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Building an understanding of water use innovation adoption processes through farmer-driven experimentation

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ABSTRACT

Smallholder farmers in Southern Africa are faced with the challenge of securing their livelihoods within the context of a wide variety of biophysical and socio-economic constraints. Agriculture is inherently risky, particularly in regions prone to drought or dry spells, and risk-averse farmers may be viewed by researchers or extension agents as reluctant to invest in agricultural innovations that have potential to improve their livelihoods. However, farmers themselves are more interested in personal livelihood security than any other stakeholder and it is the farmers' perceptions of needs, investment options and risks that drive their decision-making process. A holistic approach to agricultural innovation development and extension is needed to address both socio-economic and biophysical dynamics that influence adoption and dissemination of innovations. This paper, presents a methodology for involving farmers from the Bergville district of South Africa in the process of innovation development through facilitation of farmer-driven gardening experiments. Facilitating farmer-driven experimentation allows farmers to methodically assess the value of innovations they choose to study while providing researchers with a venue for learning about socio-economic as well as biophysical influences on farmers' decisions. With this knowledge, researchers can focus on developing innovations that are socially and economically appropriate and therefore, more readily adoptable. The participatory process gave farmers the tools they needed to make informed decisions through critical thinking and analysis and improved their confidence in explaining the function of innovations to others. Researchers were able to use farmers' manually collected data and observations to supplement laboratory generated and electronically recorded information about soil water dynamics to understand water balances associated with different garden bed designs, and to investigate whether trench beds, drip irrigation and water harvesting with run-on ditches tended to improve water use efficiency. Wetting front detectors (WFD) were shown to have some potential as management tools for farmers, provided certain limitations are addressed, while drip irrigation was found to be impractical because the available drip kits were prone to malfunction and farmers believed they did not provide enough water to the plants. Farmers participating in a series of monthly, hands-on workshops that encouraged individual experimentation tended to adopt and sustain use of many introduced garden innovations. Farmers who were also seriously involved in a formalized research and experimentation process at their own homesteads became more proficient with gardening systems in general, through continual trial-and-error comparisons and making decisions based on observations, than those who were not involved. This suggests that the practice of on-going experimentation, once established, reaches beyond the limits of facilitation by researchers or extension agents, into the realm of sustainable change and livelihood improvement through adoption, adaptation and dissemination of agricultural innovations.

1. Introduction

A 35-year-old woman with four children, a grandchild, two chickens and five geese is the head of a household in rural South Africa. Her husband returns home only on holidays, as he works in a factory 3 h away and sends remittances home to help provide for them. A traditional healer with five cows, whose wife left him to care for their two children alone earlier in the year. A young husband and wife with a baby living together in one of several homes at a larger family homestead. They work the crop fields together with the rest of the family as they have not been allotted their own parcel. How do these people, all members of the same subsistence farming community, make decisions about trying, adopting and adapting agricultural innovations? Is it reasonable to assume

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they are each influenced by the same factors because they are from the same culture and live in the same village? How do their differing socio-economic situations influence the decisions they make? Answers to these questions are not straight forward, and an approach to building an understanding of innovation adoption in a diverse community requires an integrated, flexible and participatory strategy.

The research for this project was part of the smallholder systems innovations (SSI) project, a research initiative aimed at implementing and assessing the potential social and agrohydrological impact of water related innovations based in Potshini, a Zulu subsistence farming community in the Okhahlamba Municipality of the Bergville district in South Africa. The Potshini community is comprised of around 400 Zulu homesteads and covers approximately 2.5 km^2. Mean annual precipitation is estimated at approximately 700 mm/year and precipitation falls primarily during summer months, from September to May. Winters are cold with regular frost from early May to late August and occasional snow. Strong, dry winds are experienced in August and September. A number of boreholes with hand pumps provide water for domestic use, along with small streams that also replenish reservoirs for downstream commercial farmers. Stream flows are extremely low during winter months.

According to 2001 census data, 58% of people over the age of 20 in the Okhahlamba Municipality (population 137,525) have received some level of education, but only 4% have received higher education while the rest of the population (38%) has had no schooling (Statistics South Africa, 2001). In addition, 56% of the population over the age of 5 can be classed as functionally illiterate (Okhahlamba Local Municipality, 2007). In the Okhahlamba Municipality, 33.5% of women attending antenatal clinics are HIV positive, 59.3% of children live in poor households and 60% of people over the age of 20 are unemployed. The majority (80%) of people live on tribal lands, while the remaining 20% live in freehold land areas or commercial farms (World Vision, 2003).

A number of agricultural innovations have been introduced in the area over the past 7 years by university, government and non-government organizations (NGOs). The common goal of such initiatives has been to improve livelihoods and conserve natural resources within the community. However, such goals are not attainable if community members do not adopt and disseminate the innovations. Development projects in sub-Saharan Africa have often been unsuccessful because they have introduced practices that community members did not perceive to be immediately relevant (Quinn et al., 2003). In addition to a lack of perceived relevance, documented reasons for the failure of farmers to adopt innovations include complexity of the technology, conflicting information, institutional factors, risk associated with the new practices, lack of flexibility, implementation costs (both capital and intellectual), and incompatibility with other aspects of farm objectives or management, or with physical or social infrastructure (Vanclay and Lawrence, 1994; US (EPA), 2000). Other factors identified as having potential to influence farmers' decisions about innovation adoption include age, gender, farm size, annual income, education and experience (Bengesi et al., 2004). In addition, a study conducted by Meinzen-Dick et al. (2003) revealed that farmers' attitudes toward, and trust in, extension institutions play a key role in either hindering or facilitating dissemination processes. Some of these documented factors are related to biophysical circumstances, but the majority of them are of a socio-economic nature.

It has been increasingly recognized that in areas where agriculture is constrained by poor rainfall distribution and partitioning, innovations that increase rainwater use efficiency, often involving rainwater harvesting and management strategies, have great potential for improving livelihoods and increasing food security (Rockström, 2000, 2003; Ngigi et al., 2005). In small gardens, such innovations are focussed on the conservation of soil water, which has been shown to increase crop yield and minimise the labour effort of the farmer. However, investing in agricultural innovations is inherently risky, particularly in semi-arid regions prone to drought or dry-spells. Farmers may be viewed as being slow or unwilling to invest in their own livelihood by development agents who do not understand the decision-making processes or investment options available to community members. In reality, the farmers themselves are more interested in improving their own livelihoods than any external agent might be, but their decisions are constrained by risks and uncertainties associated with past experiences and limited options (Ngigi et al., 2005).

Farmers in South Africa have many risks, goals, limitations and options to consider when making decisions, as demonstrated in

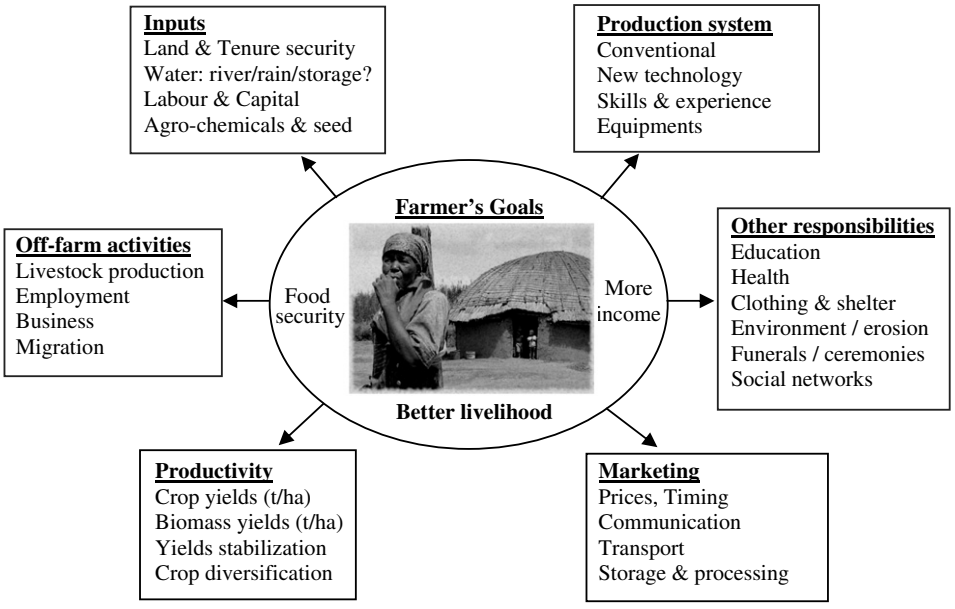

Fig. 1. Factors influencing farmer's decision-making process in rainfed agricultural systems in Southern Africa (after Ngigi et al., 2005).