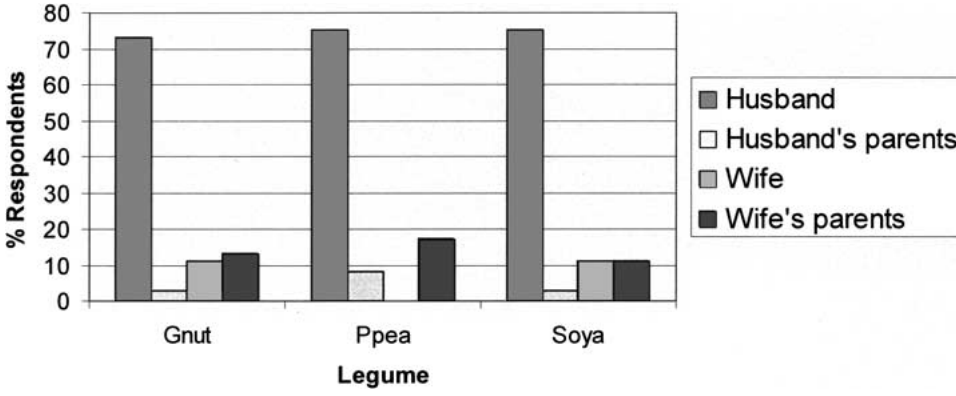

Figure 2. Reported decision-maker about crop use, November 2001 SFHC survey (groundnuts [Gnut], $n = 105$; pigeon pea, [Ppea], $n = 17$; soya bean, $n = 51$).

fertility, namely burying mucuna crop residue prior to flowering. Burying the mucuna at this time is in the busy agricultural season, and also means that farmers did not have a ready seed source for the following year. Most farmers chose not to select mucuna in part because of the complications of burying crop residue when other crops needed weeding. Thus, although farmers noted the positive aspects of mucuna on soil fertility, several other aspects relating to inter- and intra-household dynamics, labor shortages, and perceptions of the crop itself made it unpopular.

Labor shortages within the household had multiple links to agriculture and food security. Food-insecure families relied on day labor jobs (*ganyu*) as a source of seeds and food; but *ganyu* work also conflicted with their own production which in turn reduced yields and on-farm seeds (Bezner Kerr, 2004b). Households that came to rely on *ganyu* in exchange for seed during planting season also tended to plant late, leading to a vicious cycle of low yields, low seed production, and the need to do *ganyu* the following year.

Health problems within the extended family could lead to the loss of a seed variety for many years, since women are primarily responsible for caring for ill family members and legume seed maintenance. Over half of respondents in our 2001 survey indicated that illness or death within the family worsened their food-security situation. For example, one woman was ill for one rainy season, and her husband, who worked alone in the fields, lost most of the groundnut crop. They did not grow groundnuts for 7 years after that illness. The intercropped legume options (e.g., pigeon pea and groundnut) were cited as labor-saving by many farmers, because the two crops could be planted and weeded at the same time, rather than cultivating two different fields (Table 2). This labor-saving characteristic was particularly important for food-insecure households which were often short of labor during the agricultural season.

Household Decision-making about Legume Crop Use

Focus groups and interviews with men and women about intra-household decision-making revealed several important issues. Men often sold the legume crops and used the money for nonhousehold benefit, particularly alcohol. Since women often carried out the agricultural labor required for the legume crop, some found the additional legume crop more of a burden than a household benefit (Kayira, 2002). Although legumes are often considered to be more of a female responsibility, those that can be sold, particularly groundnuts, became more of a "male" responsibility, since control of cash is largely dominated by men. In the November 2001 survey, husbands were reported to make decisions about crop use for all three legumes commonly grown prior to the intervention (i.e., not including mucuna) (Fig. 2). Husbands also were overwhelmingly reported to sell the crop. This finding may reflect the "ideal" household relationship in this region, that the "husband is the head of the home," an idea widely expressed by both men and women (Bezner Kerr, 2004a).

Expressed ideals, however, are not always practiced, and the above figure may be misleading; control over food resources may be more nuanced than is apparent. Women make all meals and do not usually consult husbands about what to prepare. While a husband might decide to sell a crop without consulting his wife, a wife may also decide to feed her child groundnuts without consulting her husband. Women also reported deciding to grow legumes after discussions with neighbors or relatives about their nutritional

value. Several husbands indicated that a decision to grow a crop was often done in consultation with their wives, and the food value of the crop was an important factor in decision-making. Furthermore, semi-structured interviews about legume seeds indicate that women are primarily responsible for seed selection and storage, and knowledge about legume seeds is largely held and passed down from a mother-in-law to a daughter-in-law. There were several reported cases of wives taking groundnut seeds to other locations for storage, ostensibly to avoid children eating the seeds, but also possibly to avoid husbands taking the groundnuts for sale. Interviews with reported "legume sellers" indicated that many of them are older women. These women gave legumes to their daughters and daughters-in-law as a food source for their children, distributed legumes to family and friends, and maintained some control over legume cash earnings. Thus, while officially men are in control of legume crop decisions, more subtle power dynamics may be at play within and beyond households. These findings suggest that the increasing number of women involved in the project, and the emphasis on the use of legumes to improve child nutrition affected use of legumes and possibly household control over legume use, since it would be primarily women choosing whether to cook legumes for meals. Furthermore, it suggests that involvement of older women may be critical in mobilizing community support, since older women play a powerful role within households and communities.

Legume Choices

Interviews about why people decided to grow legumes indicate that there are many different ways that information about legumes is passed through communities. One husband indicated that he had chosen soya bean and pigeon pea because his wife heard at the hospital mobile clinic that soya beans are good for young children. Older women reported exchanging ideas and knowledge about legumes and child nutrition with other older women in informal settings. One grandmother, Mrs. Gondwe (all names have been changed to protect the identity of informants) reported deciding to grow soya bean after an informal discussion with Mrs. Banda while gathering water. Mrs. Banda, a project participant, had tried feeding soya bean and maize porridge to her grandchild after a project meeting, and was impressed with the effect on her grandchild's health. Based on this informal discussion, Mrs. Gondwe decided to join the project and grow soya bean and pigeon pea. Two years later, she had sufficient surplus of legumes to give to many neighbors and relatives, as well as providing healthy meals for her grandchildren. She expressed the opinion that she was responsible for the health of her grandchildren and that was her primary motivation for joining the project.

Issues of the Farmer Research Team Approach

There have been many setbacks and challenges for the Farmer Research Team during the project. There is an ongoing challenge for volunteers to visit all participating farmers. The purchase of bicycles in 2002 was meant to assist them in this endeavor, but it led to additional disputes. A participatory evaluation by the Farmer Research Team of farmers' fields in 2003 suggests that many farmers are not incorporating crop residue in a timely way, which limits the enhancement of soil fertility. Discussions with members of the Farmer Research Team and village committees indicated that a dispute over authority and power was at the heart of the problem. The Farmer Research Team and the village committees were in conflict over who was in charge, and who was responsible for what activities in the project. This conflict was particularly evident when bicycles were distributed to villages for the Farmer Research Team and village committees to use to visit participating farmers. Both groups felt that they were the primary owners of the bicycles, and the conflict led to reduced participation in the project, particularly in terms of farming the village plots. SFHC staff held several meetings about the project and discovered that both the FRT and the village committees were discouraged, despite the apparent success of the project. As the project has expanded, the requirements for these volunteers has also expanded, with limited benefits for their efforts.

Other cases of power dimensions within villages sometimes made the FRT a challenging research approach, particularly as the project rose in status within communities. In one case, Mr. Phiri was a very inactive FRT member (i.e., he did not grow any legumes) but was kept on the team, because he was related to the village headman and threatened to seize the land of other FRT members if he was removed. In another case, a village headman seized a food-insecure household's land that had improved in soil fertility over 3 years due to careful legume crop residue incorporation. In a third case, a FRT member did not like the promotion of more equal gender roles within the project, and continually threatened other female FRT members who

actively promoted ''gender'' within his village with hints of physical harm and witchcraft.

Power Dynamics within Households, Communities, and Research Teams

In 2003, after a participatory workshop and numerous farmer meetings, the research team noted the FRT workload and some of the village conflicts faced in their work. The research team tried various ways to improve the situation, including a ''Farmer Apprenticeship'' program. Each new village that joins has to elect members of the Farmer Research Team (two members, one man and one woman) who are also members of the village committee. The new Farmer Research Team members will spend 1 day working in the field of an old Farmer Research Team member who is known for his or her excellent farming practices. New FRT members will learn about their agricultural practices by working side by side in their fields. This approach will provide 1 day of free agricultural labor for the old FRT members, will provide them the prestige of a visit from someone in another village, and will be an innovative teaching method for the new FRT member. In addition, in new project villages, the FRT and Village Committee memberships have been merged to avoid disputes over authority.

In addition, the team decided to focus their efforts on improving inter- and intra-household relations that affected child nutrition by actively including men and grandmothers in nutrition education. The inclusion of older women and recognition of their power within households was a considerable innovation for the project (Aubel, 2001). The issue of control of household resources was addressed through participatory workshops and meetings with participating farmers that illustrated the issues through dramas, presentations, and small group discussions. The linkages between gender roles, agricultural production, and child nutritional status were emphasized. Discussions about gender relations indicated considerable resistance to modification of traditional gender relations, particularly from men and older women. Some men and older women perceived ''gender'' to mean that men and women had to share all tasks and were very threatened by initial project efforts to initiate change in this area. There were often heated arguments about the roles of men and women, mothers-in-law and daughters-in-law during these meetings. Nonetheless, participatory farmers now insist that changes are slowly taking place within households and communities, particularly around child feeding practices and child care. The focus on child health has somewhat neutralized the conflicts due to the cultural importance that children play; no villager would admit that children are not important enough to get beyond conflict.

These above examples illustrate that participatory approaches do not ensure equal voices for all community or household members, as other studies in participatory methods have noted (David, 1995; Guijt and Shah, 1998; Cooke and Kuthari, 2001). Involving villagers from different food-insecurity levels, marital backgrounds, and ages was helpful in raising different issues, but at times it was difficult to get beyond the power dynamics related to gender, age, and wealth within the communities.

Conclusions

The approach taken was successful at promoting legume options for resource-poor farmers, and at assessing legumes from a local perspective. The emphasis on linkages between soil improvement and child health led to increased involvement of women in the research process, and legume choices that reflected this emphasis. There are many factors, however, that prevent households from using the legumes to improve child nutrition. Agricultural production alone will not improve child nutrition, unless issues such as the household division of labor and control of resources are addressed. Thus, using an ecosystem approach to human health was useful in identifying some of the constraints in linking agricultural production to health outcomes. It should be noted that further analysis of nutritional and agronomic data has not yet been completed. Thus, the existing data does not allow us to answer yet one of the key questions of the project, that is, whether an increase in food production associated with legumes results in better nutrition and health status for children. Building on the knowledge generated by the first phase of the project, a second phase aims at addressing this question in full.

Participatory approaches which took into account power dimensions within households and communities were critical in motivating farmers to utilize the legumes to improve child nutrition. The Farmer Research Team proved to be successful in disseminating knowledge about improvement of soil fertility, food security and health. Villagers were enthusiastic and willing to commit to long hours in order to try to solve problems of food insecurity and child malnutrition in their communities. Nonetheless,

the participatory approach used has several drawbacks, including high workload for farmers and internal village conflicts which affect the research process. The critical involvement of community members was a heavy time commitment for them, and adequate recognition of their contribution needed to be built into the project.

There are multiple implications for other participatory research projects that take an ecosystem approach. Firstly, it is clear that this type of research is time-consuming and resource-intensive, particularly for resource-poor households, and their labor costs in particular need to be taken into consideration from the beginning. Furthermore, recognition of power dimensions and conflicts within households and communities is essential if natural resource management is to be harnessed for the betterment of human health. Who is included within the research process is a critical question for determining whose concerns will be heard, but inclusion alone will not solve power issues. Actively identifying and addressing those issues in a culturally sensitive way is a necessary step. Farmer participatory research can also be influenced by village and household power dynamics which make it difficult for some community members to express different viewpoints. Solving these conflicts to improve human health will not be straightforward, but will involve negotiation and sensitive, ongoing assessment of progress. Finally, the complexity of the problem requires input from multiple disciplines, particularly the social sciences, given the critical role that household and community dynamics play in influencing health outcomes.

Résumé: À l'aide d'une démarche transdisciplinaire et participative menée auprès des agriculteurs sans ressources, le projet Sols, aliments et collectivités en santé au Malawi a pour but d'améliorer la nutrition de l'enfant. La recherche vise à savoir si les cultures légumineuses peuvent améliorer la fertilité du sol, la sécurité alimentaire et la nutrition de l'enfant. Plus de 2000 agriculteurs expérimentent présentement ces systèmes culturaux dans la région. Cet article examine les aspects sociaux qui peuvent atténuer les chances de réussite des solutions dont les agriculteurs font l'essai; il n'a cependant pas 1'ambition de traiter de façon approfondie des interactions complexes entre la fertilité du sol, la sécurité alimentaire et l'état nutritionnel des enfants. L'accent est plutôt mis sur le processus de recherche, et notamment sur les dimensions sociales et les démarches participatives qui ont influé sur le choix des légumineuses et sur l'adoption par les agriculteurs de technologies axées sur la matière organique du sol. L'équipe de recherche agricole a contribué de façon décisive à éveiller l'intérêt de la collectivité face aux changements de pratiques agricoles nécessaires pour l'amélioration de la santé des enfants, mais elle a dû relever les défis posés par les aspects politiques de la vie villageoise et la charge de travail. Le lien avec la nutrition de l'enfant a été la raison prépondérante qui a incité à une adoption accrue des légumineuses, et les rapports entre hommes et femmes ont joué un rôle clé à cet égard. Une meilleure compréhension des limites inhérentes aux démarches participatives a aidé à la mise au point d'innovations qui peuvent être reprises ailleurs, par exemple la participation des grands-mères et un programme d'apprentissage agricole.

Mots clés: légumineuses, sécurité alimentaire, recherche participative, fertilité du sol, nutrition de l'enfant

Resumen: El proyecto llamado Suelos, Alimento y Comunidades Saludables en Malawi ha adoptado un enfoque interdisciplinario y participativo para mejorar la nutritión de los niños en un ńrea de escasos recursos agrícolas. La investigación se planteó la siguiente interrogante general: Se pueden mejorar la fertilidad de suelo, la seguridad alimentaria y la nutrición infantil mediante sistemas de leguminosas? Actualmente mńs de 2000 granjeros estńn probando estos sistemas en la región. Si bien este artículo examina los factores sociales que mitigan el éxito potencial de las opciones de leguminosas que prueban los agricultores, no intenta analizar en profundidad la compleja red de interacciones entre fertilidad del suelo, seguridad alimentaria y estado nutricional de los niños. Mńs bien se centra en el proceso de investigación y, específicamente, en la dimensión social y los procesos participativos que incidieron en la adopción, por parte de los campesinos, de las tecnologías de materia orgńnica y las opciones de leguminosas. El equipo de investigación de granjeros tuvo un papel centrar en movilizar el interés de los pobladores y propiciar cambios en las prńcticas agrícolas con el fin de mejorar la salud infantil. Sin embargo, tuvo que enfrentar desafíos relacionados con asuntos políticos locales y carga de trabajo. Una razón fundamental en la adopción de leguminosas fue su asociación con la nutrición infantil y, en este sentido, la relación entre los géneros tuvo un papel significativo. Una mayor comprensión de los límites de los enfoques participativos contribuyó a desarrollar innovaciones que se pueden replicar en otras partes. Por ejemplo, la participación de las abuelas y un programa de aprendizaje para agricultores.

Palabras clave: leguminosas, seguridad alimentaria, investigación participativa, fertilidad del suelo, nutrición infantil

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