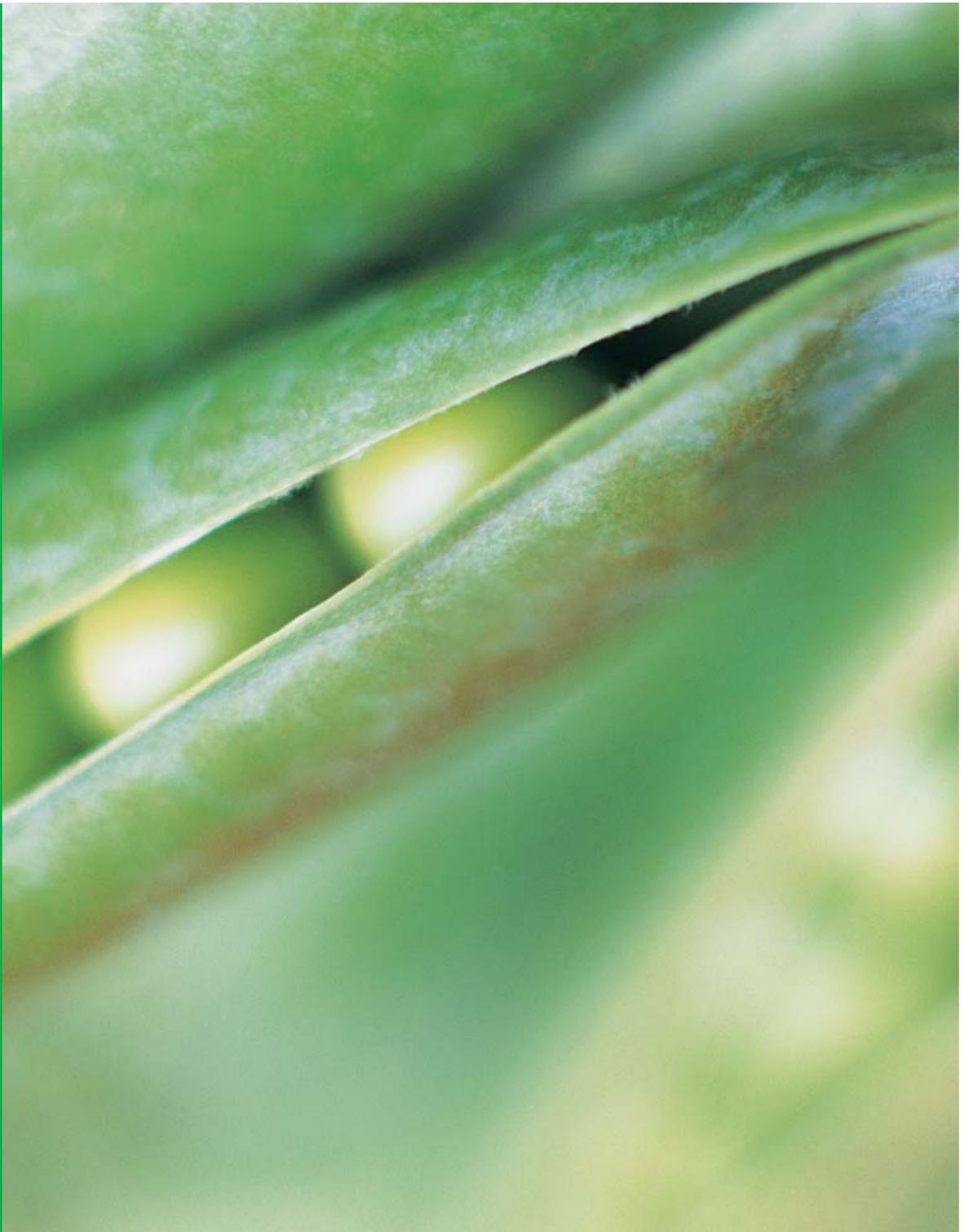


FARMER PERSPECTIVES ON THE USEFULNESS OF TECHNOLOGIES INTRODUCED BY ON-FARM RESEARCH

THE CASE OF THE TARP II - SUA PROGRAMME

BY FRED H. JOHNSEN, DISMAS L. MWASEBA, FELISTER M. MOMBO

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ACRONYMS AND ABBREVIATIONS

IDS	Institute of Development Studies at the University of Sussex, UK.
MAFS	Ministry of Agriculture and Food Security (Tanzania)
NLH	Agricultural University of Norway (the former name of UMB)
Norad	Norwegian Agency for Development Cooperation
Noragric	Department of International Environment and Development Studies, UMB
ROR	Rate of Return
SUA	Sokoine University of Agriculture
TARPII	Tanzania Agricultural Research Project Phase II
TARPII-SUA	The programme within TARPII that was managed by SUA (this programme is also known as ‘Food Security and Household Income for Smallholder Farmers: Applied Research with Emphasis on Women’
UMB	Norwegian University of Life Sciences
URT	United Republic of Tanzania

EXECUTIVE SUMMARY

Introduction

The research programme ‘Food Security and Household Income for smallholder farmers: applied research with emphasis on women’ (TARPII-SUA) was carried out from September 2000 to June 2005. The programme was organised under the umbrella of Tanzania Agricultural Research Project Phase II (TARPII) and was managed by Sokoine University of Agriculture (SUA), thus the acronym TARPII-SUA. TARPII-SUA included 34 research projects, of which 32 introduced technologies on-farm.

The objectives of the present study were firstly to find evidence to what extent farmers still use the technologies that were introduced during the TARPII-SUA program and secondly to identify the farmers’ reasons for adopting or rejecting the technologies. Thirdly, based on the farmers’ assessments, some success factors for on-farm research are suggested. Fourthly, suggestions are made for further research on the TARPII-SUA projects.

Key concepts

While all the research projects addressed in this study were *on-farm*, none of the projects could be *farmer-led* given the way the TARPII-SUA programme was organised, with researchers submitting pre-proposals and proposals which were screened and approved by other researchers and then implemented by project leaders from SUA and agricultural research stations operating under the National Agricultural Research System (NARS). The projects could however to some extent be *participatory*, and the degree of farmer participation may have varied considerably from project to project.

Adoption is seen as a complex process, where farmers may fully adopt or completely reject introduced technologies, or they may use the introduced technologies only on parts of their farms, use the technologies only from time to time, use only some elements of a technology package, or use the technologies in a modified form. While adoption in the present study is mainly used to describe contact farmers’ use of introduced technologies, the concept of *diffusion* is used for the process whereby farmers in the target village or neighbouring villages who are not contact farmers under the project take up the technology by seeing and learning from the contact farmers.

The approach to *impact assessment* in the present study has its focus on effectiveness, i.e. to what extent the project activities have contributed to increased household income, improved food security, improved nutrition and reduced workload for women, which were the development goals identified by the project. Several other aspects that would have been relevant to a project evaluation are not touched by this study.

Methodology

The study was made in a selection of villages in the Eastern Zone and Southern Highlands Zone of Tanzania that were project sites under TARPII-SUA.

Interviews were done with those project leaders from the TARPII-SUA projects that could easily be accessed. Based on the interviews, 10 projects were selected for fieldwork and within each of these 10 projects field studies were done both in the village with highest adoption and the village with lowest adoption according to the project leader’s expectations. Thus, the total number of study villages was 20.

Each of the 20 study villages was addressed during a one-day field visit. The activities of each field visit included a key informant interview with the Village Chairperson, Village Secretary or Village Extensionist, a group interview with villagers who were contact farmers under the TARPII-SUA project, and direct observation of use and impacts of the introduced technologies.

Findings from the villages

A project on *commercialisation of cassava root* involved the introduction of improved cassava varieties and processing of cassava chips and cassava flour for human consumption as well as for animal fodder. In one village the technology was adopted by a majority of the farmers within the village as well as by farmers in four neighbouring villages. Unfortunately, large-scale farmers and business people discovered the profit potential and started to cultivate and process cassava at a large scale, thereby destroying the market for the smallholder farmers. In the other village, cassava processing was abandoned because cassava yields were reduced due to drought, there was no easy access to markets due to the long distance to the nearest town, and farmers stated that they benefited more by concentrating on vegetable cultivation rather than cassava processing.

A project on *rainwater harvesting* concentrated on domestic water supply in one of the study villages and on irrigation in the other. In both cases, the physical structures had not been well maintained after the end of the project period. No diffusion of the technologies beyond the contact farmers was reported.

The key innovative element in the *chicken diseases* project was the use of a locally developed vaccine against Newcastle disease. This vaccine was well adopted during the project period, but it has never been made available after the end of the project, therefore no sustained adoption of this technology was possible.

The project on the management of *witch weed (Striga spp)* involved striga tolerant varieties of maize, intercropping maize with leguminous crops, manure application and recommended spacing. Most of the elements of the package have been adopted and are still used by contact farmers as well as other farmers in one project village and two neighbouring villages. Adoption of manure use was however low due to high labour demand. In the other study village, the adoption was low because: firstly, due to drought during the experiments there was not a convincing yield improvement from recommended management; secondly, the villagers chose to rely on fallowing to manage striga; thirdly, the men generally prioritised charcoal burning and left crop production to the women who could not easily cope with the labour demand of the introduced management practices without any help from the men.

The project on *sweet potato germ plasm maintenance and evaluation* involved introduction and on-farm testing of improved varieties of sweet potatoes together with improved management techniques. In one of the villages, one of the tested varieties was widely adopted by contact farmers as well as by the majority of other farmers in the village and in at least four neighbouring villages. Improved crop husbandry was also well taken up. After the project, the majority of the farmers shifted to another improved variety which was not introduced by the project but which the farmers assessed to be more drought resistant. In the other study village, most farmers discontinued cultivating sweet potatoes completely, apparently due to poor rains and a poor market for sweet potatoes.

The project on *milk collection, processing and marketing* involved training in skills like animal feeding, animal breeding, milking, heat treatment of milk, cleaning of utensils, quality control, and cheese production. In one project village the technologies were practiced with great success by contact farmers, but there was no substantial diffusion to other farmers, apparently due to high investments needed. In the other study village, milk processing appeared to have ceased, apparently due to limited supply of milk because other actors in the market paid higher producer prices than the milk processing group could offer.

The *farmer organisations* project provided training in organisational skills like writing constitutions, business plans and project proposals, management of projects, and record keeping. Several groups were formed in both study villages, but few of them were still active at the time of the survey. It seems that farmers expected to access credit through their training in writing business plans and project proposals, and, when they failed to get loans, they were discouraged from participation in the groups. In spite of that, some few groups appeared to do well and to have benefited from training in agronomic practices.

The project on *ticks and tick-borne diseases* focused particularly on early diagnosis and early treatment of East Coast Fever that causes high mortality rates of calves. In both villages, farmers acknowledged the benefits of the training in early diagnosis. Sustained adoption and diffusion of the recommended treatment was however very limited due to the fact that the recommended drug is expensive.

The project on *sequential cropping systems* involved the introduction of early-maturing varieties of rice in order to be able to grow an additional crop utilising the residual moisture in the same growing season. In one study village the technologies were introduced to ten contact farmers, but are now practiced by most of those farmers in the village who have land that is suitable for the technology as well as by several farmers in two neighbouring villages. In the other study village the technologies are also still practiced by all the contact farmers, but there is less diffusion to other farmers, apparently because of farmers' preference for the taste of the traditional variety of rice.

Within the *common bean varieties* project most of the contact farmers had abandoned the introduced varieties. The use of associated inputs, particularly fertiliser and pesticides, was also very low. Low use of fertiliser and pesticides was associated with high costs of these inputs, while the main complaint about the introduced varieties was that they did not have the preferred taste.

Lessons learned and conclusions drawn from farmers' response

The extent of sustained adoption of TARPII-SUA technologies varies widely. At one extreme, there are cases where technologies have been completely rejected by all contact farmers. On the other hand, we find cases where technologies are practiced full scale by contact farmers and have been taken up by many other farmers in the village as well as in neighbouring villages.

The main reasons that farmers give for adoption of introduced technologies are substantial improvements of income and food security, as expected in the project objectives. The reasons for rejecting technologies are much more diverse and include failure of the technologies to produce tangible benefits under unfavourable weather conditions (drought), technologies not being accessible to farmers, technologies not matching the farmers' priorities, introduced varieties not having the attributes that farmers prefer, expectations not being fulfilled,

required inputs being too expensive, outputs not being marketable at attractive prices, and too high workload associated with the technologies.

Based on the findings in this study, the following success factors are suggested: a convincing improvement in household income and/or food security; considerable benefits even when the weather conditions are unfavourable; easy access to the technology for farmers; the technology should respond to farmers' priorities; any introduced variety should have the attributes that farmers prefer; the project should not raise unrealistic expectations; the inputs needed to practice the technology should be affordable to farmers; the outputs of the activity should be readily marketable at attractive prices; any increase in farmers' workload should be justified by benefits that are large enough to make the effort worthwhile; real farmer participation in project identification and planning; long term involvement in farm development beyond the normal duration of a project; and active involvement of local institutions as well as good leadership of groups that implement on-farm research collectively.

Two fields of further research on the TARP II-SUA programme are suggested. Firstly, it is suggested that a study of the TARP II-SUA projects that could not be addressed in the current study is carried out with the same methodology. Secondly, a more in-depth study of success villages and the neighbouring villages where technologies have spread to, is suggested.

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1. INTRODUCTION

1.1. BACKGROUND

Green revolution technologies comprising high-yielding varieties, fertilizer and pesticide use, irrigation and improved crop management practices have been adopted by smallholder farmers in many third world countries over the past four decades. According to the advocates of the green revolution, 'yield-increasing technologies is a plus-plus solution, since it can increase food production and farmer incomes, while reducing the cost of food to consumers and improving diets, i.e. it can result in economic growth and poverty reduction simultaneously' (Borlaug and Dowsell 1995:128). The green revolution technologies have however proved unsuitable in large parts of Africa due to environmental constraints and limited availability of land with high potential for monocropping (Holden and Shanmugaratnam 1995: 247-248). Thus, generally speaking, Sub-Saharan Africa lags behind the rest of the third world in terms of agricultural productivity as well as in terms of rural poverty reduction. One key argument in the debate around the limited progress in African agriculture is that conventional agricultural research, including green revolution technology development, has failed to understand the priorities of smallholder farmers, and thereby recommended technologies that are unsuitable or mismatch the priorities of the farmers. One of the remedies that has been proposed in order to make the research more relevant to these farmers is to turn from on-station research (i.e. research conducted in experimental plots within research stations and agricultural learning institutions) to on-farm research (i.e. research conducted in the fields of the farmers).

In line with this thinking, the research programme 'Food Security and Household Income for smallholder farmers: applied research with emphasis on women' (TARPII-SUA) was carried out from September 2000 to June 2005. The programme's overall goal was 'Improved food security and household income for smallholder farmers with emphasis on women in the Eastern and Southern Highlands Zones of Tanzania (Kinabo et al. 2004:6). TARPII-SUA was implemented as a collaborative programme between Sokoine University of Agriculture (SUA) and the Ministry of Agriculture and Food Security (MAFS) in Tanzania with technical inputs from the Norwegian University of Life Sciences (UMB), formerly known as the Agricultural University of Norway (NLH). The programme was organised under the umbrella of the Tanzania Agricultural Research Project Phase II (TARPII) and was managed by Sokoine University of Agriculture (SUA), thus the acronym TARPII-SUA. TARPII-SUA included 34 research projects, out of which 32 had on-farm activities. Funding was provided by the Government of Norway.

1.2. JUSTIFICATION

Impact assessments were done during the implementation of the project in order to identify the effects of the project on the farm households (Nchimbi-Msolla et al. 2004, 2005). Those assessments were however limited to the effects that could be observed at the end of the five-year project period. Only a few years after the field activities were completed, it is considered possible to identify any lasting and sustainable impacts of the technologies that were introduced to farmers during the programme period. The present study does not aim at evaluating TARPII-SUA or any of its projects, but rather to explore success-factors of on-farm research. The large number and high diversity of projects as well as villages where on-

farm research was conducted makes TARPPII-SUA an excellent learning ground for exploring such factors.

1.3. OBJECTIVES

The farmers who have tried the introduced technologies for some time are considered to be the best judges of whether or not the introduced technologies are useful to them. If they found that the technologies were useful under their conditions, we assumed that they were still using them after the material and technical support had ceased. On the other hand, if the farmers have stopped using the introduced technologies, it must be taken as a strong indication that the technologies were not suitable for them. The objectives of the study are therefore firstly to find evidence to what extent farmers still use the technologies that were introduced to them during the TARPPII-SUA programme, and secondly to identify the farmers' reasons for adopting or rejecting the technologies. Thirdly, based on the farmers' assessments, some success factors for on-farm research will be suggested. Fourthly, suggestions will be made for further research on the TARPPII-SUA projects.

2. KEY CONCEPTS

2.1. ON-FARM RESEARCH, PARTICIPATORY RESEARCH AND FARMER-LED RESEARCH

In the context of this study on-farm research means research that is conducted on the farmers' land, animals or other resources as opposed to research conducted in laboratories, research stations or within the premises of higher learning institutions. Thus, on-farm research is hardly possible without any participation by the farmer; at the very least the farmer must have agreed that the research can be done on his or her farm. That does however not necessarily mean that all on-farm research is fully participatory. This view is in line with Martin and Sherington (1997:197), who express 'concern over the trend for 'participatory' to be used to describe any approach which involves contact with farmers and technology users at any stage of research'.

One way of characterising the degree of participation is to distinguish between contract, consultative, collaborative and collegiate research. As pointed out by Martin and Sherington (1997:204) researchers' data requirements predominate in contract and consultative research, while farmers' criteria and assessments predominate in collegiate research. Collaborative research 'faces the greatest problem in trying to satisfy both researchers' and farmers' criteria'.

Haug (1999:268-269) discusses participation in the context of extension, but the viewpoints seem equally relevant for on-farm research. To overcome the apparent ambiguities about 'who is supposed to participate in whose activities as well as who is in control and who takes the initiative' in participatory activities, Haug suggests using the concept 'farmer-led'. 'In farmer-led extension, agents should participate in farmer-defined activities, farmers being the primary actors.'

From the brief discussion above, there is no doubt that all the research projects addressed in this study were on-farm, as they all tested technologies in farmers' fields, on farmers' animals or otherwise at the farm sites. On the other hand, it is equally clear that none of the projects could be farmer-led. Farmer-led projects are hardly possible given the way the TARP-II-SUA programme was organised, with researchers submitting pre-proposals and proposals which were screened by other researchers before projects were approved by a steering committee with mostly researchers as members and then implemented by project leaders who were researchers from SUA or from agricultural research stations under MAFS.

The aspect that is still open for discussion is to what extent the projects were participatory. Clearly, the degree of farmer participation may have varied considerably from project to project.

2.2. ADOPTION AND DIFFUSION OF TECHNOLOGIES

In conventional extension theory, farmers will either adopt or reject the technologies that are presented to them. This dichotomy of adoption or rejection has however proved too simple. Firstly, it is not always clear whether a farmer should be characterised as an adopter or a rejecter, as pointed out by Mwaseba *et al.* (2006:269): 'What about farmers who discontinue an innovation for a season for lack of money, but intend to use it when they get some?' Secondly, as observed by Feder *et al.* (1984), farmers who are exposed to a technology package with components that complement each other may adopt some of the components independently. That means a farmer may be an adopter of some elements and a rejecter of other elements of the introduced technology.

The practical consequence of the discussion around the concept of adoption for this study has been to address the farmers' experiences with the introduced technologies in a broad way rather than making a simple head count of adopters and rejecters. Broadly speaking, all the contact farmers adopted the technologies during the project period, at least on parts of their farm. At the time of the present study, which was conducted a few years after the project activities stopped, some farmers have either totally adopted or totally rejected the technologies. But there are several possibilities between the two extremes, like using the technologies only on parts of their farms, using the technologies only from time to time, using only some elements of the technology package, or using the technologies in a modified form. The largely qualitative approach taken in this research will capture such variations.

The concept of diffusion belongs logically to the diffusion of innovation model that 'sees change as a linear process in which innovations generated by agricultural research are passed down to farmers through extension agencies' (Mwaseba *et al.* 2006:264). In the present study, however, we will use the concept of diffusion in the context of farmers in the target village or neighbouring villages who are not contact farmers under the project, but who have taken up the technology by seeing and learning from the contact farmers.

2.3. IMPACT ASSESSMENT OF AGRICULTURAL RESEARCH

International agricultural research has for a long period of time faced reduced funding from governments and increased criticism from some scholars who claim that the green revolution, and thereby the research that produced the green revolution technologies, has done more

harm than good (e.g. Shiva 1991). Thus, a need emerged to show that agricultural research was beneficial to the society and that investments in agricultural research were attractive. To meet this need applied impact assessment studies have been emphasised by international agricultural research organisations (Morris *et al.* 2003).

Impact assessment can be defined as a special form of evaluation that deals with the intended and unintended effects of the project output on the target beneficiaries (Anandajayasekaram *et al.*, 1996). Its focus goes beyond the products of research (e.g. seed variety, fertilizer rate recommendation etc.) to determine the effects of adoption of its products. In other words, adoption of the products of research is a prerequisite for attaining research impact. Assessment of such impacts is done using effectiveness and efficiency analyses. In effectiveness analysis the logical framework can be used as a reference to determine the extent to which the project goals have been achieved. Thus a comparison is made between research targets and actual or observed performance (achievement). Efficiency analysis assesses the people level impact by comparing the benefits to society from agricultural research with costs incurred in technology development and transfer. These benefits and costs are normally collapsed into a single number, the rate of return (ROR).

Concern has, however, been expressed that the estimated ROR to research investments may be biased upward (Arnon, 1989; Anandajayasekaram *et al.*, 1996). Even those who believe that agricultural research is a good investment for society may be sceptical about some of the very high estimates of rates of return to research (Alston and Pardey, 2001). Exaggerated rates of return are attributed to various reasons. Pingali, for example, notes that these high rates of return are partly biased by the fact that in general only success stories are incorporated in rate of return studies (Pingali, 2001: 4). But the most serious problem behind such high returns is the attribution problem (Alston and Pardey, 2001), that is, yield increases that are attributed to research alone may in fact be attributable to several other factors.

Moreover, although the rate of return is the most commonly used measure of the economic profitability of agricultural research investment, it does not normally capture other impacts of agricultural research such as improvements in the status of women within the household, improvements in the environment, sustainability of agricultural production, and improvements in income distribution.

The approach to impact assessment in the present study will focus on effectiveness, i.e. to what extent the project activities have contributed to increased household income, improved food security, improved nutrition and reduced workload for women, which were the development goals identified by the project. Several other aspects that would have been relevant to a project evaluation, like whether project activities have been implemented according to project plans, or the scientific output of the project in terms of scholarly publications in recognised journals are beyond the scope of this study.

3. METHODOLOGY

3.1. STUDY AREA

The United Republic of Tanzania is an East African country bordering Kenya and Uganda in the North; Rwanda, Burundi and the Democratic Republic of Congo in the West; Zambia, Malawi and Mozambique in the South; and the Indian Ocean in the East. The mainland covers about 881,000 km² while Zanzibar covers about 2,000 km² and lakes cover another 62,000 km². The population was estimated at 33 million in 2002, and 46% of the population is under 15 years of age. The political capital of Tanzania is Dodoma, while Dar-es-Salaam is the commercial capital (URT 2006).

Agriculture is the backbone of the Tanzanian economy. Apart from accounting for about half of the income and three-quarters of merchandise export, agriculture is also the main source of employment to about 80% of the population. Tanzanian agriculture is dominated by smallholder farmers with typical farm sizes ranging from 0.9 to 3.0 ha (URT 2006). The agricultural sector maintained a growth rate around 3% during the 1990s, which is only slightly more than the annual population growth. An agricultural growth rate of at least 5% is considered necessary for rural poverty reduction to become a reality (URT 2001).

Tanzania is divided into seven agro-ecological zones: these are the Lake, Southern Highlands, Northern-, Eastern-, Southern-, Central-, and Western Zones, all with their own agricultural research centres under the Ministry of Agriculture and Food Security (MAFS) (Shao 1994). TARPII-SUA was confined to the Eastern Zone and the Southern Highlands Zone.

The TARPII-SUA programme had field activities in a total of 125 villages within the two agro-ecological zones. The complete list of these villages by district and project is given by Nchimbi-Msolla *et al.* (2004, Appendix 2).

3.2. SELECTION OF PROJECTS AND VILLAGES

The TARPII-SUA programme had a total of 34 projects, of which 32 introduced technologies on-farm. All the project leaders who could be accessed were interviewed using a checklist (see Appendix 2.1). The project leaders were asked about their perceptions on the project's impacts, and whether they had any knowledge to what extent the farmers still practised the introduced technologies and how they benefited from those technologies. The project leaders were also asked to mention the villages where they would expect to find the highest and lowest adoption rates and to specify the reasons for their expectations as well as the causes of expected differences in adoption rates.

Based on the interviews with the project leaders the projects were divided into three categories:

- (1) Projects where the project leader was not interviewed (8 projects specified in Appendix 3.1).
- (2) Projects where the project leader was interviewed, but which were not selected for the field study (16 projects specified in Appendix 3.2).
- (3) Projects that were selected for the field study (10 projects specified in Appendix 3.3).

The decision on which 10 projects to select for data collection out of these 26 where the project leader was interviewed was taken jointly in a project team meeting. Among those not selected were projects where the project leader did not expect any substantial adoption or could not identify any specific village as having a higher or lower expected adoption rate than others. Also, projects where the project activities had continued under another programme in the same project areas after the end of the TARPII-SUA programme were not selected. When leaving out these, however, 19 projects still remained while the study had to be confined to 10 projects due to resource constraints. The final selection therefore had to be based on the research team's assessment of where the most interesting observations could be made.

For the 10 projects that were selected, fieldwork was done both in the village with the highest adoption and the village with the lowest adoption according to the project leader's expectation. Thus, the total number of study villages was 20.

3.3. FIELD WORK IN STUDY VILLAGES

In each of the 20 selected villages, the following activities were undertaken during a one-day visit by the study team:

- (1) Key informant interview with the Village Chairperson, Village Secretary or Village Extensionist, using a check list (see Appendix 2.2).
- (2) Group interview with villagers who were contact farmers in one of the TARPII-SUA projects, using another check list (see Appendix 2.3).
- (3) Direct observation of use and impacts of the introduced technologies

4. FINDINGS FROM THE VILLAGES

The present chapter is a synthesis of the findings presented by the villages in Appendix 1 of this report.

4.1. COMMERCIALISATION OF CASSAVA ROOT (PROJECT 010)

The project involved the introduction of improved cassava varieties and processing of cassava chips and cassava flour for human consumption as well as for sale as animal feed. In Zogowale village the technology was adopted by a majority of the farmers within the village as well as by farmers in four neighbouring villages. During the first years after introduction farmers made substantial incomes from the technology. It was unfortunate for the contact farmers of the project, however, that large scale farmers and business people discovered the profit potential and started to cultivate and process cassava on a large scale. This has largely destroyed the market for the smallholder farmers. There is however still a substantial production of cassava flour among the farmers, mostly for own household consumption. The project has thereby resulted in improved food security, while the impact on household income is not as much as one would expect from the very promising results in the early stages of the project.

In Miswe the processing was practiced during the first year after its introduction, but then abandoned for several reasons: Cassava yields were reduced due to drought, there was no easy access to markets due to the long distance to the nearest town, and farmers stated that they benefited more by concentrating their efforts on vegetable cultivation rather than cassava processing. Thus, currently there is no cassava processing undertaken by contact farmers, other farmers in the village, or in neighbouring villages. On the other hand, improved cassava varieties that were introduced by the project are still being cultivated in the village. Since the key element of the project was abandoned in Miswe, there is also no visible impact on livelihoods.

4.2. RAINWATER HARVESTING (PROJECT 012)

In Isimike, three groups had been formed to practice rainwater harvesting for domestic water supply. Contact farmers explained that the main impact was in terms of less time spent by women to fetch water; therefore the women could take part more actively in crop production. Unfortunately, the physical structures for rainwater harvesting that were constructed during the project period were not well maintained. There was no sign of any diffusion of the technologies to other individuals or groups within the village. The village had received visitors from other villages who had come to see and learn, but it could not be established whether any of the visitors had adopted the technology. The contact farmers attributed the apparent lack of spread of the technology to the high expenses of the technology.

The water harvesting group in Wanging'ombe comprised 18 members who had participated in the construction of a dam for supplementary irrigation, mainly for maize. Irrigation resulted in substantial yield improvements. Unfortunately, only few of the members were able to benefit from it because the dam had been silted and some of the structures had almost broken down. The technology had not expanded to other farmers within the village. According to the group members the reason for lack of spread of the technology was the high costs involved. Similar technologies were seen in neighbouring villages, but since these technologies were promoted through other projects, it could not be established whether any adoption in neighbouring villages could be attributed to diffusion from Wanging'ombe.

4.3. CHICKEN DISEASES (PROJECT 015)

The key innovative element in this project was the use of a locally developed vaccine based on *Aloe vera* against Newcastle disease, but the project also involved building improved houses for poultry and applying improved animal husbandry. In Lungo village the vaccine was adopted, but some chickens died after vaccination, probably due to overdosing and wrong timing. The disease was controlled almost 100% and as a result of lower mortality the number of chickens increased resulting in increased income and improved food security. More than half of the villagers adopted the local vaccine and some farmers in a neighbouring village also adopted it. Unfortunately, no farmers continued using the local vaccine after the end of the project because it is not available and the Government has reportedly not permitted release of the vaccine for distribution to farmers. The majority of farmers in Lungo do, however, use available commercial vaccines and benefit from training on improved housing and husbandry for chickens.

The story in Lusanga village is quite similar to Lungo. Some farmers adopted the local vaccine, but the death of chickens due to wrong use of the vaccine seemed to have been even more severe in Lusanga. The adoption rate within the village was not very high and it seems that the requirement of constructing improved chicken housing was a constraint to adoption, particularly for women. Those who adopted it experienced an increased number of chickens, and thereby increased income and improved food security. Some few farmers in three neighbouring villages also adopted the vaccine. But, as in Lungo, no single farmer in Lusanga uses the local vaccine today due to its unavailability. Many farmers do, however, use commercial vaccine and they have benefited from training in improved poultry husbandry and improved poultry housing.

4.4. MANAGEMENT OF WITCH WEED (*STRIGA SPP*) (PROJECT 018)

Control measures against witch weed (striga) comprising striga tolerant varieties of maize, intercropping maize with leguminous crops, manure application and recommended spacing were tried in the fields of 10 farmers in Mhinduro village. Most of the contact farmers as well as a high proportion of other farmers in the village still use one of the striga tolerant varieties of maize as well as recommended spacing and intercropping with legumes. However, most farmers in the village did not continue to practice manure application. The technologies are known to have spread to three neighbouring villages. The new cultivation techniques resulted in increased yields of maize, thereby increased income and food security. Availability of legumes also improved food security and nutrition. The new technologies did however imply increased labour demand and were therefore hard to adopt by female single adult households.

In Melela village, the outcome was different from Mhinduro. Five farmers participated in on-farm trials, but apart from the trials the introduced management techniques were rejected by the contact farmers and also not adopted by other farmers in the village or in neighbouring villages. Some few farmers did however continue to cultivate the introduced varieties. Since there was no significant adoption of project interventions, there was also no measurable improvement in any livelihood aspect. Three main reasons for the rejection of the technologies came up during the interviews. Firstly, due to drought during the experiments there was not a convincing yield improvement in the plots with recommended management compared to other plots. Secondly, the villagers relied on fallowing to manage striga and seemed to be confident with that strategy. Thirdly, the men in Melela generally prioritised charcoal burning and left crop production to the women who could not easily cope with the labour demand of the introduced management practices without any help from the men.

4.5. SWEET POTATO GERM PLASM MAINTENANCE AND EVALUATION (PROJECT 021)

The project involved introduction and on-farm testing of improved varieties of sweet potatoes together with introduction of improved management techniques. In Pangani village, seven varieties were tested, out of which three were chosen, and one of them (Ukerewe) was widely adopted by contact farmers as well as the majority of other farmers in the village and by farmers in at least four neighbouring villages. Introduction of improved varieties together with improved crop husbandry has improved the yields, incomes and food security of the farm households. At present, however, the majority of the farmers have shifted from 'Ukerewe' to another improved variety known as 'Zanzibar' which was not introduced by the

project. The reason for this shift is that 'Zanzibar' according to the farmers' experience is more drought resistant.

In Kongo village the new varieties were also well received and adopted by contact farmers as well as by most other farmers within the village and some farmers in the neighbouring village Matimbwa. Large yield improvements were experienced which also resulted in increased income and food security. Later, however, most of the farmers discontinued cultivating sweet potatoes completely, apparently due to poor rains and a poor market for sweet potatoes. Those who still cultivate sweet potatoes, however, use the varieties that were introduced by the project. Moreover, it is reported that the neighbouring village Matimbwa has adopted the project interventions more than the target village Kongo.

4.6. MILK COLLECTION, PROCESSING AND MARKETING (PROJECT 027)

The project involved training in skills like animal feeding, animal breeding, milking, heat treatment of milk, cleaning of utensils, quality control, and cheese production. In Vwawa village, annual milk collection had increased from 98,000 litres in 2001 to more than 240,000 litres in 2005, and was expected to pass 350,000 litres in 2007. The project utilised a dairy farmers group that had been established some time before the project started, and which had 69 members at the time of the survey. While two farmers in the village had started milk processing using a similar technology, no diffusion of the technology to neighbouring villages could be established. The contrast between the apparent success within the group and the lack of diffusion beyond the group could be explained by the investment required to process the milk to sufficient standards for the market. The success of the group can however also be explained by its good leadership.

The experience in Pomerin village was quite different from Vwama. In Pomerin, milk processing had been undertaken only for a short period of time during 2006 while no processing had yet been done in 2007 at the time of the survey. The number of group members was 18 when the project wound up, but had later dropped to 14. The lack of success was attributed to the limited supply of milk, which again appeared to be caused by other actors in the milk market who paid higher producer prices than the milk processing group in Pomerin could offer.

4.7. FARMER ORGANISATIONS (PROJECT 028)

The project provided training in organisational skills like writing constitutions, business plans and project proposals, management of projects, and record keeping. Several organisations were formed in Lusanga village, comprising hundreds of members in total, but only two organisations with about 16 members still existed at the time of the survey. Reasons given for dropping out include lack of capital and land, poor weather and lack of credit. The two existing organisations have however succeeded to raise substantial cash and yields were reported to have increased following training in the farmer groups, thus improving income and food security. Farmers from three neighbouring villages have sought training assistance from farmers in Lusanga.

The observations made in Sonjo village are in several ways similar to Lusanga. Existing informal farmer groups were trained and formalised while also new groups were formed in

the village. Moreover, farmers from two neighbouring villages have been seeking assistance from farmers in Sonjo on group formation. In spite of the training in formulating business plans the organisations in Sonjo have unfortunately not succeeded to access credit from formal credit institutions, thus, most of the farmers have become discouraged and withdrew from the organisations. On the other hand, they acknowledge that training in agronomic practices through the groups has been helpful in raising paddy yields.

4.8. TICKS AND TICK-BORN DISEASES (PROJECT 030)

The project on ticks and tick-borne diseases focused particularly on early diagnosis and early treatment for East Coast Fever, which caused high mortality rates of calves. Farmers were trained in the causes of the disease and in early diagnosis. When they found that calves were ill, they reported to the village extension officer who would notify SUA researchers who came to treat the calves. In Wami-Sokoine village the contact farmers adopted the treatment during the project period, but the diffusion to other farmers was very limited. No diffusion to other villages was recorded. Also, the contact farmers did not continue using the recommended treatment at the recommended dose after the project period, apparently because the treatment was too expensive. The contact farmers did however acknowledge that the recommended treatment was effective in reducing calf mortality and they also appreciated the knowledge that the project had brought them, particularly in the early diagnosis of East Coast Fever.

In Melela village, the four livestock keepers who were selected as contact farmers continue to use the recommended treatment. They reported that the treatment was effective in reducing calf mortality and thereby increased their herds, which again improved their income and food security, particularly the access to animal protein. Only very few other farmers in the village have tried the recommended drugs, due to high costs. Also, no diffusion to neighbouring villages was reported.

4.9. SEQUENTIAL CROPPING SYSTEMS (PROJECT 032)

This project involves the introduction of early-maturing varieties of rice in order to be able to grow an additional crop utilising the residual moisture in the same growing season. Ten contact farmers, of whom seven were women, were selected in Hembeti village. The technology is now practiced by about a third of the households in the village, which means that most of the farmers who have land that is suitable for the technology practice it. The practice has also spread to several farmers in two neighbouring villages. Farmers report that the introduced technology has resulted in increased yield and income, improved food security, and improved ability to cope with household needs like school fees and housing. The technology involves increased workload, but the farmers find the effort worthwhile.

In Ulaya Mbuyuni village there were also ten contact farmers, all of them women. These ten farmers still practiced the technology at the time of the survey, but less diffusion to other farmers in the village and to neighbouring villages was reported in Ulaya Mbuyuni than in Hembeti (12 farmers in Ulaya Mbuyuni and 9 farmers in neighbouring villages). Resistance against adoption seemed to be rooted in the preference for the taste of the traditional variety of rice. Those who adopted, however, reported increased yields and income as well as improved food security. The gender impact is particularly noteworthy; since rice is

traditionally a woman's crop in the area, women also control the money derived from selling any yield of rice that exceeds the household's food needs.

4.10. COMMON BEAN VARIETIES (PROJECT 043)

A group of 9 farmers was established for trying out improved bean varieties in Igodivaha village. This group increased to 23 members during the time of project implementation, but at the time of this study the group had shrank to 5 members. These five members still used the improved varieties. The use of fertilizer and pesticides, which is considered important to achieve good yields of the improved varieties, was however very limited due to the high costs of these inputs. Also, the area planted with improved bean varieties by the five remaining group members was too small to have any livelihood impact. Seeds had been distributed to five farmers in the village outside the group, but no diffusion to neighbouring villages was reported.

In Utelewe village the project had 30 contact farmers, but only five members turned up for the group interview. And only two of those five planted improved beans in 2006 and 2007. Their main complaint about the new varieties was that contrary to the traditional varieties, they do not have the preferred taste and therefore are less marketable than the traditional varieties. Since the adoption was minimal, no impact on livelihoods was reported. The group members did however acknowledge that they had received improved seeds and knowledge in improved methods of bean production. Seeds had been distributed to two villagers outside the group, but no diffusion to neighbouring villages could be established.

5. LESSONS LEARNED FROM FARMERS' RESPONSE

As outlined in section 1.3, this study had four objectives:

- To find evidence to what extent farmers still use the technologies which were introduced during the TARP-II-SUA programme.
- To identify the farmers' reasons for adopting or rejecting the technologies.
- To suggest some success factors for on-farm research based on the farmers' responses.
- To suggest further research on the TARP-II-SUA projects.

In this chapter, the four above-mentioned items are discussed based on the results presented in Chapter 4 and Annex 1.

5.1. EVIDENCE OF CONTINUED USE OF TECHNOLOGIES

The extent to which technologies were still in use two to three years after project activities came to an end varies substantially between projects and sometimes also between the two researched villages within the same project. At one extreme is the sequential cropping systems project (032) and particularly Hembeti, where the introduced technology is not only practiced by contact farmers, but also by the majority of the other farmers in the village who have suitable land for the technology, and even by a large number of farmers in two

neighbouring villages. At the other extreme we find the vaccine promoted by the project on chicken diseases (project 015) where sustained adoption was not possible since the vaccine is not available and had not even been released.

The observations made in this study also underscore the complexity of adoption. The cassava project (010) was very well adopted and the technology can even be said to be too successful since in the next stage commercial interests saw the profit earning potential and out-competed the contact farmers. The rainwater harvesting project (016) was clearly adopted and farmers benefited from it. In spite of that, the sustainability is under threat, since the structures are not well maintained. In the project on chicken diseases (015) farmers adopted well and would probably still have used the technology if it had been made available to them. The witch weed project (018) as well as the common bean project (043) showed substantial adoption of the introduced varieties, at least in Mhinduro and Igodivaha villages, respectively, but very little adoption of the management techniques that were supposed to accompany the improved varieties. Introduced sweet potato varieties (022) were immediately well adopted by farmers in Pangani, but shortly after, those farmers shifted again to a variety that was not promoted by the project. Farmers in Wami-Sokoine (project 030) have adopted the practice of early diagnosis of East Coast Fever, but do not use the recommended drug at the recommended rate. From this complexity, it would be very difficult, and hardly meaningful, to separate farmers into adopters and non-adopters. What we have observed, however, is that the projects show high variability when it comes to adoption and sustained use of the introduced technologies.

For the reasons explained above, this study does not attempt to express a percentage of sustained adopters. In spite of that, the picture when it comes to adoption in this study, is so mixed that it contrasts the finding by Nchimbi-Msolla *et al.* (2005: 288) where 97.3% of interviewed TARP-II-SUA contact farmers said they would continue using the introduced technologies. There are two apparent reasons for the differences between the two studies. Firstly, data for Nchimbi-Msolla (*op.cit.*) were collected in March and April 2005 while the fieldwork for the present study was done in July – October 2007. Farmers may have been optimistic about their ability to continue using introduced technologies immediately after the end of the project activities, but during more than two years without project support they may have faced constraints that they didn't expect. Secondly, in the questionnaire survey that was made in 2005, farmers may have said whatever they expected the interviewers wanted to hear.

5.2. REASONS FOR ADOPTING OR REJECTING THE TECHNOLOGIES

This study shows that farmers' reasons for adopting technologies introduced by TARP-II-SUA were very much in line with the TARP-II-SUA objectives of increased household income and improved food security. These two dimensions seem to be much interlinked, which is not surprising, both because farmers produce the same products for sale and for household consumption, and because increased income is sometimes used for supplementary food purchase. Positive effects on both household income and food security were mentioned in several villages, including Zogowale (commercialisation of cassava root, project 010), Mhinduro (management of witch weed, project 018), Vwawa (milk collection, processing and marketing, project 027) and Hembeti (project 032, sequential cropping systems).

Additional project objectives were a reduced workload for women and improved nutrition. These perspectives were not in the forefront of the farmers' response, but certainly increased consumption of vegetables in the case of sequential cropping systems (project 032) and increased consumption of beans in the case of common bean varieties (project 043) must have improved the nutritional quality of the diet. The reduced workload for women was mentioned in relation to water harvesting whereby women were relieved from the burden of walking long distances to fetch water (project 012).

The reasons for lack of sustained adoption and lack of spread of technologies are much more diverse and complex. In some cases limited success may be explained by bad luck in terms of drought in the critical phase of technology introduction. Or, one can put the argument another way saying that the technologies did not succeed because they were unable to yield benefits during drought. This seems to be the case in Miswe (commercialisation of cassava root, project 010) where processing of cassava appeared less interesting because of low cassava yields due to drought. Also in Melela (management of witch weed, project 018) the intention to demonstrate high yields with improved management techniques failed due to drought. Even in Lusanga (farmer organisations, project 028) some farmers mentioned drought as one of the reasons for dropping out of the groups.

Another obvious reason for discontinued adoption is the unavailability of the introduced technology as experienced in the case of locally developed vaccine in the chicken diseases project (project 015).

Some interventions seemed in one way or another not to fit into the farmers' priorities. That appeared to be the case for farmers in Miswe (commercialisation of cassava root, project 016) who rejected the idea of commercialisation of cassava root because they found vegetable production more beneficial. In Melela (management of witch weed, project 018) many farmers did not find the introduced technologies interesting because they were happy to rely on fallowing as striga control. Besides, they wanted to spend their time and effort on charcoal burning rather than on improved crop production. Also, farmers in Wami-Sokoine (ticks and tick-borne diseases, project 030) expressed other priorities as they would rather want a dip against ticks than vaccines against East Coast Fever.

In close connection to the issue of farmers' priorities, introduced new varieties sometimes fail to meet the farmers' preferences. This seems to be the case in Utelewe (common bean varieties, project 043) where the introduced beans according to the farmers did not have the preferred taste. Even in Ulaya Mbuyuni (sequential cropping systems, project 032) limited diffusion was explained by introduced short-maturing rice varieties not having the preferred taste. And in Pangani (sweet potato germ plasm maintenance and evaluation, project 022) most of the farmers abandoned the introduced varieties and shifted to another variety that apparently was more drought resistant.

Sometimes a project doesn't deliver what the farmers expected. In the farmer organisation project (project 028) farmers did, with or without good reason, expect to access credit through their farmer organisations. When they were not successful in their applications for loans from credit institutions, many lost their motivation for the organisation's activities.

Another reason for discontinued adoption and lack of further diffusion of introduced technologies is that inputs associated with the technologies are sometimes considered by farmers as too expensive. This was clearly the case with the project on ticks and tick-born

diseases (project 030) where farmers in both villages explained that the recommended drug was very effective, but too expensive. Also, the lack of spread of technologies in milk collection, processing and marketing (project 027) seems to be linked to the high investments needed. An additional problem in one of the project villages (Pomerin) was that the milk that was needed as the main input in the production had become too expensive due to competition from large-scale buyers. Probably, even the lack of maintenance of the rainwater harvesting structures (project 012) can be explained in terms of introduced technologies being too expensive for farmers to manage.

Some technologies did not take off due to lack of markets or farmers' products not being competitive in the markets. Farmers in Miswe (commercialisation of cassava root, project 010) expressed that there was no accessible market for their cassava-based products. In Zogowale (same project) the market was there and the project was well received, but the contact farmers were out-competed by larger scale producers in the long run. Whether anything could be done for the farmers in Zogowale to regain their market power would require a more in-depth study.

Finally, increased workload associated with introduced technologies is sometimes an obstacle. One example is Mhinduro (management of witch weed, project 018) where farmers adopted the striga tolerant varieties well, while there was very limited adoption of the practice of applying manure, which was supposed to accompany the improved varieties. Farmers explained that they didn't use manure because it involved too much labour. On the other hand, farmers in Hembeti (sequential cropping systems, project 032) adopted the new technologies very well, in spite of reporting a considerable increase in workload. That shows increased workload doesn't need to be an obstacle if the farmers experience that the benefits from the technology are high enough to make the effort worthwhile.

5.3. SUCCESS FACTORS FOR ON-FARM RESEARCH

Based on the discussion in section 5.2, the following nine attributes of an on-farm research project can be expected to increase its chances of success. In addition, some success factors that are less obvious from section 5.2 are also discussed below.

- 1) The introduced technology yields a convincing improvement in household income and/or food security
- 2) The introduced technology yields considerable benefits even when the weather conditions are unfavourable
- 3) The technology is easily accessible to farmers
- 4) The technology responds to farmers' priorities
- 5) Any introduced varieties have the attributes that farmers prefer
- 6) The project does not raise unrealistic expectations among farmers
- 7) The inputs needed to practice the technology are affordable to farmers
- 8) The outputs of the activity are readily marketable at attractive prices
- 9) Any increase in farmers' workload is justified by benefits that are large enough to make the effort worthwhile.

It appears that most of the items above, but particularly items 4 and 5, will be more easily achieved if farmers participate actively in the early stages of definition, conceptualisation and planning of the projects. Such high level of farmer participation has not been facilitated by

the TARPII-SUA institutional arrangements, which involved researchers submitting pre-proposals and proposals without any requirement or funding for involvement of farmers in these critical stages of the projects. Farmer participation can therefore be added as a tenth success factor.

During the fieldwork it turned out that some projects were based on earlier, similar projects and local institutions backing such projects so that the projects fitted into a longer term continuum of farm development activities. In Hembeti (sequential cropping systems, project 032), for example, there is a farmer training centre nearby that already existed long before the TARPII-SUA project, which assisted actively during the implementation of the project and continues training farmers in Hembeti and nearby villages after the finalisation of the project. This may be the main explanation for the higher diffusion of technologies in Hembeti compared to Ulaya Mbuyuni. Similarly, in Vwawa (milk collection, processing and marketing, project 027) the project was based in a dairy farmers group that had been established through earlier project activities and continued adoption could be observed in this group. On the other hand, the same project failed to prompt sustained adoption in Pomerin which had no similar history. Another characteristic of the dairy farmers group in Vwawa was a very competent group leadership, which contributed greatly to the sustained adoption within the group. Based on these observations, we suggest long-term involvement in farm development, active involvement of local institutions and good group leadership as additional success factors.

5.4. SUGGESTIONS FOR FURTHER RESEARCH ON THE TARPII-SUA PROJECTS

The present study explored only a fraction of the experiences that could be derived from the TARPII-SUA projects. Two fields of further research should be seriously considered.

Firstly, only 10 out of the 32 projects that had on-farm activities have been researched in this study. The selection of the projects has been based more on gut feeling than on hard facts. The selection criteria can also be questioned, e.g. the decision to leave out projects that continued field activities in the same villages under a new programme was correct from the perspective of studying sustained adoption and spontaneous diffusion of technologies, but may at the same time have disqualified the best success stories from the study. It would therefore be worthwhile to study the remaining 22 projects with the same methodology as we have used in the present study. Such an extended study will give a fairly complete picture of the adoption and spread of TARPII-SUA technologies.

Secondly, the present study has shown some few cases where introduced technologies have spread far beyond the contact farmers, like Hembeti (sequential cropping systems, project 032) and Mhinduro (management of witch weed, project 018). To gain more information on these success stories, one would need a more in-depth study of the success villages and their neighbouring villages where the technologies have spread to. This would involve interviews of a representative sample of households, using a questionnaire to get detailed information on the impacts of the technologies on household income, food security and other social parameters as well as farmer-specific, project-specific and context-specific variables that can explain adoption and diffusion of the technologies. Such a study could yield new and much deeper insights than the present study into success factors in introduction of new technologies

to farmers. Also, such a study would produce more detailed knowledge on the impacts of successful technologies at farm level.

6. CONCLUSIONS

All the projects that have been researched in this study appear to have contributed to new knowledge among researchers, and, as acknowledged by farmers through their responses, also brought knowledge to farmers. As such they may all have been worthwhile undertakings. The objectives of the TARPII-SUA project, however, were much more ambitious, promising increased household income and improved household food security for farmers, particularly women. The present study was therefore undertaken to:

- 1) find out to what extent farmers still use the technologies that were introduced to them during the TARPII-SUA programme;
- 2) identify the farmers' reasons for adopting or rejecting the technologies;
- 3) suggest some success factors for on-farm research based on the farmers' assessments;
- 4) make suggestions for further research on the TARPII-SUA projects.

The responses from the farmers showed a widely varying degree to which farmers still used the technologies that were introduced by the TARPII-SUA programme. At one extreme, we found technologies where no trace of sustained adoption could be identified. At the other extreme, we found technologies which were not only still being practiced by the contact farmers, but which had also been taken up by a large number of other farmers in the project village and in neighbouring villages.

The responses from the farmers further indicated that the main reasons for adopting technologies were increased income and improved food security, as expected from the programme objectives. The reasons for rejecting technologies turned out to be much more diverse:

- Technologies unable to yield convincing benefits under unfavourable weather conditions, specifically drought.
- Unavailability of the introduced technology.
- Technologies not matching farmers' priorities.
- Introduced varieties not meeting farmers' preferences.
- Projects not yielding according to farmers' expectations.
- Farmers considered inputs associated with the technologies too expensive.
- Lack of available markets where the farmers' products achieve attractive prices.
- Increased workload without sufficiently large benefits to make the work worthwhile.

Based mainly on the farmers' responses to reasons for adopting or rejecting technologies, the following success factors for on-farm research are suggested:

- 1) The technology yields a convincing improvement in household income and/or food security.
- 2) The introduced technology yields considerable benefits even when the weather conditions are unfavourable.
- 3) The technology is easily accessible to farmers.

- 4) The technology responds to farmers' priorities.
- 5) Any introduced varieties have the attributes that farmers prefer.
- 6) The project does not raise unrealistic expectations among farmers.
- 7) The inputs needed to practice the technology are affordable to farmers.
- 8) The outputs of the activity are readily marketable at attractive prices.
- 9) Any increase in farmers' workload is justified by benefits that are large enough to make the effort worthwhile.
- 10) Real farmer participation in project identification and planning.
- 11) Long term involvement in farm development, beyond the normal duration of a project.
- 12) Active involvement of local institutions.
- 13) Good leadership of groups that implement activities collectively.

Two fields of further research on the TARPPII-SUA programme are suggested. Firstly, only 10 out of the 32 projects that had on-farm activities have been researched in this study. Thus, it is suggested that a study of the remaining 22 projects is carried out with the same methodology as in the present study. Secondly, a more in-depth study of success villages and their neighbouring villages where technologies have spread to is suggested in order to gain new and deeper insights than the present study into success factors in the introduction of new technologies to farmers and in order to get in-depth knowledge into the impacts of these technologies at farm level.

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APPENDIX 1. DETAILED OBSERVATIONS BY PROJECT AND VILLAGE

Commercialisation of cassava root (project 010)

VILLAGE 1: Zogowale

Assumed highest adoption village

1. Village Profile

Zogowale village is located about 32 km from 'Maili moja' township in Kibaha district. It has a total of 980 households with a population of about 1860 people. Institutions in the village include two churches, one mosque, one primary school and one secondary school. The major ethnic groups in this village are Wakwere (68%) and Wazaramo (20%) and the minor ethnic groups are Wagogo, Wanyamwezi, Wachagga and Wapare.

The major food crops grown in the area include cassava (which is also grown as a cash crop), maize, millet, cowpeas and pigeon peas. Cash crops include cashew nuts, mango and citrus fruits. Poultry and goats are major livestock kept in the village. There are no forestry related activities in the village.

Non-farm livelihood sources include casual labour in cassava farms, small food stalls (mama nitilie mostly by women) and kiosks, which are mostly run by men.

2. Approach to project implementation

Farmers in the village had started growing cassava in large quantities long before the introduction of the cassava processing project. At a meeting with TARPII-SUA researchers, extension officers and sugar cane research institute staff at Kibaha, a ward extension officer informed researchers about the problems that farmers faced in terms of storage and marketing. The idea was taken up by TARPII-SUA researchers. This was followed by a meeting with farmers and the extension staff in the village. It was decided that groups of farmers would be formed in order to be assisted with processing and marketing. These groups were formed by willing farmers. They were then taken to the Sugar Research Institute to learn more on cassava processing and marketing before the project activities were implemented in their village. Farmers were taught on how to process cassava into chips for livestock feeds and were assisted to search for markets for unprocessed cassava at nearby townships.

3. Adoption and diffusion of technologies

3.1 Adoption among contact farmers

Contact farmers received the project very well and all of them adopted the technology of making chips from cassava. The chips were very marketable in nearby townships where people keep livestock. It was reported that within a very short time all cassava that was in the fields was processed into chips. In spite of this the supply was not sufficient to satisfy existing demand. Later on farmers were given a cassava flour milling machine by the Community Fund for Commodity (CFC). Also, the Tanzania Food and Nutrition Centre (TFNC) assisted farmers to make different products from cassava flour such as 'maandazi', cake and 'chapati'.

3.2 Diffusion to other farmers in the village

A majority of farmers adopted the technology of making chips in the village. They did so by borrowing a machine that belonged to farmers within a group. They also milled cassava using the milling machine given to the group by CFC and were able to make the products mentioned above. For instance, over 50% of widows in the village formed their own group and requested the village government a large piece of land to grow cassava for processing. At the time of the study 80% of farmers who adopted the technology within the village still practiced flour milling while chips making was only practiced by 20% of people. Most products are for home consumption and only occasionally farmers sell them when they get orders from consumers.

3.3 Diffusion to neighbouring villages

Farmers at Visiga, Vikuge, Maili 30 and Misufini adopted the technologies. They however depended on machines found at Zogowale village. At the time of the study the machines were out of order. Some farmers have opted for machines that are powered by electric motors.

It is worth noting that well off farmers from Kibaha Township and Dar es Salaam have taken large plots in the area and they grow cassava in large quantities, process into flour and chips and are selling competitively in Kibaha and Dar es Salaam. Farmers who participated in the project no longer enjoy the lucrative market they had before. This has been a negative incentive for them to continue growing cassava in large quantities.

4. Project impacts

The project has had several impacts to farmers in this area such as the introduction of sweet cassava varieties and knowledge of various products that can be obtained from cassava flour. Specifically, the following impacts were observed:

4.1 Household income and assets

Before the inception of the project, farmers waited for occasions like Ramadan festivals and food shortages to harvest and sell cassava from their farms. When the project started the situation changed. They harvested cassava regularly, processed it into chips and later on when flour milling technology was introduced they sold flour and other products to earn more income. Yield and therefore surplus from cassava increased because no more cassava was left to rot in the field. They earned between TZS 70-90 per kg of chips and some TZS 200-400/- per kg of flour. They earned a substantial amount of money and some stated that they were able to buy iron roofs for their houses before the business was 'hijacked' by large scale business people.

4.2 Food security and nutrition

The implementation of the project improved farmers' food security and welfare in two ways. First, the introduction of sweet cassava varieties enabled farmers to make chips and flour that was directly suitable for home consumption rather than being used only for feeding livestock; secondly, a range of cassava products that were made at household level increased the array of food choice for eating.

4.3 Gender roles and women's livelihoods

Both men and women performed all major operations and activities associated with the introduced technologies equally because they all belonged to different groups. As stated earlier, women especially widows in the village are earning a substantial income from the introduced technology. Some at individual level are managing to send packed cassava flour

for selling at 'Nane Nane' Agricultural Show in Morogoro. Thus the project has helped them improve their livelihood.

4.4 Women and men's workload

Both women and men complained that the use of the hand operated processing machine was tedious. The fact that the processing requires plenty of water for washing added another burden because water is fetched from far away in the village except during the rainy season.

4.5 Other impacts

The project created awareness on new markets for cassava and cassava products. However, on the negative side, after the entry of large scale business people from Dar es Salaam and Kibaha Township, farmers in the village no longer earn the substantial amounts they used to.

5. Other observations

The farmers requested assistance in the form of transport, further training in packaging and reliable market outlets.

VILLAGE 2: Miswe Assumed lowest adoption village

1. Village Profile

Miswe village is located 38 km from 'Maili moja' township in Kibaha district. In this village the following infrastructure is found: one primary school, one health centre, one church and one mosque. There are two Non Governmental Organisations (NGOs), namely Research on Poverty Alleviation (REPOA) and Heifer Project International (HPI) promoting dairy goat production. The Wazaramo constitutes the largest ethnic group (60%) followed by the Wakwere (20%). Other ethnic groups such as the Sukuma, Pare and Chagga constitute the remaining 20 percent.

The sources of agricultural livelihood include food crops (cassava, paddy, peas, maize and horticultural crops), cash crops (cashew nuts, paddy and horticultural crops), livestock (poultry and dairy goats) and forest activities (charcoal making). Non-farm livelihood sources include fishing, food stall and kiosks.

2. Approach to project implementation

Farmers in the village had started growing cassava in large quantities long before the introduction of the cassava processing project. At a meeting involving TARPII-SUA researchers, extension officers and Sugarcane Research Institute staff at Kibaha, a ward extension officer reported to the researchers on the problems that farmers faced in terms of storage and marketing. The idea of addressing these problems was taken up by TARPII-SUA researchers. This was followed by a meeting with farmers and the extension staff in the village. It was decided that groups of farmers would be formed in order to get assistance with processing and marketing opportunities. These farmers were then taken to the Sugarcane Research Institute to learn more on cassava processing and marketing before the implementation of the project in their village. Farmers were taught on how to process cassava into chips for livestock feeds and were assisted to search for markets for cassava at nearby townships.

3. Adoption and diffusion of technologies

The technologies introduced in this village were only practiced at the beginning of the project period but were then abandoned due to a number of reasons: The area was hit by drought which reduced cassava yield in the farmers' fields. The village is far from urban centres and thus could not attract buyers to go to the village and buy the products. Based on interviews it seemed that cassava processing was not a priority among most contact farmers in this village. Most of them stated that they preferred cultivation of vegetables along the river valley, as this was the best paying activity. They also claimed that some members in groups were dishonest.

The presence of electricity in the village could also have been a disincentive for the villagers to adopt manual cassava processing. The only technology still being practiced around homesteads is growing of cassava varieties that were introduced from other places by the project. These varieties are 'Kirby' and 'Cheapen'.

4. Project impact

Contact farmers stated that they got some income from making chips in the first year of the project implementation. In general, there is no visible impact in terms of improved income, household assets, food security and nutrition. Gender roles, women's livelihood, women and men workloads have not changed as a result of the project since most of the introduced technologies were abandoned shortly after the project inception.

Rainwater harvesting (project 012)

Village 1: Isimike

Assumed highest adoption village

1. Village profile

Isimike is located about 20 km from Makambako town. The village has a population of 1,644 divided in 397 households. Of these, 887 are women and 757 are men. The main sources of livelihoods are crop and livestock production. Maize is mainly grown for food while sunflower is cultivated for cash. Other crops grown on a small scale are cowpea, bambara nuts and beans. About 60% of the households in the village keep cattle and goats. Off-farm activities are in the form of petty trade and kiosks that cater for groceries and basic necessities of life.

There are a number of on-going projects. These projects include on-farm seed production, beekeeping and conservation projects. They are all funded by DANIDA. In terms of infrastructure, there is a primary school and 3 churches while a mosque is under construction. Interviews with some contact farmers indicated the feeling among community members that their village is isolated. This is reflected in their having benefited little in terms of development projects compared with other villages in the district.

2. Approach to project implementation

Isimike is located in a semi-arid zone. Thus the TARP II-SUA's on-farm research on water harvesting for domestic use was an attempt to address a critical community problem. More specifically, on-farm research involved the participation of farmers in construction of water harvesting structures/tanks. The project team reported to the village authorities and then presented the project at a village meeting. It was noted that in the preliminary stages of project implementation the village authorities were closely involved. The project team then

asked those interested in the project to form groups. However, drawing on their past experiences of unfulfilled promises by development agents, the majority felt the project would not materialize and thus only few individuals joined the groups. In all, a total of three groups were formed and each was involved in the construction of its tank. Later, a water harvesting structure was built at the village primary school using the rooftop as catchment for harvesting rainwater. While the project supplied funds and materials, contact farmers contributed labour in construction of the tanks. Two types of water harvesting technologies/tanks for domestic use were introduced:

- Trick tank (above ground tank with raised paved catchment)
- Sub surface tank with on-ground paved catchment

3. Adoption and diffusion of technologies

3.1. Adoption among contact farmers

Some contact farmers are benefiting more from the project than others. For example, the group that is operating the “trick tank” still has access to water during the critical dry season period. However, sometimes the group is unable to carry out minor repairs and maintenance. The other two groups operating the suspended underground tanks do not get good supply of water from the same. This is because covers of the two tanks have been destroyed by ants and for this reason the water is unsafe for domestic use.

3.2. Diffusion to other farmers in the village

Use of the water harvesting technology for domestic use is only limited to contact farmers. There was no evidence indicating the adoption of the same by neither individual farmers nor other groups of farmers. Interviews with contact farmers indicated that the main reason behind this is that its adoption is expensive.

3.3. Diffusion to neighbouring villages

Besides being told that the village has been receiving visitors from both neighbouring and distant villages to “see and learn” about rainwater harvesting, it could not be established whether the visitors had actually adopted the technology on returning home.

4. Project impacts

4.1. Household income and assets / Food security and nutrition

As far as this project is concerned, its impact on household income and assets (4.1) and food security and nutrition (4.2) is indirect. Thus access to water for domestic use within short distances would reduce time spent in searching water. The time thus saved would allow family members, especially women who are traditionally responsible for fetching water, to participate in preparing the fields for crop cultivation. This is an operation, which is normally done just before the onset of rains. Indeed, interviews with contact farmers testified that the benefit of the technology is that it has enabled women to participate in farm activities with other household members including their husbands.

4.2. Gender roles and women’s livelihoods

In families where group members are close and have access to water using the technology both men and women fetch it. In this way women are relieved from the heavy workload and thus are able to perform other productive activities.

4.3. Women's and men's workload

The project has been beneficial especially to women who are traditionally responsible for fetching water. Thus availability of water nearby has greatly reduced the women's workload during the dry season when water is in short supply.

4.4. Other impacts

Group interviews indicated that the village is receiving visitors from nearby villages and outside the district. These come to "learn from them" about water harvesting.

VILLAGE 2: Wanging'ombe Assumed lowest adoption village

1. Village profile

The village is located some 20 km from Makambako, the nearest town, on the Mbeya-Iringa road. The Wahehe and Wabena form the main ethnic groups in the village. There are 539 households with a combined population of 1,575. Of these 713 and 862 are men and women respectively. Livelihood activities are mainly centered on agriculture involving crop and livestock production. Crop production involves maize mainly for subsistence. Other crops such as sunflower, bambara nuts and groundnut are produced for cash income. Less than a quarter of the households in the village keep livestock – mainly cattle. These households keep cattle for draft animal power, manure and milk. Off-farm activities are largely limited to petty trading.

There are some projects that are being implemented in the village. They include a dairy goat project and a pasture improvement project. The infrastructure includes 2 primary schools, 1 secondary school, 1 health centre, 6 churches and 3 mosques. There is also a Wildlife Department field station.

2. Approach to project implementation

On-farm research carried out in the village focused on two technologies for crop production, namely water harvesting and draft animal power (DAP). Implementation involved the participation of two groups of contact farmers – one for water harvesting and another for DAP. At the time the project came to an end the "DAP" group had 14 members while the membership of the "water harvesting" group was 18.

Selection of contact farmers was done after the project team had interacted with the village authorities. Some of the contact farmers were selected because they volunteered to participate in the project. Others joined some time later after observing the benefits of joining the groups. Yet still the project team approached others to participate.

The "DAP" group members were supplied with some equipment/tools: ridger, ripper, plough, cultivator and tie-ridger. The working equipments were bought by the project and currently are "owned" by the group and hired out for a fee of TZS 5,000 per equipment. Members of the "water harvesting" group participated in the construction of an irrigation dam. On completion members used the harvested water for supplementary irrigation of their fields, planted mainly with maize. Each of these members had a minimum of one acre.

3. Adoption and diffusion of technologies

3.1. Adoption among contact farmers

All members of the two contact groups are practicing technologies that were introduced by the project – draft animal power and water harvesting. They all indicated that the technologies were useful for them. However, the “water harvesting” group indicated that only few of them are getting water from the dam because of siltation. Moreover, direct observation indicated that the structures are almost breaking down. On the other hand, most members of the “DAP” group used only some of the equipment and especially the cultivator. The main reason for the rather high usage of the cultivator is that it helps with weeding, which is a critical and labour demanding activity.

Contact farmers indicated that they had realized increased maize yields as a result of adoption of the DAP technology. In particular, the yield increase from 3 bags – 10 bags of maize per acre is attributed to the ability to use the DAP technology.

3.2. Diffusion to other farmers in the village

Water harvesting for crop production has not expanded beyond the group. While appreciating its usefulness, members of the group observed that it was too expensive. Experiences with the DAP technology showed that it is widely used by other farmers in the village. As with contact farmers, besides the plough, the cultivator is widely used. Also it was found that while some farmers picked the technology from contact farmers (the “DAP” group) others picked it from farmers in neighbouring villages, particularly Mayale and Utiga who are using a similar technology.

3.3. Diffusion to neighbouring villages

The DAP technology has spread to neighbouring villages. However, considering that similar technology was being promoted in other villages, its diffusion cannot be solely attributed to efforts by the project implemented in Wanging’ombe.

4. Project impacts

4.1. Household income and assets

Yield increases have resulted in increased household income, which has largely translated in the ability of some farmers to build good houses. Other farmers have used income to buy cultivators and more land besides paying school fees.

4.2. Food security and nutrition

Increased maize yields (from about 3 bags to 10 bags per acre) as a result of increased ability to weed the fields, have contributed to food being readily available at household level.

4.3. Gender roles and women’s livelihoods

Following the introduction of the DAP technology men are also involved in weeding the fields. Traditionally weeding maize fields has largely been the responsibility of women and children. The sharing of roles as a result of using the technology has helped improve the health status of women following the reduction of drudgery associated with the use of manual labour in farming.

4.4. Women and men’s workload

Weeding is the most critical operation in farming in the village. This is traditionally the responsibility of women and young children. Following the introduction of DAP, and especially the cultivator, women have been relieved from this backbreaking activity. The use

of cultivator has greatly reduced the workload of women in weeding crop fields, especially maize. In general, contact farmers were unanimous that the introduction of the technology had substantially lessened women's labour in weeding.

4.5. Other impacts

As a result of increased incomes parents are able to send their children to school. They are also able to buy clothes for family members. Besides, the time saved from farm activities as a result of using the DAP technology is spent on other activities such as gardening.

Chicken diseases (project 015)

VILLAGE 1: Lungo

Assumed highest adoption village

1. Village profile

Lungo village is located 8 km from Madizini sub-town in Mvomero district. It consists of 225 households. The institutions found in the village include one primary school, one health centre, and two churches. There are also various projects found in the area such as SURUDE, Heifer Project International, and TARPII-SUA projects. The major ethnic group is the Pare (70%) while the minor ethnic groups include the Chagga (20%), the Zigua (5%) and the Fipa, the Nyamwezi and the Gogo account for around 5 percent of the village population. Sources of agricultural livelihoods include food crops such as maize, paddy, and cassava. Yet sugarcane, sunflower and vegetables are grown as cash crops. Livestock kept in the village include cattle, goats, pigs and poultry. Forest livelihoods include lumbering and firewood activities from the nearby teak plantation.

The sources of livelihoods include selling crops, auctioning and casual labour in sugarcane and teak estates. Formal employment in education and health sectors provide livelihoods to some few members of the community.

2. Approach to project implementation

The project leader introduced the project idea in the village. The extension officer was asked to pick contact farmers among known innovators who kept poultry. They were asked to form groups. A meeting was convened after which four farmers were chosen to participate in the project.

The project activities included building improved housing units for poultry, husbandry techniques, blood sample collection for identification of Newcastle infested birds, growing and formulation of Aloe Vera to be used as a vaccine and vaccination practices using commercial and Aloe Vera local vaccine extract.

3. Adoption and diffusion of technologies

3.1. Adoption and diffusion among contact farmers

Contact farmers accepted and adopted the use of local vaccine extract brought by the project. However some contact farmers complained that the practice of using local vaccine extract was not effective without the use of commercial vaccines. Some experienced deaths of chicken after vaccination. But this was the result of failure to follow instructions like size of dosage and timing. They also attested that they were not informed about the results of blood

samples, which were taken from their birds. They also said that in subsequent tests the disease was almost 100 percent controlled.

After the project ended none of the contact farmers continued to use the local vaccine extract because it is not available in the village. It was reported that the vaccine had not yet been permitted by the Government to be released to farmers. Instead, most poultry keepers continue using available commercial vaccines.

3.2. Adoption and diffusion to other farmers in the village

More than 50%, mostly women, adopted the use of the local vaccine. However, they also stopped using it after the project ended for reasons given above.

3.3. Diffusion to neighbouring villages

Only a few farmers (around 10% women and men) at Kidudwe tried the vaccine during the project life.

4. Project impacts

4.1. Household income and assets

Contact farmers reported a decrease in poultry mortality rate. They reported an increase in the number of chickens and additional income from sales of chicken and eggs. They reported to earn an average of TZS 100,000 in each household that kept chickens. The income helped them to pay school fees and items for their children.

4.2. Food security and nutrition

The increased number of birds assured them the availability of relish and nutrients from slaughtered chicken and eggs.

4.3. Gender roles and women's livelihoods

No apparent gender influences were reported to have been attributed to the implementation of this project. However, women farmers who participated in the project reported that there were improvements in their livelihoods as they could earn substantial income from sales of chicken and eggs.

4.4. Women and men's workload

The requirements to construct improved poultry houses were a burden for women, as they did not own much assets/capital compared to men in the village. However, it was mostly women who adopted the technology.

4.5. Other impacts

Training in good poultry husbandry greatly improved knowledge among farmers in the village.

VILLAGE 2: Lusanga

Assumed lowest adoption village

1. Village profile

Lusanga village is located 5 km from Madizini sub-town in Mvomero district. It consists of 960 households with a population of 7,120 people. The institutions found in the village include one primary school, one secondary school, one health centre, four churches and three mosques. There are also various projects found in the area such as the teak plantation, Heifer

Project International, DAIPESA and PADEP. The major ethnic groups include the Wazigua (40%), Wanguu (30%) and others like Wasukuma, Wachagga, Wapare and Wafipa constitute the remaining 30 percent of the population. Sources of agricultural livelihoods include food crops such as maize, paddy, banana and cassava. Sugarcane is grown as a cash crop. Livestock kept in the village include cattle, goats, pigs and poultry. Forest livelihoods include lumbering and firewood activities.

The off-farm sources of livelihood include carpentry, fishing, auctioning and casual labour in sugarcane and teak estates. Some few members earn their livelihoods through formal employment in the education and health sectors.

2. Approach to project implementation

The project leader introduced the project idea in the village. The extension officer was asked to pick contact farmers among known innovators who kept poultry and belonged to existing farmer organisations. The project activities included building improved housing units for poultry, husbandry techniques and vaccination practices using commercial and local vaccine extract.

3. Adoption and diffusion of technologies

3.1. Adoption among contact farmers

Contact farmers accepted and adopted the use of a local vaccine extract brought by the project. However some contact farmers complained that they initially lost almost all the birds under the experiment. This is because they vaccinated when the Newcastle disease had already infected the birds. In subsequent experimental batches the mortality of birds was highly reduced.

After the project ended none of the contact farmers continued to use the local vaccine extract because it is not available in the village. We were also told that the vaccine had not yet been permitted by the government to be released to farmers. Thus most poultry keepers continue using available commercial releases.

3.2. Diffusion to other farmers in the village

Some women and men who were able to construct improved housing units copied and adopted the use of local vaccine. However they also stopped using it after the project ended for reasons given above.

3.3. Diffusion to neighbouring villages

Some few farmers at Kidudwe, Diyongoya and Madizini tried the vaccine during the project life.

4. Project impacts

4.1. Household income and assets

Contact farmers reported a decrease in poultry mortality rate. The increased number of chickens earned them additional income from the sale of chicken and eggs. The income helped them to pay school fees and items for their children. Improved poultry units were assets for subsequent flocks after the project ended.

4.2. Food security and nutrition

The increased number of birds assured them the availability of relish and nutrients from slaughtered chicken and eggs.

4.3. Gender roles and women's livelihoods

No apparent gender influences were reported to have been attributed to the implementation of this project. However, women farmers who participated in this project reported that there were improvements in their livelihoods as they could earn substantial income from sales of chicken and eggs.

4.4. Women and men's workload

The requirement to construct improved poultry houses was a burden for women as they did not own much assets/capital compared to men in the village. As a result, the extent of adoption was higher among men than among women.

4.5. Other impacts

Training in good poultry husbandry had improved knowledge among farmers in the village.

5. Other observations

In general, there were many projects in this village and these seemed to confuse participants because new projects do not continue with activities of already established projects. Instead, they embark on completely new activities.

Management of witch weed (*Striga* spp) (project 018)

VILLAGE 1: Mhinduro

Assumed highest adoption village

1. Village Profile

Mhinduro is located some 30 km northeast of Muheza district headquarters in Tanga region. The village consists of 325 households. The institutions found in the village included the following: one primary school, one health centre, four churches and one mosque. There is a sisal estate and a factory nearby.

The major ethnic group in the village is the Wasambaa (75%) followed by the Bondei (20%), while the Ngoni and the Makonde constitute the remaining five percent of the inhabitants.

The major agricultural activities from which the villagers earn their livelihoods include growing food crops, mainly maize and cassava, and cash crops (banana, coconut, cashew nut and oranges). The major livestock kept by farmers in this village included poultry, cattle, pigs and goats. Forestry activities such as tree planting began only recently. The sources of non-farm livelihoods include petty business such as kiosks, milling machines, restaurants, formal employment in teaching and health services and casual labour in the sisal estate and factory nearby.

2. Approach to Project Implementation

The problem formulation and the village identification were jointly done by TARP-II-SUA researchers, district agricultural officers and the village extension officer in a meeting at the district agricultural office. It was already known by the district office and village extension

officer that the maize fields in the village were heavily infested by witch weed (striga) to the extent that maize yield in the area was very poor. Farmers used to harvest at most three bags of maize in their plots. Using PRA technique, TARPPII-SUA researchers and the village extension officer convinced farmers to form a group and only 10 farmers did so. They then convened a series of meetings and training to farmers in the group on the effects of striga to maize and other cereals, and appropriate control measures to eradicate the weed infestation.

The tasks in the field consisted of laying experimental plots with control measures (intercropping maize varieties-Staha and Kinzani with cowpeas or beans, green grams and wild sunflower at appropriate spacing and with the application of manure) versus plots without control measures. They evaluated the results in a participatory way. Results revealed that it was possible to raise crop yield by using these intervention measures.

3. Adoption and diffusion of technologies

3.1. Adoption among contact farmers

All the contact farmers in the group adopted and received the technology very well, particularly in the use of the Staha maize variety in combination with legumes. The Kinzani maize variety was not widely adopted because it is not high yielding even though it was resistant to striga infestation. Moreover, it was not readily available during the sowing season. After the project ended most contact farmers did not continue with some agronomic practices like the use of manure in their plots. They claimed that the technology package as a whole was expensive, as it needed extra labour to make plots and carry manure to the fields. Despite this, 25% of the women and 100% of the men still continue to practice intercropping maize with legumes at correct intra-row and inter-row spacing.

3.2. Diffusion to other farmers in the village

Almost 40% of other farmers in the village adopted the new maize seed variety (Staha) and continue to grow it to date. Other agronomic practices such as intercropping maize with legumes at a proper intra-row and inter-row spacing are widely being applied by the majority of farmers within the village. By contrast, the use of manure was not adopted by many farmers in the village.

3.3. Diffusion to neighbouring villages

Neighbouring villages such as Bamba and Churwa adopted manure application and intercropping maize with legumes at proper spacing. At Kauzeni village nearly 50% of farmers in their association adopted the new techniques. They requested a big plot from the village government and are now producing large quantities of maize. It was reported that the technology was obtained from consultation with contact farmers in the Striga project at Mhinduro village.

4. Project Impacts

4.1. Household income and assets

Farmers testified that as a result of the introduction of proper control of striga, they were able to raise maize yield in their plots from three bags to 6-8 bags. Out of 6-8 bags, they were able to sell half of the produce and earn some income. For example, farmers who sell four bags of maize at a market price of TZS 12,000/- per bag earn up to 48,000/- TZS per season. They were also able to sell some legumes harvested from intercropped plots. At the moment other agents introduced new maize seed varieties (DK 51, 53 and TMV1) which are relatively high yielding compared to the Staha variety. Capitalising on the knowledge that they had acquired

from the striga project, farmers in Mhinduro and neighbouring villages adopted the new seed varieties very easily and are now able to earn substantial income from maize growing.

4.2. Food security and nutrition

Farmers reported a positive contribution of the project to household food security and nutrition. Improved maize yield ensured availability of food throughout the year and a diversity of crops (cereal and legumes) gave them means to be able to eat meals with an assurance of getting protein, fats, vitamins, minerals and carbohydrates.

4.3. Gender roles and women's livelihoods

The project had no influence on gender roles between different groups of people in the village because two groups were separated on gender lines (between female and male). Thus each group performed similar tasks to manage the plots. Women's livelihoods improved as whatever was sold after harvest was solely owned by group members, i.e. whatever income the women group earned belonged to them. Similarly, whatever was earned by men belonged to men.

4.4. Women's and men's workload

The majority of contact farmers said that the new technology was intensive and expensive because it needed a large labour force to make plots, carry manure and intercrop crops. This was particularly so for women because during the interview single women confessed that it was difficult for them to continue making plots and manure application in their fields.

4.5. Other impacts

The project has been able to impart knowledge and understanding on what a striga weed is all about, its bad effects to maize (and other cereals) and cultural control measures. It has helped eliminate a widely held traditional belief among farmers that low yields were the result of the maize being stolen by neighbouring farmers. Moreover, farmers had realised the importance of using improved practices in their farm operations in order to raise crop yield. It is therefore no wonder that they were asking for agricultural inputs that are readily available and affordable.

VILLAGE 2: Melela

Assumed lowest adoption village

1. Village profile

Melela village is located 35 km from Morogoro municipality. It has 1,600 households, four primary schools, two secondary schools, one health centre, six churches and two mosques. Other key institutions in this village include the Melela bustani (bustani is a Kiswahili word for garden) and World Vision that promote agricultural extension services in the area. The main ethnic groups in the village are the Waluguru (70%) and Maasai (26%), while other ethnic groups like the Wakinga account for 4% of the population.

The food crops from which farmers earn livelihoods include maize and sorghum while simsim, sunflower and vegetables are grown as cash crops. Livestock kept in this village include cattle, goats, poultry, sheep and pigs. Charcoal making is a major forest business among men in this village. Non-farm livelihood sources include carpet making, basketry weaving, kiosks and food stalls, local brewing, and casual labour in mining. Also, a small number of the inhabitants earn livelihoods from teaching and health professions.

2. Approach to project implementation

The problem of striga infestation in the area was known earlier among TARPII-SUA researchers and the ward extension officer. It was already known by the district office and village extension officer that the maize fields in the village were heavily infested by witch weed (striga) to the extent that maize yield was very poor. The ward extension officer was asked to pick five farmers (3 men and 2 women) to participate in on-farm trials using the new technologies for control of striga.

The tasks in the field consisted of laying experimental plots with control measures (intercropping maize varieties-Staha and Kito with cowpeas or beans, pigeon peas and wild sunflower at appropriate spacing and with the application of inorganic fertilisers) versus plots without control measures. The farmers evaluated the results in a participatory way. Results revealed that it was possible to raise crop yield by using these intervention measures.

3. Adoption and diffusion of technologies

3.1. Adoption among contact farmers

Initially all the five contact farmers in the group adopted and received the technology very well, particularly on the use of the Staha maize variety in combination with legumes. However, they soon abandoned the technology because of a number of problems. First, they had known striga weed well before the implementation of the project and had devised their own control strategy that involved leaving fallow the heavily infested fields. They normally shift to valleys where fields are not heavily infested. Therefore, when the project staff brought free seeds and fertilisers for trials they were diverted to striga free land instead of striga infested fields. Moreover, given their culture women perform most of the farm operations. Men are mainly engaged in charcoal making and mining. On the use of fertilisers, farmers found and had experienced that they were expensive. Thus none could continue using them after free supplies came to an end. Many would buy a few kilos and apply it onto vegetable crops along the valley. A series of droughts that followed immediately after the project had started discouraged farmers to continue with the technology as they could not see significant improvements on trials that were already in place. Thus, during the time of interview only a few contact farmers stated that they continue growing Staha maize variety. All the other technologies had been abandoned.

3.2. Diffusion to other farmers in the village

The technologies were not taken up by other farmers in the village since they could not see positive performance from colleagues who joined the project. Most continue to use fallow and shifting cultivation as strategies for striga control.

3.3. Diffusion to neighbouring villages

No neighbouring villages adopted the new technologies.

4. Project impacts

4.1. Household income and assets

There were no visible impacts because the technologies were abandoned very early after the inception of the project.

4.2. Food security and nutrition

Some contact farmers reported that they harvested some peas intercropped with maize. This could contribute to the diet as a protein source.

4.3 Gender roles and women's livelihoods

In this area men are mainly engaged with charcoal making and mining activities while women perform most farm operations. For men there was a redefinition in terms of their roles because they are not engaged in farm operations. Men who joined the project were therefore required to go to farm. There was no impact on women's livelihoods.

4.4. Women and men's workload

Workload for both women and men increased because of increased farm operations like laying plots, fertiliser application and intercropping, which they were not used to before.

4.5. Other impacts

The use of legumes and inorganic fertilisers in the trials seemed to have resulted in some form of improvement in soil fertility.

Sweet potato germ plasm maintenance and evaluation (project 021)

VILLAGE 1: Pangani

Assumed highest adoption village

1. Village profile

This village is located 5 km from Maili moja town in Kibaha district headquarters. There are 200 households with a population of 917 people. The institutions found in the village include one primary school, one secondary school, three churches and one mosque. Wasukuma constitute the largest ethnic group (60%) in the village. Other ethnic groups include the Wazaramo, the Waluguru, the Wamakonde, the Wangoni and the Wamatumbi.

The sources of agricultural livelihood in the village include food crops such as cassava, maize, and sweet potato; cash crops such as cashew nuts, simsim and groundnuts are grown; livestock kept include cattle, goats, and poultry while forestry activities involve mainly charcoal making.

Non-farm livelihood sources included formal employment in teaching and health profession and casual labour in cassava fields and in cattle rearing.

2. Approach to project implementation

The village was known to grow sweet potato before the project was implemented there. Through a meeting that was held between SUA researchers and the extension service at the Kibaha sugarcane research institute, a ward extension officer recommended that the project be implemented in Pangani village. This was based on his prior knowledge that farmers in the village were hard working compared to farmers from other villages that grow sweet potatoes.

The idea was taken up by TARPII-SUA researchers. This was followed by a meeting with farmers and the extension staff in the village. It was decided that groups of farmers be formed and participate in a trial of new technologies of sweet potato production. Willing farmers formed groups. They were later taken to the Sugar Research Institute to learn more about sweet potato production before project implementation in their village. Seven sweet potato varieties were introduced from other places for on-farm testing against local varieties. After

testing, three varieties were chosen. These were ‘Simama’, ‘Ukerewe’, and ‘Jitihada’. Also the use of improved ridges was introduced to contact farmers.

3. Adoption and diffusion of technologies

3.1 Adoption among contact farmers

All contact farmers in the two groups adopted the three new sweet potato varieties. However, the ‘Ukerewe’ variety was the most widely adopted because it is high yielding, sweet in taste and fetched high prices on the market. At the time of the study, it was still being grown, though in small quantities for the following reasons: it is susceptible to pest attacks especially when it is not harvested early, the area has become prone to frequent droughts in recent years, and there is a new variety known as ‘Zanzibar’ which has all good attributes of the ‘Ukerewe’ variety and in addition it is more drought resistant. Thus, many farmers are turning away from ‘Ukerewe’ to ‘Zanzibar’.

3.2 Diffusion to other farmers in the village

Almost 80 percent of other farmers in the village had abandoned the local varieties and went for the introduced varieties. Of these 70 percent were women. This is because men are largely involved in charcoal making. Many continue to grow ‘Ukerewe’ in small proportions while slowly turning to the more popular ‘Zanzibar’.

3.3 Diffusion to neighbouring villages

The technology had spread to neighbouring farmers at Maili moja, Kidimu, Machinjioni and Lulanzi villages. Farmers in these areas have been sourcing sweet potato planting materials from Pangani after they realised the good sweet potato quality they used to buy from there.

4. Project impact

4.1 Household income and assets

Contact farmers stated that the new sweet potato variety improved their earnings by over 60 percent, particularly in years when weather was good. For instance, they used to earn between 20,000/= and 30,000/= Tanzanian shillings per plot before the new technologies had been introduced. After the project intervention they were able to earn over 50,000/= Tanzanian shillings per plot especially when they grew ‘Ukerewe’ variety. They stated that the income earned was used to support payments of school fees for their children and buying some household items. The income was however not enough to buy other assets. In most cases these are bought using money earned from charcoal making.

4.2 Food security and nutrition

Improved yield increased food security at the household level as families were able to eat three meals (breakfast as bites, lunch and dinner as main meals). Indeed, women stated that sweet potato had become the main dish and that it was consumed from morning till evening especially by children.

4.3 Gender roles and women’s livelihoods

In this village women are mostly involved in farm production operations whereas men are mainly involved in charcoal making. Women stated that because of the improved income status in their households, they were able to afford buying household items like utensils, which is normally not considered the men’s responsibility.

4.4 Women’s and men’s workload

For women this project brought a relief because earnings they got helped them to buy water for domestic use from vendors. Formerly they used to fetch water from far during the dry season.

4.5 Other impacts

Realization of the need to use improved inputs and agronomic principles in production is an added impact. For example, farmers had realised the need to grow okra along the valleys and farms after harvesting sweet potato in order to raise more income from farm operations.

5. Other observations

More benefits could have been achieved if farmers could be trained on storage techniques to increase the shelf life for the harvested potatoes. Also, impacts could be increased further if the use of manure in the ridges was fully emphasised to farmers such as in other sweet potato projects.

VILLAGE 2: Kongo

Assumed lowest adoption village

1. Village Profile

The village is located 15 km from Bagamoyo district headquarters and 85 km from Dar es Salaam city centre. It consists of 270 households and a population of 1,760 people. The institutions found in the village include one primary school, two health centres, three churches, four mosques, Dar es Salaam Water and Sewerage Authority (DAWASA), Mzizima Sugarcane Farm and Heifer Project International promoting dairy cattle production and marketing.

The major agricultural activities from which people earn livelihoods include the production of food crops such as cassava, sweet potato, and paddy, as well as cash crops such as cashew nut, mango and coconut. Livestock included dairy cattle, goats, and poultry.

Non-farm livelihood sources include earnings from casual labour at DAWASA and Mzizima Sugarcane Farm, food stalls and kiosks, as well as formal employment in the school and health centres.

2. Approach to project implementation

Kongo village was well known to grow sweet potato before the project was implemented. Through a meeting that was held between SUA researchers and the extension service at the Kibaha-based Sugarcane Research Institute, the ward extension officer from Bagamoyo recommended Kongo village to participate in the project. He had prior knowledge that farmers in that village were hard working compared to farmers from other villages that grow sweet potato.

TARPII-SUA researchers brought new sweet potato varieties and processing machines. Farmers who were selected to participate in the project were supplied with the new sweet varieties and tested them on farm together with researchers. The varieties were evaluated and three varieties were very well received by farmers due to their good yield, taste and

marketability. Of the three, a variety known as ‘Ukerewe’ or ‘Mkalakala’ was the best in many aspects.

3. Adoption and diffusion of technologies

3.1 Adoption among contact farmers

The technology, particularly cultivation of small, compact and simple ridges and use of the three new sweet potato varieties was adopted by almost all contact farmers. The new varieties were marketable, sweet and high yielding. The technology of using ridges was simple except that farmers were required to incorporate manure in the ridges. However, almost 50% of contact farmers had stopped growing sweet potato due to a number of reasons including a series of three years of poor rains, poor markets, and negligence to follow extension advice. For example, when they do not use manure in the ridges they do not get good yield and give up using the technologies. Lack of knowledge on how to preserve the crop was also a disincentive to continue cultivating the crop.

3.2 Diffusion to other farmers within the village

Most women and men adopted the technology but due to reasons stated above, most gave up. The only sweet potatoes still grown by some few farmers are ‘Ukerewe’ or ‘Mkalakala’.

3.3 Diffusion to neighbouring villages

It was reported that over 10% of farmers living in a nearby village (Matimbwa) adopted the technology of growing the high yielding ‘Ukerewe’ variety. After learning from Kongo village that the variety was acceptable in many aspects they approached the project leader to supply them with planting materials of this variety. They are, at the moment, producing the crop more than in Pangani village.

4. Project impact

4.1 Household income and assets

The project has had a positive impact in terms of household income and assets. Farmers reported that when they used to grow local sweet potato varieties and unimproved ridges they used to get up to 12 bags (locally called ‘viroba’) per acre per season. A 50 kg bag at that time was sold for 10,000 Tanzanian shillings at the farm gate. With use of new technologies, they were able to harvest up to 35 bags per acre per season. Thus they improved both income and yield.

4.2 Food security and nutrition

With improved yield farmers had been able to satisfy their daily food requirements except during seasons when weather was bad. Increased income means farmers got purchasing power to buy a variety of other food items to improve nutrition.

4.3 Gender roles and women’s workload

There are no apparent effects on differentiation of roles along gender lines because both women and men participated and performed activities equally.

4.4 Other impacts

The use of manure in the ridges seemed to have contributed to soil fertility improvement in the plots.

5. Other observations

Farmers are still eager to continue using the new variety of sweet potato. Training on storage and processing of sweet potatoes would also be useful.

The project involved individual extension personnel instead of agricultural officers in the district. This may have affected the sustainability of the activities when the project came to an end.

Milk collection, processing and marketing (project 027)

VILLAGE 1: Vwawa

Assumed highest adoption village

1. Village profile

The project on processing milk was implemented at Vwawa, which is the administrative headquarters of Mbozi District in Mbeya Region. The Vwawa Dairy Farmers Group (VDFG), which was implementing the project, draws its members from villages in and around Vwawa. Currently, group members are drawn from 10 villages as follows: Ndolezi, Hasambe, Ilole, Mbimba, Isangu, Ichanjezya, Old Vwawa, Ilembo, Nambura, and Vwawa Mjini. Currently the membership of the group stands at 69, of which 11 are women and the rest (58) are men. Group members and other milk producers sell milk at the collection centre at Vwawa where the processing unit is also located.

2. Approach to project implementation

The research team carried out on-farm research with the VDFG. The group was formed some years ago during the implementation of the Southern Highlands Dairy Development Project (SHDDP). This project was implemented for over 20 years in various parts of the Southern Highlands including Mbozi District.

Prior to implementation of the project, the project team embarked on a comprehensive training programme involving production and processing aspects. Training in production covered, among others, animal feeding, animal breeding, and milking. Training in milk processing, on the other hand, focused on heating milk to required temperature, cleaning of utensils, quality control, preparation of culture, and cheese production.

Besides training, the project supported the group with some equipment/working tools including a cooler and pasteuriser.

3 Adoption and diffusion of technologies

3.1 Adoption among contact farmers

VDFG is still actively involved in processing such milk products as fresh milk and yoghurt. Milk from both members and non-members is processed. The storage capacity of the facility at the collection centre is 500 litres. Milk supply/collection has been increasing annually from 98,000 litres in 2001 to 240,975 litres in 2005 and estimates for 2007 are 357,720 litres. As a consequence, VDFG are in need of a daily storage capacity ranging from 1,000 – 1,500 litres.

3.2 Diffusion to other farmers in the village

Only two other farmers have started collecting milk and processing using similar technology. Diffusion has relied on informal contacts between the VDFG leadership and interested parties. However, it could be that low diffusion may be due to investment required for processing products to standards that are dictated by the market.

3.3 Diffusion to neighbouring villages

Diffusion to neighbouring villages could not be established during the study.

4 Project impacts

4.1 Household income and assets

Processing of milk by the VDFG has helped create a more reliable market for milk for members and non-members alike. This has not only reduced the amount of spoiled milk but more importantly it has contributed to increased income among group members as a result of selling milk. This has translated into, among others, the ability to build good houses. Moreover, some VDFG members have been able to generate their own power after constructing a biogas facility.

4.2 Food security and nutrition

Although milk production is meant for both food and income, a reliable market has also meant that farmers now sell more milk than before. Thus less is now available for household consumption. This has implications not only on food security but also on meeting nutritional needs of household members.

4.3 Gender roles and women's livelihoods

Men and women are assigned to undertake milk processing. However, women seemed to outnumber men in performing activities related to processing milk.

4.4 Women's and men's workload

Considering the above it would seem that women's labour is much more used than male labour in the processing of milk products.

4.5 Other impacts

Additionally, milk processing by VDFG has created employment opportunities to a number of youths. A good number carry out milk processing. Others have been employed as vendors to sell processed milk products especially in Tunduma. Also interviews indicated that as dairy production becomes a profitable venture more farmers are turning to dairy production. As a result, there is an increasing demand for pasture for dairy production to cater for a growing population of dairy cattle. Pasture obtained from communal lands/fallow lands is no longer adequate to meet demand. This has compelled dairy farmers to engage in pasture production. Thus a new form of land use is emerging whereby land that was previously used for other crops such as maize is being converted to pasture.

5 Other observations

To expand milk supply further, the group is keen to improve productivity of dairy cattle. To achieve this, a mechanism has been established to make close follow-up on the use of improved animal husbandry practices among the dairy cattle farmers. Tunduma, a border town between Tanzania and Zambia located about 30 km away from Vwawa, is the major market for the group's products. Besides, the VDFG leadership is aware of the huge market

potential. The group has already prepared a project proposal to build an automated milk processing plant.

VILLAGE 2: Pomerin

Assumed lowest adoption village

1. Village Profile

A German Lutheran missionary established what later evolved into Pomerin village some 100 years ago. Located in the newly established Kilolo District, it has grown into a large settlement with a total of 713 households and a population of 3,499. The main ethnic groups in the village are the Wahehe, Wabena, and Wawanji. Regarding infrastructures, there are a total of 4 churches (Catholic, Lutheran, Seventh Day Adventist, and Tanzania Assemblies of God), 1 secondary school, 2 primary schools and 1 dispensary.

Crop and livestock production are the major sources of livelihoods. Crops produced for food include maize, beans, peas, and vegetables such as tomato. Bell peppers and peas are important sources of income. About half (356) of the households keep cattle. Other types of livestock are also kept. These include goats, chicken and pigs. Local beer brewing is an important off-farm activity. In addition, there are 15 kiosks. These are important sources of groceries and other basic commodities.

The most conspicuous community project under implementation is a market structure put up by the Participatory Agricultural Development and Empowerment Project (PADEP).

2. Approach to project implementation

The project team identified and worked with a group of dairy cattle keepers, which was established under the Southern Highland Dairy Development Project (SHDDP). This project began in the late 1970s and came to an end in December 2003. Registered in 1999, the group sought to achieve two major objectives: to collect and sell milk as well as promote dairy production. It was also hoped that this would contribute to increased milk production.

Two members were sent to Uyo Agricultural Research Institute (ARI-Uyo) in Mbeya for training on milk processing and quality control. Besides, the project carried out training for the group members on husbandry practices encompassing such aspects as animal feeding, breeding, and milking as well as milk processing. Besides training, the project also bought some equipment including a charcoal cooler, milk separator, and butter churn, among others.

When the project was winding up the group had 18 members. Four members have since left the group and thus currently the group has only 14 members. While some members who left did so after relocating from the village where others had abandoned dairy production.

3. Adoption and diffusion of technologies

At the time of the study there was no milk processing. Processing was done for only a short period of time in 2006. In fact, it was reported that milk processing had stopped since January 2007. The main reason behind this is a lack of adequate supply of milk from group members and other dairy/livestock keepers. Interviews with officials indicated that the group was not able to offer competitive prices to what other buyers were willing to pay.

4. Project impacts

Since milk processing was no longer going on in the group, no livelihood impacts of the project could be expected.

5. Other observations

The business environment in which the group operated was rather competitive. Besides competing with some buyers within the community, there are also outside competitors well endowed with resources. One such competitor is ASAS – a privately owned milk processing company. With resources at its disposal ASAS can access the market of processed products in and around Iringa town located about 50 km away from Pomerin.

Farmer organisations (project 028)

VILLAGE 1: Lusanga

Assumed highest adoption village

1. Village profile

Lusanga village is located 5 km from Madizini sub-town in Mvomero district. It consists of 960 households with a population of 7,120 people. The institutions found in the village include one primary school, one secondary school, one health centre, four churches and three mosques. There are other institutions found in the area such as Teak, Heifer Project International, DAIPESA and PADEP projects. The ethnic groups in the village include the Wazigua (40%), Wanguu (30%) and others like Wasukuma, Wachagga, Wapare and Wafipa. Sources of agricultural livelihoods include food crops such as maize, paddy, banana, cassava and corms; sugarcane is grown as a cash crop. Livestock kept in the village include cattle, goats, pig and poultry. Forest livelihoods include lumbering and firewood activities.

The off-farm sources of livelihood include carpentry, fishing, auctioning and casual labour in sugarcane and teak estates. There are also a few formal employees in education and the health sector.

2. Approach to project implementation

The project staff formalised the informal farmer's organisations that existed during a project known as Special Programme on Food Security. They taught members how to write constitutions and business plans (proposals), manage projects, keep records and register their organisations.

3. Adoption and diffusion of technologies

3.1 Adoption among contact farmers

Only contact farmers were trained. Many organisations were initially formed but at the time of interview it was reported that only two of the farmer's organisations were still in existence. The two farmer's organisations had managed to raise some income and had deposited it at the bank in a bid to strengthen their own Saving and Credit Cooperative (SACCO) known as LUJIMAMO. It was reported that around 16 farmers belonging to these organisations still practice skills gained from the project. They grow vegetables, maize and paddy in a communal farm. They also engage themselves with poultry keeping. However, most farmers in organisations had dropped out due to lack of capital, shortage of land, poor weather and lack of micro credits. This is particularly so for women who claimed that land inheritance has favoured men over women. Thus, men have grown sugarcane at the expense of vegetables that was affordable to women. One of the shortcomings is the fact that very few farmers were involved at the start of the projects. Thus diffusion to other farmers has been very minimal. The approach of Farmer's Field Schools (FFS) could have had a big impact as through them many farmers could get the training.

3.2 Diffusion to other farmers in the village

It is estimated that around 70 percent of the farmers in the village were convinced to work in teams in farmers' organisations after realising success from contact farmers. Thus this was followed by the formation of many organisations especially when other projects like PADEP came in the village afterwards.

3.3 Diffusion to neighbouring villages

The new training had been sought after by other farmers in neighbouring villages at Manyinga, Dihinga and Digoma in Diyongoya ward. Farmers in these villages have been seeking training assistance from contact farmers at Lungo village.

4. Project impacts

4.1 Household income and assets

One of the farmer's organisations has managed to raise cash from 200,000 TZS to 1 million as a result of training they received from the project. Another one has risen from zero to 425,000 TZS. Crop yield was also reported to have increased from 3-5 bags per plot of annual crops to 15 bags per plot.

4.2 Food security and nutrition

Increased commitment and responsibilities of organisation members increased crop yield. This assured them some form of food security and nutrition.

4.3 Gender roles and women's livelihoods

No apparent differences in gender roles could be attributed to the inception of this project. Women's livelihood was reported to have improved as a result of increased yield in communal farms.

4.4 Women and men's workload

An apparent increase in workload was observed as a result of the inception of the project. This is because there were many other projects that were started in the village. This became a burden as both men and women became confused with such a high concentration of projects

and a mix of different knowledge at the same time. Lack of land hinders women to carry on with the expansion of fields for vegetables, which is a project that most of them can afford as a group.

4.5 Other impacts

The project improved farmers' knowledge on marketing, improved business operations, and crop and animal husbandry.

5. Other observations

Many contact farmers seemed to confuse projects, maybe because there were many in the area.

Extension workers reported that people in this village are generally adamant to follow extension advice.

VILLAGE 2: Sonjo

Assumed lowest adoption village

1. Village profile

Sonjo village, which is adjacent to the Udzungwa National Park, is located 5 km from Mang'ula sub-town along Ifakara road in the Kilombero district in Morogoro region. The village consists of 370 households with a population of 1,246 people. Institutions found in the village include one primary school, one secondary school, one health centre, one church and two mosques. The major ethnic groups in this village include Wabena, Wahehe, Wandamba, and Wapogoro.

The major food crops in the village include maize, paddy, cassava and sweet potatoes. Cash crops include sugar cane and paddy. Livestock include dairy cattle, goats and poultry. Non-farm livelihood sources include income from casual labour in sugarcane estates and kiosks, and a few people earn income from employments in health and teaching.

2. Approach to project implementation

The project staff formalised the informal farmer's organisations that existed before the project. They taught members how to write constitutions, business plans (proposals), management of projects, record keeping and their subsequent formal registration.

3. Adoption and diffusion of technologies

3.1 Adoption among contact farmers

The training was well received by both men and women members in the organisations within the village.

3.2 Diffusion to other farmers in the village

Contact farmers reported that soon after hearing about the training that was being offered by the project to participating farmers' organisations, there were more formations of other farmers groups within the village. The new groups sought assistance in similar training from contact farmers even after the project ended.

3.3 Diffusion to neighbouring villages

The new training has been sought after by other farmers in neighbouring villages at Mukula and Msufini. Farmers in these villages have been seeking training assistance from contact farmers at Sonjo village.

4. Project impacts

4.1 Household income and assets

The project opened up minds among contact farmers on various sources of micro credit for their farming activities. The skills in writing business plans helped them to write proposals for requesting loans from the President's Fund in year 2007. However, farmers reported that they had not been able to get loans due to bureaucratic red tape in lending institutions. Farmers also reported that formalising the farmer organisations increased commitments and responsibilities for every member within the organisations. This helped them to improve yield and income from farms that belonged to organisations.

4.2 Food security and nutrition

There were some forms of training on paddy transplanting which improved yield. Similarly increased commitment and responsibilities of organisation members contributed to increased crop yield. This assured them some form of food security and nutrition.

4.3 Gender roles and women's livelihoods

No apparent differences in gender roles could be attributed to the inception of this project. Women's livelihoods improved from increased yield from paddy and sugarcane fields because money obtained from groups' activities was equally appropriated by all members regardless of gender.

4.4 Women's and men's workload

No change in workload was observed as a result of the inception of the project.

4.5 Other impacts

Farmers had expected to get money from credit institutions especially after being taught how to write business plans. After being unable to get what they had expected most farmers have given up and withdrew from organisations which eventually led to the collapse of many organisations. On the positive side, training on record keeping has enabled them to track performance records of their organisations.

5. Other observations

Contrary to expectations it seems from the interview and impression we got from the farmers, that Sonjo adopted more practices associated with farmer organisation than Lusanga village.

Ticks and tick-borne diseases (project 030)

VILLAGE 1: Wami-Sokoine

Assumed highest adoption village

1. Village profile

Wami-Sokoine village is located some 40 km from Morogoro municipality on the Morogoro Dodoma highway. The village has 702 households with a population of 2,687. It has one

primary school, three small cold drug pharmacies, three churches and one mosque. The village is one of the TARP II SUA Project villages that are readily accessible throughout the year. It is largely inhabited by the Maasai who are mainly pastoralists. Although the livestock population is not known every Maasai household has a defined size; normally a large boma has an average of 1,500 heads of cattle and small ones 20 heads of cattle. The Maasai do cultivate rice though on a limited scale as a cash and food crop. While the rich use hired labour to herd their cattle, poorer households rely on family labour. The households which are regarded as rich have two to three bomas located in the village and nearby villages, while the poorer have one small boma.

2. Approach to project implementation

The project sought to promote EDET, that is, “Early Diagnosis and Early Treatment” for East Coast Fever (ECF), which leads to high mortality rates of calves. The project taught farmers on the causes of the disease, and to carry out early diagnosis. Once an animal was diagnosed with ECF, SUA staff would treat it with a drug known as Butalex. Such intervention could lead to reduction of calf mortality rates and thus increased herd size.

3. Adoption and diffusion of technologies

3.1 Adoption among contact farmers

The diagnosis of the disease was the main technology to be adopted by livestock keepers and the Village Extension Officer (VEO). On finding out that some of the calves under the project were sick the farmers reported this to the village extension officer who subsequently notified SUA researchers who in turn would treat the sick calves. Thus the VEO played a rather limited role in the implementation of the project since he was not involved in providing the recommended treatment. The role of keepers was equally limited to supplying information. It is apparent that this was informed by the desire of the researchers to collect quality data, something they alone could guarantee.

3.2. Diffusion to other farmers in the village

Very few herders tried to use the new drug. Since it is known to be expensive many herders are using other alternative drugs that are cheaper than Butalex. The extent of adoption and diffusion of the technology was not evident. Although the contact livestock keepers appreciated that the recommended drug was effective, they could not use it widely because it was extremely expensive. Thus the use of Butalex has dropped as compared to the project period when the same was supplied free of charge. More importantly, even the keepers who used it did so by mixing with antibiotics. Some claimed it was effective while others thought otherwise. Some would only use Butalex for treating exotic breeds rather than indigenous breeds due to their fear of losing expensive animals. In general, it would seem that the keepers have adapted the technology to suit their production environment.

3.3. Diffusion to neighbouring villages

There has not been diffusion to neighbouring villages. When the project took off project staff bypassed the extension officer. He could have promoted the technology even after the project ended. Another weakness was seen in the project approach. Instead of project staff equipping herders with improved skills in correct treatment of the disease they themselves performed the treatment. Greater impact and diffusion could be achieved if a veterinary clinic could be established in the area with full presence of a veterinary clinician to train herders on best drug administration procedures.

4. Project impacts

4.1. Household income and assets

It was evident that the project contributed to reduction in calf mortality rates. One of the keepers reported that before the inception of the project they used to suffer mortality rates as high as 50% but that this dropped to as low as 10%. This translated into increase in herd size among the participating “bomas”. Whether this also translated to increased incomes was not evident.

4.2. Food security and nutrition

Through their culture the Maasai tribe are livestock keepers in this area. Their main nutritional intake is meat and milk. Increased herd size obviously increased their access to such food.

4.3. Gender roles and women’s livelihoods

Among the Maasai, men are involved to a large extent in animal grazing and other related activities while women take care of families at the campsite and milking of cows. It was reported that contact men continue to seek veterinary services after having been enlightened on disease diagnosis by the project staff. The project has not been able to alter gender roles.

4.4. Women’s and men’s workload

No apparent impact on women’s and men’s workload was observed as a result of implementation of this project.

4.5. Other impacts

Through the project they were educated and thus received more knowledge in relation to animal health and in particular ECF. They would prefer to get more knowledge on the same. Moreover, given a choice they would have preferred a construction of dipping facilities, indicating their desire to prevent rather than treat diseases. This was a result of realizing that hand spraying of araccides was not effective in controlling ticks and hence tick-borne diseases.

VILLAGE 2: Melela

Assumed lowest adoption village

1. Village profile

Melela village is located 35 km from Morogoro municipality. It has a total of 1,600 households, four primary schools, two secondary schools, one health centre, six churches and two mosques. Other key institutions in this village include Melela bustani, and World Vision that promote agricultural extension services in the area. Ethnic groups in this village include Waluguru (70%), Maasai (26%) and other minor ones like Wakinga.

The crops from which farmers earn livelihoods include maize and sorghum as food crops and simsim, sunflower and vegetables as cash crops. Livestock kept in this village include cattle, goats, poultry, sheep and pigs. Charcoal making is a major business among men in this village. Non-farm livelihood sources include carpet making, basketry weaving, kiosks and food stalls, local brewing, and casual labour in mining. Some few earn livelihoods from teaching and health professions.

2. Approach to project implementation

TARPII-SUA staff asked the livestock extension officer to search for and select contact livestock keepers because they are scattered in different locations and sometimes migrate with their animals. Four livestock keepers were selected and interviewed on ways they used to control the East Coast Fever (ECF) parasite in order to harmonise with new intervention measures they aimed to promote. After having made agreements with herders they started collecting blood samples to ascertain presence/absence of ECF infestation from cattle. This was followed by treatments using Butalex.

3. Adoption and diffusion of technologies

3.1. Adoption among contact farmers

Four livestock keepers who were selected as contact farmers adopted the use of the new drug. They knew it before the project was introduced. However, they were not using it because it was expensive and they did not know whether it was more effective than most other drugs that they were using. They also expected that the new drug was only effective for exotic cattle breeds and not for indigenous breeds. When the drug was administered to infested calves by project staff and herders it was found to be more effective than other drugs that were used by herders. During the interview one herder reported that out of 20 infested calves that were treated with the new drug only three calves died. The contact farmers continue to use the drug against ECF for calves in their herds.

3.2. Diffusion to other farmers in the village

Very few herders tried to use the new drug. Since it is known to be expensive many herders are using other alternative drugs that are cheaper than Butalex.

3.3. Diffusion to neighbouring villages

There has not been diffusion to neighbouring villages. It is worth noting that ineffective diffusion could have been caused by infrequent visits and contact with the veterinary officer. Also when the project took off project staff bypassed the extension officer. He could have promoted the technology even after the project ended. Another weakness was seen in the project approach. Instead of project staff equipping herders with improved skills in correct treatment of the disease they performed the treatment themselves. Greater impact and diffusion could be achieved if a veterinary clinic could be established in the area with full presence of a veterinary clinician to train herders on best drug administration procedures.

4. Project impacts

4.1. Household income and assets

Contact farmers reported reduced calf deaths and hence increased size of their herds. They could thus sell and earn good income. Due to high effectiveness of the drug the frequency of administering the drug to the calves has been reduced.

4.2. Food security and nutrition

Through their culture the Maasai tribe are mainly livestock keepers in this area. Their main nutritional intake is meat and milk. Increased herd size obviously increased their access to such food.

4.3. Gender roles and women's livelihoods

Among the Maasai people, men are involved to a large extent in animal grazing and other related activities while women take care of families at the camp site. It was reported that contact men would continue seeking veterinary services after having been enlightened by the project staff. The project has not been able to alter gender roles.

4.4. Women and men's workload

Men's workload increased to some extent because they have to travel to Morogoro municipality for veterinary services. No apparent impact on women's workload was observed.

4.5. Other impacts

No other impacts have been seen.

Sequential cropping systems (project 032)

VILLAGE 1: Hembeti

Assumed highest adoption village

1. Village profile

Hembeti village has a population of 4,010 divided into 656 households. Turiani, the nearest large trading centre, is located some 25 km to the north. In terms of infrastructure the village has one school, two mosques and two churches. Mkindo Farmer Training Centre is located a short distance from the village. The village is multi-ethnic with the Wanguu forming the dominant ethnic group. Other ethnic groups include the Waluguru, Wasukuma and Wachaga.

Agriculture involving crop and livestock production forms the main source of livelihood. Although farmers grow a variety of crops, rice remains the most important source of food and income. A total of 1,500 ha in the village are used to grow rice. Other crops grown include beans, tomato, okra, cabbage, onion, carrots, and coconut. Livestock kept include cattle, goats and chicken. Most cattle numbering about 400 are of traditional breeds while only 24 dairy cattle are exotic. The average annual household income is estimated at TZS 400,000/=.

2. Approach to project implementation

The main objective of the project was to promote maximum use of residual moisture. The recommended cropping sequence is rice followed by legumes or vegetable crops. The project was introduced to villagers at a village meeting. Then a total of 10 contact farmers - 7 women and 3 men - were picked from sub villages to participate in the project. The large proportion of women contact farmers reflected the focus of the project on women farmers. The selected farmers were requested to allocate a quarter of an acre for research trials. Additionally, they were trained on, among others, how to till the land and transplant rice. Contact farmers were also supplied with inputs such as seeds, fertilizer and pesticides.

Use of improved rice varieties formed a critical component of the technology. This is because they mature early and thus provide space for other crops to utilize residual moisture. Thus trials involved the use of five varieties of rice including TXD 220, TXD 306, and a local variety - Supa. Later farmers selected varieties based on their performance. Besides, farmers decided which crop to grow after harvesting rice based on the results of soil analyses done by researchers at the nearby Cholima Agricultural Research Institute. Crops that could

be grown after harvesting rice included beans and maize and various vegetable crops including onions, tomato, and eggplant.

3. Adoption and diffusion of technologies

3.1. Adoption among contact farmers

All the contact farmers are still practicing the technology. Currently, TXD 306 is widely grown because of its superior attributes. These include high yields and good taste. In general, after harvesting rice farmers grow various crops such as beans and maize and vegetable such as onions, tomato, and eggplant. The vegetable crops, especially tomato, are grown for the Dar es Salaam market.

The type of crops grown as part of sequential cropping depends on the type of fields. For example, in permanently irrigated fields one rice crop is succeeded by another crop of rice. Indeed, this is the most profitable way of utilizing these fields because moisture is not a limiting factor. Moreover, most of these fields are grown to improved varieties of rice. On the other hand, in fields that are not permanently irrigated production of maize, beans or vegetables would succeed a rice crop. This applies also to fields that are in the valley bottom that retain moisture over a longer period than the fields located in the upland part of the village.

3.2. Diffusion to other farmers in the village

About one-third of the villagers practice sequential cropping based on growing improved rice varieties. These are people with access to land that is appropriate for this type of technology. In other words, the limiting factor to the diffusion of this technology is access to land that can conserve residual moisture enough to support crop growth during the dry season after harvesting the rice crop.

3.3. Diffusion to neighbouring villages

The technology has spread widely beyond the project village to other neighbouring villages including Dihombo and Mkindo. In general, the widespread use of the technology may be attributed to local extension efforts and informal contacts/interactions between the contact farmers and their peers. It can also be attributed to Mkindo Farmer Training Centre, which promotes improved rice production using the Farmer Field School (FFS) approach.

4. Project impacts

4.1. Household income and assets

Both rice and vegetable crops such as tomato are important sources of household income. Incomes at household level have increased as a result of increased sales, especially rice. Besides using incomes to meet basic household needs, farmers reported using the income to build good houses. They also use it to pay school fees for their children.

4.2. Food security and nutrition

Farmers have recorded significant increases in rice yields from 8 bags to 25 bags per acre as a result of using improved technologies including improved rice varieties. This has increased the availability of food at the household level. Also, production of vegetables has increased the availability of a variety of foods at the household level and thus improved nutrition. However, availability and consumption of vegetables, which was mentioned as an outcome of the project, is seasonal.

4.3. Gender roles and women's livelihoods

In general, women are responsible for most farm activities while men are more involved in off-farm activities. However, farm operations related to rice production are jointly shared between men and women. It was also observed that women headed households fail to cope with introduced technology because of limited access to labour.

4.4. Women and men's workload

Assessment of the technology by both men and women contact farmers indicated that adoption of the technology involves hard labour and that it was time consuming. Moreover, the cropping intensity has contributed to more labour demand. In general, they opined that their workload has significantly increased. However, they observed that it was worthwhile investing in the technology given the returns.

4.5. Other impacts

As a result of increased household incomes, farmers reported being able to pay school fees. Besides, transplanting rice has reduced the amount of seeds for growing rice implying a reduction in costs of rice production. While demand for labour has increased, time spent in weeding the fields has reduced as a result of planting in lines. In addition, the project provided opportunity for farmers to learn agronomic practices for improved crop production.

5. Other observations

Marketing of the produce, especially vegetables, is problematic.

VILLAGE 2: Ulaya Mbuyuni **Assumed lowest adoption village**

1. Village Profile

Ulaya Mbuyuni is located some 55 km from Mikumi town and 32 km from Kilosa town. The total population is 1,023 divided into 261 households. Wasagara form the main ethnic group. The other ethnic groups include the Waluguru and Wagogo. In the past Ilonga Agricultural Research Institute used the village as its site for on-farm research on soybean and maize. In terms of infrastructure, there is one primary school and 2 mosques.

To a large extent livelihood is obtained from crop production. The food crops grown include maize, rice, cowpeas, sorghum, cassava, and sweet potato. Cotton used to be an important cash crop. Nevertheless, its importance has declined with time because of poor marketing. Currently, the main sources of cash are sunflower, vegetables (especially tomato) and pepper. Livestock is also kept. Only few households keep cattle while chicken and ducks are widely kept. Off-farm activities involve sale of labour, petty trade, local brewing, and brick making.

2. Approach to project implementation

The project team embarked on the project after interactions with the village officials. The village authorities were actively involved in the formation of a group of contact farmers. Indeed, the village leadership picked the 10 women contact farmers to form the group. Women were targeted by the project because they are the main producers of rice. The trials involved a number of improved rice varieties including TXD 220, TXD 88, TXD 306 and a local variety and popular variety, Supa. At the end of the trial they selected: TXD 220, TXD

88, and TXD 306. The project supplied inputs such as seeds and fertilizer to the contact farmers as part of research materials.

3. Adoption and diffusion of technologies

3.1. Adoption among contact farmers

All the contact farmers said they were using improved varieties of rice. They reported on an increase in rice yields from 3 bags to 10 bags per acre. Nevertheless, the use of inputs such as fertilizer was low as compared to the project implementation period. Only two of the five contact farmers met were still using fertilizer. In addition, it was noted that the supply of improved rice seeds introduced by the project was inadequate. This was partly explained by drought and floods in 2006 and 2007 respectively.

3.2. Diffusion to other farmers in the village

An important component of sequential cropping is the use of improved varieties of rice and other crops. Of the improved varieties, TXD 306 ranked as the most preferred variety. Currently, 10 men and 2 women farmers have adopted the varieties. In all, improved varieties have not spread widely to other farmers in the village apparently because most farmers prefer local varieties such as Supa for their superior taste.

3.3. Diffusion to neighbouring villages

It was pointed out that 9 women have adopted the practice (6 from Nyamene and 3 in the Kibaoni villages).

4. Project impacts

4.1. Household income and assets

Contact farmers reported an increase in household income. Part of this income was used to buy household items such as food. Others reported investing the money in petty trade.

4.2. Food security and nutrition

Following increased production of rice, the contact farmers reported being more food secure than was the case in the past. Moreover, as a result of increased production, they are able to sell rice. This is a new development since in the past they rarely sold rice because of low production.

4.3. Gender roles and women livelihoods

Although men help with some farm operations, women are largely responsible for most operations related to rice production. On the other hand, men are more involved with crops which are planted after harvesting rice such as maize and tomato. Moreover, it was observed that the technology, and in particular the use of improved rice varieties, had helped improve their own welfare as well as that of their families. Some respondents pointed out that they were able to meet some household expenses on their own. In all, using the technology had made them less dependent on men as a result of earning income from selling rice.

4.4. Women and men's workload

As indicated earlier, rice is considered a woman's crop. Following the introduction of improved rice varieties as a component of sequential cropping, women shoulder the main responsibility for the workload associated with improved rice farming operations. As a result, they observed that despite obtaining high yields, improved methods of rice production such

as deep tillage and planting in lines using recommended spacing, are too demanding in terms of time and labour. For this reason, it becomes necessary to hire labour to help with some of the operations.

4.5. Other impacts

Besides income and food security, the other reported impact of the project is that increased incomes have made it possible for parents to send their children to school.

5. Other observations

Inability of farmers to access inputs for rice production affected its productivity. It also seemed that most farmers are growing rice without fertilizer. Notwithstanding high yields that could be obtained using improved rice varieties, contact farmers seemed to pay more attention to the cost (fertilizer and hard labour) involved in producing the crop. For example, it was emphasized during interviews to the effect that “you have to use a lot of inputs (fertilizer)” to grow rice using improved varieties. They responded to this challenge by cultivating relatively small plots of land.

Common bean varieties (project 043)

VILLAGE 1: Igodivaha

Assumed highest adoption village

1. Village profile

Igodivaha is located about 50 km from Njombe town. The Wabena form the main ethnic group in the village. There are a total of 373 households and a population of 1,541, which includes 725 men and 816 women.

Farming is the main source of livelihood. In particular, farmers grow maize, beans, sunflower, Irish (round) potatoes, sweet potato, and vegetables (tomato and onions). Maize and beans are grown for subsistence while sunflower provides the main source of cash. Livestock, and especially pigs, are kept by about 50% of the households.

An environmental conservation project (HIMA) was implemented in the village and was phased out a couple of years ago. Among others, the project promoted environmental conservation through tree planting. It also encouraged farmers to use compost to improve soil fertility. Tree planting was implemented at both community and household levels.

In terms of infrastructure, there is one shop and 2 kiosks. Also, there is one school, 5 churches, and one health centre.

2. Approach to project implementation

Village officials convened a meeting during which the project team (researchers) explained the objective of the project. Later they asked for volunteers to participate in the project. In the end a total of 9 farmers (5 women and 4 men) volunteered to participate. By the time the project came to an end the group had increased in size to 23 members (16 women and 7 men). However, at the time of carrying out the study the group had only 5 members (3 women and 2 men).

On-farm research under the project involved evaluation/selection of 23 varieties out of which one was local and the rest (22) were improved. Besides, the use of fertilizers and pesticides formed part of the trials. Trials began in 2003 and ended in 2005. Thus a total of three (3) rounds of trials were conducted. Trials were confined to the main rainy season, locally known as *kifuku*. This is the main season for growing beans. But the crop is also grown during the dry season in the lower parts of the valley. During this period crop growth depends on residual moisture/watering. At the end of the project in 2005, farmers selected 2 varieties for production – Uyole 98 and Uyole 94. Also, they observed that crop growth was high when TSP + CAN + manure combination was applied.

3. Adoption and diffusion of technologies

3.1. Adoption among contact farmers

During 2006 only 6 out of 23 members planted the varieties. During 2007 all the 5 remaining group members planted the varieties. Use of other complementary inputs/technologies, namely fertilizer and pesticide by the 5 remaining contact farmers was limited because of the high cost. In general, the use of these inputs almost stopped after the trials were phased out.

3.2. Diffusion to other farmers in the village

The five group members distributed seeds to 4 women and one man.

3.3. Diffusion to neighbouring villages

This could not be established during the study.

4. Project impacts

Interviews with contact farmers did not reveal impact on a number of variables (4.1 – 4.5). This could be attributed to the fact that the fields cultivated by the contact farmers are too small to make any meaningful impact on livelihoods.

5. Other observations

Interviews with the contact farmers showed growing beans during the rainy (main) season requires heavy use of pesticides to control blight and other diseases. A large number of farmers discontinued using the technology on realizing that to obtain high yields they needed to use a lot of the inputs. This shows that the use of complementary inputs depended on project support. Even those who are still growing improved varieties use only small plots because a bigger plot would demand more use of inputs. Also, contact farmers indicated that they could soon stop growing the crop for lack of improved seeds.

VILLAGE 2: Utelewe

Assumed lowest adoption village

1. Village Profile

The village is located about 35 km from Njombe town. There are a total of 348 households with a population of 1,500. As in Igodivaha, the Wabena constitute the main ethnic group. Livelihood activities include farming and livestock production. The most important crops grown in the village are maize, Irish potato, wheat and beans. Various livestock include cattle, goats, sheep, pig, and chicken.

The village has the following infrastructure: 1 primary school, 1 health centre, 2 churches, and 4 kiosks.

2. Approach to project implementation

First the project team informed the village authorities about the objectives of the project. Villagers were also informed about the same at a village meeting. Contact farmers were selected among established bean farmers from each of the sub villages. In the end, a total of 30 contact farmers were picked to participate in the project. For logistical purposes they were split into two groups each with 15 members.

Furthermore, on-farm trials, which were done for 3 years, involved bean variety evaluation. The evaluation covered a total of 25 varieties (24 improved and 1 local) and use of fertilizer and pesticides. At the end of the evaluation each of the two groups of contact farmers selected two varieties. While the first group selected U96 and U94, the second group selected U98 and U96. In selecting those varieties the contact farmers used a number of criteria. These included early maturity, taste, disease resistance, yield, and marketability.

3. Adoption and diffusion of technologies

3.1. Adoption among contact farmers

Only two of the five members present during the interview planted the varieties during 2006 and 2007. Only one of them used some small quantities of fertilizer. It was also apparent that there was hesitation among the contact farmers to grow improved varieties of beans because they don't taste well and are thus less marketable compared to traditional varieties.

3.2. Diffusion to other farmers in the village

Only one of the five contact farmers reported having distributed the varieties she planted to two villagers other than contact farmers.

3.3. Diffusion to neighbouring villages

This could not be established during the study.

4. Project impacts

As with Igodivaha, the minimal level of adoption has limited the impact of the intervention on the relevant variables (4.1-4.5).

5. Other observations

Those who did grow the varieties applied them only on small plots of land. This could mean that they were still experimenting with the technology. The issue of poor marketability of improved bean varieties came up very strongly during the interviews.

APPENDIX 2. RESEARCH INSTRUMENTS

2.1 Checklist for interviews with project leaders

- 1 Identification
 - Project number
 - Name of project leader interviewed
 - Date of interview
- 2 Perceptions on the project's impact on food security and household income during the project period
- 3 Any available knowledge on whether farmers still *practice* the introduced technologies after the termination of TARPII-SUA?
- 4 Any available knowledge on how and to what extent farmers still *benefit from practicing* the introduced technologies after the termination of TARPII-SUA?
- 5 Confirmation of the list of project villages (as given in the TARPII-SUA impact report, Volume 1, Annex 2).
- 6 Out of the project villages, in which village would you expect to find the highest adoption rate of the introduced technologies?
- 7 Out of the project villages, in which village would you expect to find the lowest adoption rate of the introduced technologies?
- 8 What is your basis for believing that the village mentioned under item 6 has a higher adoption rate than the village mentioned under item 7?
- 9 What do you believe are the causes of the expected difference in adoption rate between the village mentioned under item 6 and the village mentioned under item 7?
- 10 Do you have any other comments on the performance of your project?

2.2 Checklist for key informant interviews

I Village information

1 Identification

Position of interviewee

Project number:

Project name (short version):

Village:

District:

Date:

Interviewer(s):

2 General village profile (distance and accessibility to nearest town, no. of households, schools, health services, churches, mosques, other key institutions, ethnicity, past agricultural projects)

3 Sources of agricultural livelihood (food crops, cash crops, livestock, forests)

4 Sources of non-farm livelihood (business, formal employment, casual labour)

II TARP II-SUA

5 How was the project introduced?

What were the project activities?

How were the contact farmers selected?

How was the project received?

6 To what extent and in which ways did the contact farmers benefit from the technologies?

7 Can any visible evidence of technologies be shown to the interviewer?

8 Were there any reasons for some contact farmers not to practice the technologies?

III Sustainability and diffusion

9 To what extent are the TARP II-SUA technologies still practiced by contact farmers?

10 Beyond the contact farmers, are there other farmers within the village using the technologies? If yes, what proportion?

11 Are farmers in neighbouring villages using the technologies? If yes, which villages and in what proportion?

12 What institutions are involved in diffusion of the technologies?

13 What kinds of support do those institutions provide?

14 To what extent and in which ways do farmers benefit from the technologies?

Who else benefited?

Were there any losers?

15 Are there any (social or economic) categories of farmers for whom the technologies are not suitable?

16 Are there any constraints to diffusion?

17 Are there any other issues regarding the project that you would like to raise?

2.3 Checklist for group interviews with contact farmers

- 1 Identification
 - Project number:
 - Project name (short version):
 - Village:
 - District:
 - Date:
 - Interviewer(s):
 - Number and gender of interviewees
- 2 What were the technologies that were introduced through the TARPII-SUA project?
- 3 To what extent did you find the technologies useful?
- 4 What proportion of you (females and males) are still using the technologies?
- 5 Are there any benefits from adopting the technology? Which ones?
- 6 Are there any costs or disadvantages from adopting the technology? Which ones?
- 7 If some of you do not practice the technologies any more, please explain the reasons
- 8 Have other women and men farmers within the village adopted the technologies? If yes, what proportion?
- 9 Have other women and men farmers in neighbouring villages adopted the technologies? If yes, which villages?
- 10 Are there any other issues regarding the project that you would like to raise?

APPENDIX 3. OVERVIEW OF ALL TARPIL-SUA PROJECTS

3.1 Projects where the project leader was not interviewed

Project number	Project title	Reason for not interviewing
014	Development and dissemination of mushroom cultivation and technologies at household and community levels in the Southern Highlands and Eastern Zone, Tanzania	Project leader died
022	Strategies for improving commodity market information and market access by farmers and traders in the Eastern and Southern Highlands zones in Tanzania	The project did not introduce technologies at village level
023	Integrated rice improvement program for women farmers in Kilombero River Basin, Morogoro, Tanzania	Project leader died
024	Improved cattle productivity through strategic feeding and reproductive health control in smallholder herds in Eastern Zone, Tanzania	Project leader had shifted to an other employer and was not accessible
034	Impact of macro-economic policy reforms on agricultural productivity, food security and poverty in Tanzania: a case of the Southern Highlands zone	The project did not introduce technologies at village level
035	Formulation of weaning foods for enhancing household income and nutrition security	Project leader had shifted to an other employer and was not accessible
038	Evaluation of tillage practice and organic mulch on yield of rice and cowpeas grown in sequence under lowland rain-fed rice culture in Kyela and Kilombero districts	Project leader died
040	Testing of improved fallow for improving soil fertility: the use of trees and shrubs that enhance the availability of soil phosphorus and firewood	Project leader was travelling during the time of the interview

3.2 Projects where the project leader was interviewed, but the project was not selected for field study

Project number	Project title	Number of villages/sites	Assumed highest adoption village	Assumed lowest adoption village
011	Soybean variety evaluation for yield potential and utilization as human food in Eastern and Southern Highlands zones of Tanzania	4	Simike or Mahanga	Kisanga
013	Agroforestry technologies for soil fertility improvement and wood production in semi-arid areas of Morogoro and Iringa	2	Ibuti	Gairo
016	Optimizing milk production and quality in smallholder dairy sector through control of mastitis, improved management and reduced post milking microbial contamination	14	Picha ya Ndege	Mazimbu Mzinga Kilakala Kingolwira Mlimani Boma
017	Improvement of dry season feeding for smallholder dairy production in Southern Highlands of Tanzania	4	Ibumila	Ikeru
020	Development, transfer and adoption of selected fruits and vegetable processing and preservation packages developed at SUA and MAFS by smallholder farmers in the Eastern and Southern Highlands zones	4	Semgano	Mindu
025	Development of farm-level technologies for improving productivity of small ruminants in Eastern and Southern Highlands zones of Tanzania	3	Langali	Manda-mzingara
026	Design-management interactions in smallholder irrigation systems. A case study of the Usangu plains	3	Mwale	Ihahi
029	Development and promotion of improved processing, packaging and storage of sweet potato and cassava for diversification of use and commercialisation of value added under smallholder conditions	3	Magindu	Ihenje
031	Development of nutritional guidelines for diet improvement in Morogoro and Iringa regions	5	Kalenga	Mwarazi
033	On-station and on-farm evaluation of improved pigeon pea varieties in the Eastern Zone	4	Kabuku-Ndani	All villages adopted very well

036	Development of appropriate interventions to enhance livestock, meat marketing, preservation and consumption in rural areas of the Eastern zone	3	Mnjilili	Chamakweza
037	Improvement of soil fertility in coconut based farming through crop rotation in farmer fields	6	All 3 villages in Pangani (Choba, Boza, Madanga) are well performing	Miale
039	Promotion of sustainable utilisation of draft animal technologies for the improvement of agricultural productivity for smallholder farmers	5	Kisilo	Nkundi
041	In-vitro micro-propagation for mass production of clean planting materials of desirable banana cultivars	5	Kyimo	Mkenge
042	On-farm development and promotion of integrated disease management measures for rice yellow mottle virus disease control in Kyela district, Southern Highlands of Tanzania	5	Lugambo Ngonga	Luhurego
044	Evaluation of the effect of nitrogen and phosphorus application in conjunction with tillage and residue management on physical and chemical characteristics of soil, weed, microbial population and diversity and on yield of maize	2	Michungwani	Lubunga A

3.3 Projects where the project leader was interviewed, and the project was selected for field study

Project number	Project title	Number of villages/sites	Assumed highest adoption village	Assumed lowest adoption village
010	Commercialisation of cassava root as a source of energy in commercial livestock feed	2	Zogowale	Miswe
012	Assessment and promotion of rainwater harvesting (RWH) to overcome water shortage for domestic, livestock and plant growth in semi arid areas of Njombe district	2	Wanging'ombe	Isimike
015	Improvement of health and productivity of village chickens by controlling important diseases	7	Lungo	Lusanga (Mvomero)
018	Integrated management of Witch weed (<i>Striga spp</i>) in sorghum and maize based cropping system of the Eastern Zone	4	Mhinduro	Melela
021	Sweet potato germ-plasm maintenance and evaluation in the Eastern zone	2	Pangani	Kongo
027	Development and application of appropriate technologies for milk collection, processing and marketing by smallholder dairy farmers and traditional livestock keepers in the Eastern and Southern Highlands zones of Tanzania.	5	Vwawa	Pomerin
028	Strengthening farmers' accessibility to information input and market in Tanzania through existing and new forms of farmers' organisations	4	Lusanga (Mvomero)	Sonjo
030	Optimising of on-farm regimes for controlling ticks and tick-born diseases for smallholder farmers of dairy and traditional Zebu cattle	5	Wami-Sokoine	Melela
032	Introduction of sequential cropping systems in selected villages of Morogoro with emphasis on women farmers	3	Hembeti	Ulaya Mbuyuni
043	Verification of common bean varieties tolerant to low soil phosphorus and acid conditions (low pH) in Imalinyi division, Njombe district	4	Igodava	Utelewe

APPENDIX 4. TERMS OF REFERENCE

Farmers' perspectives on usefulness of technologies introduced by on-farm research: the case of the TARPII-SUA program.

Background

The applied research program 'Food security and household income for smallholder farmers: applied research with emphasis on women' (TARPII-SUA) was carried out from September 2000 to June 2005. The overall goal of the program was 'Improved food security and household income of smallholder farmers with emphasis on women in the Eastern and Southern Highlands Zones of Tanzania'. TARPII-SUA was implemented as a collaborative program between Sokoine University of Agriculture (SUA) and the Ministry of Agriculture and Food Security (MAFS) in Tanzania with technical inputs from the Norwegian University of Life Sciences (UMB), formerly known as the Agricultural University of Norway (NLH). The program was funded by the Government of Norway. It was organised under the umbrella of Tanzania Agricultural Research Project Phase II (TARPII) and was managed by Sokoine University of Agriculture (SUA), thus the acronym TARPII-SUA.

Justification

Impact assessment was done during the implementation of the project, in order to identify effects of the project on the farm households. This assessment was however limited to effects that could be observed at the end of the five year project period. Only now, about 2-3 years after the field activities were completed, it is possible to identify any lasting and sustainable impacts of the technologies that were introduced to farmers during the program period. The present study does not aim at evaluating the individual projects under TARPII-SUA, but rather to explore success-factors and 'failure-factors' of on-farm research. The large number and high diversity of projects as well as villages where on-farm research was conducted makes TARPII-SUA an excellent learning ground for exploring such factors.

Objective

The farmers who have tried the introduced technologies for some time are considered to be the best judges of whether or not the introduced technologies are useful to them. If they found that the technologies were useful under their conditions, we assume that they are still using them, after the material and technical support has ceased. On the other hand, if the farmers have stopped using the introduced technologies, it must be taken as a strong indication that the technologies were not suitable for them. The objective of the study is therefore to find evidence on to what extent farmers still use the technologies that were introduced to them during the TARPII-SUA program and to identify the farmers' reasons for adopting or rejecting the technologies.

Methodology

The TARPII-SUA program comprised 34 projects of which 32 projects had on-farm components and worked with contact farmers in about 125 villages in total. Based on interviews with programme management and project leaders as well as on information available in the TARPII-SUA impact assessment reports, 15 villages where it is believed that the project activities have a high adoption rate and 15 villages where it is believed that the project activities have had limited or no adoption will be selected. High adoption and low adoption villages where the same technologies were introduced will be identified, because these will give the most interesting comparisons. In each of the selected villages, the following activities will be undertaken during a one-day visit by the study team:

- (1) Key informant interview with Village Chairperson, Village Secretary or Village Extensionist.
- (2) Group interview with villagers who were contact farmers of the TARPII-SUA project.
- (3) Direct observation of use and impacts of the introduced technologies

Team composition

A senior scientific staff member from Noragric will be the team leader, while one senior researcher and one junior researcher from SUA will be team members. Since SUA was the implementing institution of the TARPII-SUA project and Noragric was also involved in the implementation, it is considered important for the credibility of the study to involve a recognised independent institution like the Institute of Development Studies (IDS) at the University of Sussex to spend one week in Tanzania during the initiation of the fieldwork and one week on reviewing and contributing to the draft project report. The study team will therefore consist of:

- Dr. Fred H. Johnsen, Noragric, UMB
- Dr. Dismas L. Mwaseba, SUA
- Ms. Felister Mombo, SUA
- Dr. Martin Greeley, IDS, University of Sussex