Papers
Theme 3
Knowing and Learning Processes

Convenor: Christine King and Christine Holding-Anyonge

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Across the Divide: The Impact of Farmer-to-Farmer Linkages in the Absence of Extension Services

Tim Hart & Roberta Burgess

HSRC and ARC Infruitec-Nietvoorbij, South Africa

Abstract

The literature on recent trends in agricultural development emphasises the importance of extension and research practitioners participating with smallholder farmers in order to improve agricultural development, providing various cases to illustrate this point. The same body of literature also provides examples of networks amongst smallholder farmers that make a crucial difference to local agricultural development by supporting smallholders. These networks are seemingly made up of more or less homogeneous resource poor individuals: sharing their skills, knowledge, inputs, etc. to ensure their ability to produce and to survive. However, in some instances the members of these networks are not homogeneous individuals, but often come from diverse backgrounds, having different access to various resources. During the Apartheid era in South Africa the state extension services predominantly focused on the large-scale commercial farmers and paid scant attention to the smallholder farmers in the various rural reserves. This paper, in the form of a case study, describes the context, initial linkage and relationship between two apple farmers, one a large-scale commercial producer and the other a smallholder, in the south-western cape deciduous fruit producing area. Despite Apartheid legislation and other socio-economic constraints this linkage and subsequent relationship allowed the smallholder to enter the national and the export apple markets during the 1970s and to continue to supply to these markets until today, despite most of his contemporaries having ceased their apple production by the 1970s. This was largely achieved by the farmer's ability to use the subsequent relationship to enable him to innovate his production practices within the confines of his political and socio-economic circumstances. This case provides three clear conclusions that must be noted by those involved in agricultural development (1) relationships between farmers are important for their livelihoods, (2) farmers are innovators, whose innovations are constrained by the parameters of the context within which they are actors and not by their ability to innovate, and (3) where extension and research services do exist, they should seriously consider strengthening farmers' networks and innovations.

Introduction

Much of the current literature on agricultural development during the past decade, emphasises the need for development agents, including agricultural extension and research, to participate in meaningful ways with smallholder farmers in order to ensure natural resource management, sustainable production and agricultural growth (Scoones and Thompson, 1994; Reij and Waters-Bayer, 2001; Perret and Mercoiret, 2003; Pound et al., 2003; CTA, 2004;). The reasoning behind this argument is that farmers have many of the solutions to their own problems (Reij and Waters-Bayer, 2001), or can at least make meaningful contributions to solving their problems by virtue of knowledge regarding their circumstances and local environment (Chambers et al., 1989; Scoones and Thompson, 1994). The combination of farmers' knowledge and that of appropriately focused research and extension can be a formidable force in agricultural development as the two can complement one another (Scoones and Thompson, 1994; Reij and Waters-Bayer, 2001; Perret and Mercoiret, 2003; CTA, 2004). This literature also illustrates that much of the success of smallholder farmers relies on their local networks with one another and their self-initiated innovations to improve and adapt their practices in light of changing circumstances within the contexts in which they function; often marginal and risk prone environments (Scoones and Thompson, 1994; Reij and Waters-
Bayer, 2001).

Some successful projects have been carried out in sub-Saharan Africa, the success of which involved farmer innovations and linkages amongst farmers and between farmers and agricultural development agencies (including NGOs and official extension and research services). However, in many cases appropriate external support was lacking (Reij and Waters-Bayer, 2001) and farmers used whatever resources they could to compensate. Examples emphasising local innovations include the Indigenous Soil and Water Conservation and the Promoting Farmer Innovation projects in sub-Saharan Africa which encouraged groups of farmers to share and further develop their innovations by collaborating with development supporting agencies, usually in the form of NGOs (Reij and Waters-Bayer, 2001).

Other examples, which emphasise extension linkages with farmers, include the study of the successful implementation of the Farmer Field School approach in Zanzibar (Bruin and Meerman, 2001) and its growth as a participatory extension and research approach in East Africa (Matata et al., 2001). Smallholder farmers in Africa tend to share information and inputs with other farmers, be they family members, neighbours or farmers from other regions. These linkages and resulting networks of exchange seem to be one of the reasons why they are able to survive under some of the harshest physical conditions. Experience suggests that linkages between farmers exist both in the absence and in the presence of official extension services, warranting further consideration of the significance and contribution of these networks to agricultural development. This article adds to the discussion on networks and linkages by considering the impact of the linkage between a smallholder producer and a large-scale commercial apple producer, in the absence of official extension services.

Smallholders and Deciduous Fruit Exportation

Exporting deciduous fruit from the Western Cape Province of South Africa to markets in Europe, North America and Asia contributes significantly to the province's Gross Domestic Product. The main export producers are large-scale farmers. Even with the change in

discriminatory legislation and practices in South Africa after 1994, few smallholder farmers have entered this market. This is due to:

- the historical political inequalities faced by the predominantly coloured and black smallholder farmers, in particular the lack of access to agricultural resources and inputs, because legislation used to exclude them from mainstream commercial farming;
- the subsequent inability of smallholders to produce the volumes and, at times, the quality required for export;
- the significant influence of economies of scale, making it almost impossible for smallholders to achieve a significant profit.

The few smallholders who manage to export their fruit do so through collective or individual arrangements with large-scale commercial operations.

One such farmer is Aubrey Billet, aged 78, from Haarlem. In the absence of agricultural extension and research services, but through his linkage with a large-scale producer he started exporting apples in the 1970s. During the ensuing decades, he developed his own knowledge and innovations in both fruit production and socio-economic arrangements and could thus continue to export most of his annual apple crop.

Agricultural Changes in Haarlem

The hamlet of Haarlem lies in the narrow Langkloof Valley and developed around the mission station established by the Lutheran Church in the early 1800s. The nearly perfect climatic conditions, with cold winters and an altitude of 800m, have made this area well known for its export-quality apples and peaches. During the 1970s, numerous smallholder farmers exported their deciduous fruit in collaboration with neighbouring large-scale commercial farmers. The Lutheran Church helped the hamlet buy more land so that local farmers could expand their operations and produce even more for export.

However, the oil crisis in the late 1970s, the closure of the local railway station, politically motivated economic sanctions and the decline in value of the South African Rand relative to major foreign currencies led to the almost complete demise of deciduous fruit production by smallholders in Haarlem. By 1989, most had stopped growing apples for export. In the early 1990s, many uprooted the fruit trees and switched to arable cash crops. Agricultural production declined, but agriculture and associated employment remained important economic activities. Many residents were employed on surrounding large-scale farms and a few were employed on the smallholdings within Haarlem. Most smallholders now produce livestock and vegetables for household consumption, local sales and street vendors while a handful supply the fresh-produce markets in Port Elizabeth. A few still grow deciduous fruit for home and the local market. The remaining fruit trees are scattered and old. Aubrey Billet, however, still exports apples.

Strengthening the Linkage and Early Innovations

Like other Haarlem smallholders during the 1960s and 1970s, Aubrey used his small piece of land to grow various crops for home consumption and local sales. The smallholders' farming practices were severely constrained because they could not buy inputs in small quantities from the local cooperative, which was geared for large-scale production and supplied inputs only in large quantities. During the 1970s, a large-scale farmer approached Aubrey and other smallholders and an arrangement was reached whereby they would produce high-quality

apples, which he would buy and then sell on national and foreign markets. These farmers started planting an increasing number of apple trees and the large-scale producer transferred the necessary technology and advice. Those who worked as labourers on large-scale farms employed local residents to maintain the small orchards. The smallholders bought the small quantities of inputs they needed and could afford directly from the large-scale farmer. This enabled them to overcome the obstacles incurred by the unaffordable large volumes of inputs supplied by the co-op. Thus, they could enter the national and export apple markets.

Aubrey has a particularly keen interest in apple production, as does the large-scale farmer. Based on their mutual interest, these two men who differ greatly in socio-cultural background and economic status developed a strong friendship that continues today and extends to a friendship between Aubrey and the farmer's son, who now manages the large-scale commercial farm.

To sell to export markets, farmers must produce apple varieties that meet the high demands and preferences of consumers. As a result of changes in consumer preferences, farmers have to invest in new apple varieties every 10–12 years. Resource-poor farmers with, little land and facing high input costs, cannot afford to do this.

Aubrey planted most of his existing apple trees, of the Starking variety, in the mid-1980s. When market demand for Starking apples decreased, he wanted to switch to Granny Smith, but could only afford to replace a few trees immediately. He therefore decided to experiment with grafting Granny Smith shoots (scions) onto the existing Starking trees.

He had learned about grafting while discussing apple production with his large-scale farmer friend. He taught himself and soon became adept in using this technique. Rather than spend money to buy scions from a nursery, he asked his friend if he could select potential scions from the shoots pruned annually in July from young trees on the large-scale farm. He stored the scions in the vegetable crisper of his refrigerator (where the temperature never went below 5^{o} C) until September/October and then grafted them onto his Starking trees. From his discussions with his friend, he knew that nurseries stored their scions in a similar way before grafting, but used a special storage medium too costly for Aubrey.

After a few trials, Aubrey discovered that he needed to use young scions, not older than one year, and to locate a place on the tree that would take new growth, i.e. where a new branch or shoot was emerging. He also had to make sure that the cut made on the tree was an almost perfect match to the cut on the scion, so that the newly grafted scion would take easily. As Aubrey could not afford a grafting knife, he used a sharpened kitchen knife that produced clean razor-edged cuts, ensuring a good fit. He noted that, when he changed apple varieties by grafting onto existing trees, he could harvest suitable fruits two to three seasons after grafting. This was more cost effective for him than replacing the trees, which had to be bought from a nursery and from which he could harvest only four to five seasons after planting. However, he bought a few Granny Smith trees to replace some older Starking trees.

Scaling Out

A few years after grafting Granny Smith onto the Starking trees, the market preference changed yet again. A new variety, Royal Gala, became popular amongst local and foreign consumers. Aubrey obtained some Royal Gala scions from his friend and grafted these onto Starking and some Granny Smith trees. He also grafted a few onto some Starking trees that

were producing Granny Smith apples, resulting in one tree producing both varieties on the same rootstock. He found that he could harvest Royal Gala apples within two seasons after grafting. However, he encountered some problems with the trees on which he had grafted both Granny Smith and Royal Gala. Each variety reacts differently to pests and diseases and therefore needs a different spraying schedule. If early and late cultivars are grown on the same tree, timely spraying for one variety affects the quality and size of the other. This had serious financial implications. Thus, although he could successfully graft two varieties on one tree, his limited knowledge of pest and disease control led him to decide to use only one variety per tree. He therefore grafted Royal Gala only onto the remaining Starking trees.

When to Graft and when to Replace Trees

Despite his success with grafting, Aubrey sees this as a short-term solution. He has noticed that a newly planted rootstock, with a pre-grafted scion, produces a better yield and fruit quality over a longer period in comparison to one of his "innovative trees". He suggests that these trees be replaced with new trees when the rootstocks are about 20 years old. According to his experience, the quality and quantity of the fruit start to deteriorate in later years. Most of the trees onto which he grafted a new variety were ten years old at the time. The grafting effectively gives each tree another ten years of productive life with a different variety currently in high demand from consumers. By saving his income, he could buy replacement trees when the production of the "innovative trees" started declining. His relationship with the large-scale farmer and his son enabled him to purchase new trees at minimal cost. When they ordered their new trees from the nurseries, over 500km away, they included Aubrey's order. They did not ask him to contribute towards the transport costs and he did not have the expense of ordering a small quantity only for himself. He does not graft onto the new replacement trees until their production drops or the market requirements change, as these are purchased with the market-required variety pre-grafted onto them.

Lessons for Extension and Research

The relationship that developed between two farmers who came from quite different backgrounds and have different resources, but share a common interest in apple production has played a pivotal role in Aubrey's access to materials and ideas which he could integrate into his local knowledge and thus develop his innovations. It also gave him access to a relatively closed market. Unlike the other smallholder farmers he realised the potential of the linkage within the context of the 1970s and 1980s and developed it to the extent that it contributed to his household livelihood for over three decades, enabling him to formally educate his three children. He turned a financial arrangement into a friendship that benefited him over the long-term. Such relationships and exchange of knowledge between farmers are important if they are to survive in a climate when research and extension services are being increasingly downsized. The success of this linkage is largely due to the fact that it was a mutual arrangement that was allowed to develop overtime; it was not prescribed from outside.

Only one other smallholder in Haarlem still grows apples for commercial purposes. Because he produces for the local market (consumers within Haarlem), his produce need not be of such high quality as is required for export. He does not practise grafting and relies on his old trees to produce what they can for the local market. Times have changed in Haarlem, and social reform in South Africa has made it possible for some smallholders to obtain loans and some government support. Also an extension officer now visits the community occasionally,

as does a researcher from the Agricultural Research Council (ARC). This means that they are in a better position than Aubrey was in 1970 to purchase trees and get knowledge when required. These notable changes in the existing situation from the 1960s to the present emphasise the importance of context for a farmer with regard to how he /she goes about innovating, forming linkages and ultimately producing agricultural produce. The linkage in the 1960s enabled Aubrey and the other farmers to overcome a number of constraints, namely:

1. Access to input suppliers;
2. High input costs and the need to buy greater volumes than necessary;
3. Market access constraints such as distances and production of necessary volumes;
4. Access to crop information and market trends.

Often these are constraints that even today the extension services cannot resolve. This case stresses that linkages between farmers are important as they ensure their ability to produce, improve production, enter distant and broader markets, and ultimately, a farmer's success.

The overall impact of extension services can be improved if:

1. extensionists identify the linkages or networks that exist between farmers, amongst smallholder farmers and other agricultural actors;
2. extensionists and researchers realise that farmers are innovators whose innovations need support, rather than outright rejection and the persistence with transfer of technology practices which might not be adopted or even adapted.

This example also shows that farmer innovations are context bound and implies the use of various linkages will affect the ability of farmers to innovate and the successful contribution these innovations make towards agricultural production. By using simple, low cost and immediately available resources and technology, smallholders innovate to ensure the sustainability of their production.

Conclusion

By expanding his knowledge through his own experimentation, within a politically unfavourable environment and without the direct support of agricultural extension and research services, a smallholder farmer continued producing apples for markets that were virtually inaccessible to smallholders, while most of his fellow smallholders sought other alternatives to maintain their livelihoods. His innovation allowed him to secure his family's livelihood and educate his children for more than three decades. This case provides three clear conclusions that must be noted by those involved in agricultural development:

1. Farmers' linkages are vital for their success and survival; providing them with access to various inputs and markets that are typically unattainable.
2. Such linkages can also provide the necessary catalyst and opportunity for farmers to innovate, thereby maximising the potential of these linkages and subsequently optimising production within the constraints of their circumstances.
3. In light of this, effective agricultural extension and research requires officials and agents to not only work with farmers but to go beyond individuals and village groupings to look at the significance of broader linkages and the role these play in agricultural production and development. Where appropriate they should seriously consider strengthening farmers' networks and innovations, rather than ignoring or replacing these.

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The Farm Holon and Soil Context to Aid Understanding of Farming Systems

Charlotte Lake and William L. Bland

Abstract
Agricultural and food systems pose myriad questions, with interconnected meanings, from the ecological to the cultural. Yet human survival is intimately tied to navigation of this complexity. How we understand this and the resulting discussions and research will shape peoples' lives and survival. Currently reductionist and systems perspectives dominate our research agendas in agricultural development. An alternative is the holon framework, which without defining goals and sustainability guides the analyst towards a larger picture of the system. The farmer and the farm are at the center of this framework and it shifts our focus from seeking one optimal answer toward envisioning many successful configurations. The holon approach to agroecology guides us to see the farmer making decisions in an environment of contexts and this in turn encourages us to be less judgmental and more understanding. In this paper we examine one of these contexts, the soil, as a point of entry into this understanding. Ultimately the farmer's interactions with the soil must be understood in light of the fact that it is but one of multiple contexts in which he or she must work. Soil is an intriguing context in that it is to some degree responsive to the framer's action, for better or worse. We first review the holon concept, then explore the soil context.

The Holon Approach to Agroecology

A holon is simultaneously a whole and a part of a larger whole (Koestler 1967). From the idea of the holon Bland and Bell (200x) developed a framework for understanding agricultural endeavors in general. The farm is envisioned as a holon, identified as a whole in the sense that it is a collection of planning and production that yields livelihoods and goods. It is also a part of a larger web of phenomena, material and meanings, much of which can be understood as contexts in which the farm must operate. These contexts not only provide meaning to the holon but also impose limitations. The farmer responds to the multiple contexts, thus forming a specific configuration of the holon. To survive a holon must constantly plan and change, altering its configuration to maintain viability. This constant planning and action in the name of survival we take to be intentionality. These contexts also are incommensurable, which implies that they cannot be analyzed to ascertain an "optimum" configuration of the farm. Putting the farmer at the center of multiple and sometimes contradicting contexts allows us a deeper understanding of a farmer's behavior and that attention to one context may prevent proper attention to another.

Looking at agricultural endeavors in this way differs from other conceptual frameworks, yet complements some of them as well. Current thinking about agriculture can be broadly grouped into reductionist and systems thinking. Reductionist thinking breaks down complex phenomena into parts to study each separately, after which they presumably can be reassembled with the understanding that has been gained. It often relies on a disciplinary approach, which tends to yield research findings divorced of important connections to other points of view. Reductionist research often takes place at agricultural experiment stations removed from the real life conditions of the farmer, and results are frequently applied in a universal manner with little or no regard to larger regional or local conditions.

Systems thinking was introduced into agricultural research and teaching at the university research level by Spedding in the 1970s. It often uses mathematical modeling to understand a simplified version of the system or to predict the outcome of a specific parameter such as yield. Within the system tradition Farming Systems Research (FSR) is an important approach

to agricultural research and development. While FSR keeps the systems idea of looking in a holistic way and finding interactions between components, it focuses on the farmer and the specifics of his or her situation as well as stressing on-farm research to answer agricultural questions. Within FSR, typologies are often created as a basis for understanding farms.

The holon approach to agroecology is in many ways a systems approach, yet its focus is on the farm as an intentional entity, and the contexts within which it operates. Traditional systems approaches divide the world into the system and the environment. This creates boundaries, and an imposition of order that may provide a specific set of answers at the expense of other possibilities (Bland and Bell 200x). This tends to not allow for "agency" or "innovation" between the relationships and the overall system structure is static (Bland and Bell 200x). The holon approach allows for "slippage" between relationships and the evolution of the farm over time. The farm as an intentional entity seeks to persist within its many contexts and therefore not have one specific "system" configuration.

The Soil Context

The soil context is of obvious fundamental importance to agriculture, but it is also intriguing because of its potential for manipulation. Some contexts must be taken as given, such as the cost of fuel or the price received for a crop. These contexts are stabilized by factors over which the farmer has little influence. Much of the soil context may be like this, e.g., the farmer has no more control over the clay mineralogy of a field than of the rainfall. But in other ways choices of the farmer can dramatically impact the soil, for better or for worse. Tillage disrupts structure and accelerates oxidation of organic matter, soils on slopes may be made susceptible to water erosion, or infiltration can be improved by residue and minimum tillage. Implicit in the holon approach is that the farmer is capable of reading changes in context in a timely enough manner to react appropriately. Many soils, though, are strongly buffered systems, i.e., they will continue to function well even as they are degraded, although not indefinitely. Contexts so buffered are difficult to read.

To develop our understanding of the soil context within the holon approach we are reviewing the literature on tropical agriculture, with attention to specific situations and what contexts shaped how the farmer interacted with the soil. That is, previous research that has examined the relationships between farmer and soil can demonstrate some of the diversity of ways by which farmer and context interact.

The importance of the soil context in determining the farmer use of the land has been studied at the farm, regional and continent scales. At the macro scale, regional patterns of fertility have been shown to determine at the least where farming is located, e.g., Voortmen et al (2003) sought connections between climate and soil to predict land use selection in Africa and found strong selection against poor soils. At the micro scale on-farm land use varied with patterns of soil fertility, in turn influencing types of crops that were planted, amount of organic fertilizer use and amount of labor designated for the area. The extent to which a farmer recognized and responded to micro-variability of soil fertility varied with income level. Farmer response in this case was influenced by income while specific decisions were shaped by the soil. In the holon approach to agroecology we interpret income level as a pointer to important contexts like resource availability or, perhaps, risk aversion. Farmer use of micro-variability is determined to some extent by other contexts, rather than a characteristic such as wealth. Carter et al (1995) also looked at on-farm soil variability and responses, especially how income and resources affect how, and how intensely, a farmer

exploits the soil micro-variability. They found that farmers' use of soil micro-variability increased with lower resource levels and labor was concentrated where fertility was highest. Cowley et al (2000) touched on micro niches and selection of crops and how this related to population pressure in their study on agrarian change in Marigoli area of Kenya. Specifically they found a linear unidirectional relationship between population pressure and agricultural intensification, but that soil fertility management changed in response to other than population and was not simply explained. With these studies we get a glimpse of the soil as a context to which the farmer reacts, but as mediated by other contexts such as cash flow, and how this shapes practices on farm to regional levels.

A specific and widespread effect of farming on the soil context is erosion. This is appreciated as a major problem for world food production (e.g., Pimentel et al. 1985, Larson et al. 1983). The productivity-lowering effects of erosion include lower water retention, reduced fertility and organic matter to reduction of rooting depth. Off farm effects such as increased sediment loads in streams and lakes that adversely affect aquatic organisms can also change farmer choices but may not be as direct or immediate as those on-farm.

To understand how farmers react to soil erosion we must appreciate the concept of the "time constant," or "half-life" idea discussed by Sparovek et al (2001). They pointed out that the impact of soil erosion on yield unfolds over time, with important implications for reading of the contexts by the farmer. They note that in cases of extremely high erosion rates there is a self-regulation mechanism, in that the farmer can readily sense the problem and has incentive to invest in preventative measures. In the case of high input agriculture, however, response to the effects of soil erosion can be put off to a later time. Thus reactions to soil erosion may vary according to amount of erosion and farming techniques, which delay the perception and consequences of the problem.

Other reactions to soil erosion can be seen in the preventative measures taken when a farmer perceives a change in a context. These measures can be in the form of indigenous interventions and western technology imported into developing countries. Indigenous measures include in situ techniques such as grass strips, trash lines, pits, earth bunds, stone lines and protection ditches (Wakindiki and Ben-Hur 2002).

The holon approach to agroecology emphasizes that farmers simultaneously operate in multiple contexts, so reactions to one must be viable in all of them. In J.A. Ashby's study (1985) we can see the effects of the multiple contexts on the soil. The smallholder farmers of the Cauca valley in Colombia faced population pressures that led to the use of marginal lands located on slopes for cultivation. While many larger farms shifted to the production of coffee, this has not been an option for the small holders who lack the capital to pay the higher wages needed to compete for labor in the area during the harvest season. An alternative for these farmers is to advantage of markets for cassava, despite this crop's negative effect on soil. This crop can grow on soils of low fertility, but takes two years to establish ground cover and thus increases soil erosion and depletion of soil fertility on these farms. Cultivation of this crop continues despite institutional measures to mitigate environmental effects by discouraging its cultivation. Here contexts other than the soil have shaped the farmers choices towards a practice harmful to the soil.

Conclusion

The examples illustrate the multiple ways in which a context can influence farmer behavior and how farmers have actively tried to influence this context. Farmer perception of a problem is the first step toward an appropriate reaction, and perception may be delayed by other factors. Examining the literature we see that other contexts influence farmer decisions about the soil. Here resource level, government involvement, population pressure and markets were key in determining farmer response to the soil context.

That farms operate simultaneously in multiple and disparate contexts mandates understanding them from multiple disciplinary perspectives. Disciplinary research can be problematic in a multi-contextual setting if one perspective forces its interpretation and emphasis on the understanding of the farm holon. The holon perspective begins with the whole farm at the center, with the farmer reading and acting simultaneously in multiple contexts. This leads us away from a normative analysis of farmer behavior and towards an understanding of each situation as unique. Understanding these contexts as incommensurable moves us away from seeking optimal configurations for a specific goal, e.g., yield, and toward a better understanding of why farms are as they are. This humility on the part of the analyst will result in more thoughtful interventions in the name of agricultural development.

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Un Grand Effort pour Éviter d'Apprendre

Catherine Macombe

CEMAGREF, France
(Les noms des personnes et des lieux sont déguisés pour préserver leur anonymat).

Abstract
Il n'y a plus place pour l'orientation paternaliste du développement rural vers le "client" des années 1970-1980. En réalité, de nos jours, comment les ruraux font-ils pour apprendre et pour partager leurs expériences ? Nous aimerions le savoir. Voici le cas d'une petite communauté d'exploitants agricoles d'une région de moyenne montagne française.
Nous rapportons ici une action commencée en 2000, qui est toujours en cours, et regroupe une vingtaine d'exploitants. Elle est vécue comme une opération de développement local dans une petite région agricole française. Elle a démarré suite au sentiment d'une menace sur les débouchés du lait produit localement. La finalité de l'action est de trouver et de mettre en œuvre une ou des solutions pour assurer aux agriculteurs un débouché préservant leurs revenus actuels. L'idée est de fabriquer artisanalement des fromages fermiers, jusqu'à présent portés par une association de producteurs fermiers, depuis une quinzaine d'années.

Contexte

Dans les années 1990, un groupe d'une dizaine d'éleveurs transformateurs fermiers et vendeurs directs de produits laitiers, ont créé l'association Cowcheese afin d'échanger sur leurs pratiques, voire de commercialiser ensemble. Voulant « *retrouver l'authenticité du produit* » ils ont élaboré un cahier des charges de production et de transformation avec l'aide d'un technicien, et se sont mis à produire des Rigottes (fromage traditionnel). Conseillés par une école de commerce, ils ont même créer un nouveau fromage, la Marguerite.

Dès l'année 2000, d'autres éleveurs qui livrent exclusivement en laiterie, prennent conscience collectivement des menaces qui pèsent sur l'avenir de leur production : baisse des prix du lait accompagnée par la délocalisation possible des quatre grandes laiteries implantées localement « Et puis les perspectives d'avenir, bon trois ans en arrière, les prix étaient magnifiques mais…mais bon quid du quota, quid du prix, l'entrée des nouveaux pays, il y avait un nombre d'incertitudes tellement élevé sur…l'avenir de la production laitière qu'il était peut-être opportun de se pencher sur ce problème la (--) l'énorme partie du lait produit dans les Monts du Lyonnais est transformée dans les produits de marque style Danone, Nestlé, Yoplait, mais n'est pas du tout identifiée au terroir, au territoire. Et si demain le lait est tellement plus intéressant à prendre ailleurs, comment on fait nous pour…pour sauvegarder quelque chose ? » (interview n°1). Mené par un leader qui occupe des postes de responsable professionnel en laiterie, et surtout au niveau national, et très soutenu par l'animateur du Comité de Développement, le groupe décide de s'informer sur les alternatives offertes. Peu à peu se dessine un projet, qui consiste à fabriquer artisanalement une gamme de fromages au lait cru, à partir des savoir-faire des producteurs fermiers. Le projet est favorablement accueilli par l'association Cowcheese, si bien qu'en 2003, un groupe de 17 éleveurs laitiers rejoint la structure. « Tout naturellement quand les producteurs laitiers entre guillemets, c'est-à-dire ceux qui fournissent que du lait à la laiterie, qui vont pas jusqu'au bout du produit, le jour où ils se sont posés la question, (--) on s'est dit ça finalement ça colle pas mal avec le premier projet et c'est peut-être la petite impulsion qui nous fallait pour aller sur du collectif, c'est pour ça que l'association Cowcheese a accueilli avec plaisir le groupe laitier. » (interview n°5). Le nouveau groupe Cowcheese s'organise et se montre très actif. Un premier

fromager, puis un deuxième, effectuent des essais de fabrication. En 2004, après de nombreuses réunions, visites, demandes d'études, formations, le projet commercial se précise et une première mise en place en GMS1 est testée (juillet à septembre 2004). Aujourd'hui, suite à ces essais, le groupe envisage d'autres modes de commercialisation.

Méthode pour mettre en évidence les apprentissages

Notre groupe de recherche est intervenu ponctuellement entre mars et mai 2004, à la demande de l'Institut National de la Recherche Agronomique (INRA) dans le cadre d'un programme régional d'aide au développement (PSDR : Programme pour et Sur le Développement Régional). Notre objectif ici est de mettre en lumière la manière dont les participants agriculteurs ont appris, et ce qu'ils ont appris, en particulier au contact des enseignants-chercheurs, ingénieurs encadrés, consultants, que nous baptisons du terme générique de « chercheurs », et qui nous ont précédé (ils ont conduit neuf études en deux ans). Les matériaux disponibles sont les compte-rendus des réunions des participants durant environ quatre années (40 documents), rédigés et communiqués par le Comité de Développement, et les rapports des neuf études déjà financées au bénéfice du groupe. Nous avons également procédé à six interviews (traces fabriquées) d'agriculteurs du groupe Cowcheese. C'est sur la complémentarité des deux types de traces (fabriquées et disponibles) qu'est bâtie notre approche des apprentissages.

Tout ce que les partenaires ont pu apprendre d'utile au projet ne peut pas être reconstitué exhaustivement, et tout apprentissage ne peut être considéré comme pertinent. Nous devons définir ce que nous entendons par apprentissage, et comment nous avons procédé pour les évaluer. Nous distinguons deux niveaux d'apprentissages : au premier niveau (majeur), les apprentissages pertinents sont ceux qui permettent aux partenaires d'acquérir les éléments constitutifs de leur logique d'action actuelle. Au second niveau (mineur) les apprentissages intéressants sont ceux qui permettent de rendre le projet opérationnel (acquis techniques sur le choix des produits, la manière de fabriquer, de promouvoir et de vendre). Pour détecter ces apprentissages, nous procédons en trois étapes. Nous reconstruisons d'abord la logique actuelle du groupe Cowcheese, à l'aide des fondements théoriques rappelés dans l'annexe I. La reconstitution de cette logique comporte des « affirmations sur le monde » de type normatif, adaptées au contexte (« il faut que la démarche soit accessible à un agriculteur de base de la région ») Nous repérons ensuite dans le passé, grâce aux compte-rendus, les propos et les décisions qui attestent que ces apprentissages majeurs étaient déjà présents, et les dates auxquels ils étaient déjà établis. Pour l'étude des apprentissages mineurs, nous localisons les conclusions qui pourraient être opérationnelles pour le groupe Cowcheese dans les rapports des neuf études produites par des chercheurs. Nous les comparons, grâce aux compte-rendus, avec les décisions réellement prises par les éleveurs.

Seule la première étape s'appuie sur une rencontre directe avec les exploitants. Elle débute par les six interviews d'exploitants, conduites à leur domicile, les 22 et 29 mars 2004. Ces personnes avaient été choisies par le groupe Cowcheese lui-même, en respectant la consigne de désigner des personnes parties prenantes du projet mais dont les opinions étaient les plus variées possible. L'interview, de type non directif-actif (Mucchielli, 1991) tend à faire produire un discours de justification du projet Cowcheese et s'articule autour de quelques thèmes (rapportés dans le document 1). Elle est enregistrée et retranscrite. L'analyse des

[1] GMS : Grandes et moyennes surfaces outlets

retranscriptions d'interviews utilise la grille fournie par la grammaire de la justice conçue par Boltanski et Thévenot (1991) (voir annexe I).

Document 1 : Guide d'entretien

Pouvez-vous me raconter l'histoire de votre exploitation ?
Par rapport au projet de Cowcheese, où en êtes-vous ?
Quel est l'objectif de cette démarche ?
Que pensez-vous de l'idée de vendre en supermarché ?

Les deuxième (repérage des apprentissages majeurs dans les compte-rendus) et troisième étapes (comparaison des recommandations des études et décisions prises) sont des travaux sur documents.

Résultats et discussion

Nous avons retrouvé la logique partagée par le groupe (31), puis mis en évidence dans les compte-rendus des indices attestant que les éléments de cette logique se sont mis en place très tôt, sans doute avant ou dès le début de la démarche (32). Quant aux apprentissages mineurs, il est manifeste qu'ils ne pouvaient s'accomplir que dans le cadre de cette première logique. Ainsi, les études exploratoires hors de ce cadre ne sont jamais demandées, les résultats en contradiction avec la logique initiale ne sont pas entendus, et dans certains cas, les résultats arrivent « trop tard » (33).

Contenus de la logique rigidifiée:
Les entretiens nous ont livré la logique partagée suivante. Le bien commun local est « le développement du territoire ML basé sur une agriculture de qualité ». Tous veulent « *préserver beaucoup d'installations* » et « *maintenir beaucoup d'habitants dans les campagnes* ». Quatre niveaux de groupes de référence sont cités :

- le niveau 4, international, qui oppose la France et les pays de l'Est (nouveaux entrants dans l'Union). C'est à ce niveau qu'est débattue la menace de délocalisation des laiteries.
- le niveau 3 oppose les habitants de la petite région, et plus particulièrement les agriculteurs, à leurs homologues des Savoies. La région est une « *zone accidentée, en altitude, dynamique, avec beaucoup de diversifications* » qui a fait « *le pari sur les hommes plutôt que sur la taille des exploitations* ».
- le niveau 2 oppose cette fois les éleveurs laitiers de la petite région (qui connaît une « *vraie dynamique laitière* », c'est la « *Petite Bretagne* », avec « *beaucoup de vendeurs directs* ») aux éleveurs laitiers de la région administrative.
- Le niveau 1 oppose le groupe des nouveaux entrants dans Cowcheese aux éleveurs qui sont sortis du projet, mais aussi les anciens de Cowcheese (vendeurs directs de produits laitiers) aux autres vendeurs directs de produits laitiers (qui ne sont pas organisés collectivement et ne travaillent pas directement, en conséquence, à la reconnaissance de l'agriculture des Monts du Lyonnais).

Le socle de la démarche est véritablement l'égale puissance d'accès au projet de tous, au moins potentiellement. En conséquence, le cahier des charges, loin d'être élitiste, décrit le système d'élevage actuel (troupeau Holstein, recours aux ensilages, achat d'aliments) et proclame l'attachement des participants à cette agriculture typique. Un autre indice de l'ouverture de la démarche est donné par la possibilité d'intégrer les éleveurs fermiers. Mais il faut admettre que cette ouverture garantit la transmission des savoir-faire en direction des fromagers chargés d'élaborer les fromages artisanaux.

Il est bien affirmé l'existence des « petits » et les « grands ». Par opposition à ceux qui ne s'engagent pas dans la démarche, à ceux qui attendent ou qui se sont retirés, les nouveaux entrants dans Cowcheese réunissent « *des gens convaincus* » « *avec des vraies convictions* », « *qui se posent de vraies questions* », « *des gens lucides par rapport au contexte* », « *des précurseurs* » « *non élitistes* ». De même, le groupe des « anciens Cowcheese » définit ses grands, par opposition aux autres vendeurs directs, comme ceux qui « *mettent à disposition [du groupe] leurs savoir-faire* », « *ceux qui s'accordent sur un étiquetage* » et ceux qui « *veulent mettre en place un atelier d'affinage en commun* ». Autrement dit, il suffit d'appartenir à l'un de ces deux groupes de référence « nouveaux » ou « anciens » Cowcheese pour faire partie des grands.
La formule d'investissement, qui permet d'accéder à la grandeur, a été étudiée pour le groupe des nouveaux uniquement. Pour devenir grand, il faudra totalement adhérer au projet, soit consentir les sacrifices suivants : « *prendre sa production en main* », « *investir dans la fruitière* », « *apporter du lait à la fruitière* » et « *affronter les GMS* », par opposition à ceux qui reculeront devant l'épreuve, qui « *resteront intégrés dans les laiteries* [industrielles] », « *refuseront d'apporter du lait à la fruitière et d'investir dans la fruitière* » et surtout qui refuseront « *d'affronter les GMS* ».

<u>La logique rigidifiée est ancienne</u>**:**
Les apprentissages majeurs sont ceux qui conditionnent et rythment véritablement le déroulement du projet. Nous avons donc recherché des traces de ces apprentissages dans les compte-rendus, mémoires de l'action. Voici les grandes idées sur le monde qui traduisent chacune des éléments de la logique découverte chez les producteurs (leur identification abrégée en majuscule) :

- « *le développement du territoire [local] basé sur une agriculture de qualité* » est le bien commun local (BCL)
- Il y a des oppositions entre groupes de référence, qui confortent l'identité des exploitants engagés dans le projet (Group).
- Le cahier des charges de production doit être ouvert à tous, proclamant l'adéquation du projet avec le type d'agriculture pratiqué (CAHIER).
- Il y a une différence indiscutable entre les grands (ceux qui s'engagent dans le projet) et les petits (CONVIC)
- La composition de la formule d'investissement est la nécessité de monter une fruitière pour prendre sa production en main (FRUIT), et d'affronter des GMS (GMS).

On pourra s'étonner de la place conférée, dans notre récit, à « l'affrontement des GMS » (qui rentre dans la catégorie des apprentissages majeurs) par opposition par exemple à l'indifférence manifestée envers le type de produit technique (fromage au lait cru) choisi par les exploitants. En fait, il est manifeste que les participants pourraient tout aussi bien vendre du lait cru en bouteilles ou d'autres types de fromages, pourvu que ce soit en GMS. La mise en œuvre de ces autres produits est d'ailleurs envisagée sans soulever aucune passion. A contrario, la question de la vente en GMS fait l'objet de grands débats mais aussi d'un défi (« *montrer aux grandes laiteries qu'on peut faire aussi bien qu'eux* »).

Quatre documents exemplaires, extraits des compte-rendus (voir annexe II) permettent d'attester que les contenus nécessaires à la constitution de la logique des exploitants étaient déjà construits, ou en voie de construction, dès le début historique de la démarche (été 2000/ printemps 2001). Les apprentissages majeurs avaient eu lieu antérieurement. Tout se passe désormais comme si les exploitants ne retenaient de leurs expériences que ce qui conforte l'idéologie déjà en place. Les traces d'apprentissages majeurs dans les documents plus récents resteront limitées.

Ecart entre les résultats des études et les conclusions tirées

Des chercheurs (sans nous compter) sont intervenus à neuf reprises. Leur impact nous est connu au travers des documents traces et des huit rapports d'étude plus un document illustrant une intervention pédagogique. Nous avons vu que pour mettre en lumière les apprentissages mineurs, notre méthode consiste à comparer les conclusions des études et les décisions prises. L' annexe III reprend le détail de cette démonstration.

Cet examen donne l'impression que le projet a bien souvent « avancé tout seul », en dehors des résultats de ces études. Celles-ci ont certainement contribué à livrer des éléments de réflexion, et l'impact des chercheurs a pu se faire sentir au cours des conversations, des contacts direct, mais sans que l'on puisse en juger ici. Cependant, le manque d'appropriation des conclusions des études est patent. La principale difficulté provient, nous semble-t-il, du décalage entre le moment où les agriculteurs posent la question et le moment où l'étude vient y répondre. Quand ce résultat est enfin disponible, les éleveurs sont passés à un autre thème de préoccupation, voire, dans certains cas, ont dû anticiper les résultats de l'étude et donc choisir une position pour « avancer ». Mais surtout, une fois que la formule logique est fortement établie, il semble impossible de la « déboulonner » ou simplement de tenir compte des résultats qui lui seraient contraires. De plus, des études non conformes aux préjugés de cette formule ne peuvent être demandées : ainsi, les quatre études de débouché portent avant tout sur les GMS et n'envisage guère d'autres modes de commercialisation. Cette étroitesse de vues limite aussi l'intérêt des études. Les chercheurs ont été sollicités plutôt pour cautionner des stratégies dessinées en leur absence que pour délivrer un avis éclairé.

Aussi est-il difficile d'identifier des apprentissages mineurs pour lesquels le rôle des chercheurs aurait été déterminant. Quant aux apprentissages majeurs, qui déterminent la logique d'action, nous avons vu qu'ils étaient déjà acquis avant la moindre intervention d'un chercheur. L'attitude désinvolte envers les recherches se retrouve chez des personnes que nous avons interviewées, en tous cas au début de l'entretien, et confirme cette impression « *c'est une étude de plus* » (interview n° 4).

Conclusion

Ce cas donne l'occasion de montrer la manière dont un groupe a procédé pour ne pas apprendre, malgré les études qu'il demandait, ce qui pouvait déranger sa logique initiale. Le groupe a cependant progressé et appris dans certains domaines, puis la confrontation au marché (les essais de vente en grandeur réelle en GMS en 2004) ont remis en cause une partie de la logique initiale. Cependant, beaucoup de temps et d'argent ont sans doute été perdus. Or toutes ces études ont été financées par des fonds publics. De fait, ce papier interpelle la libéralité des subventions publiques envers les organisations d'agriculteurs. D'autant plus que les premiers membres de l'association Cowcheese, fondée en 1990, ont eux aussi bénéficié d'un grand nombre d'études financées de la même manière. En effet, ces subventions abondent des études successives et désordonnées, pour la plupart non exploitées par les demandeurs. Plutôt qu'une telle libéralité, nous suggérons le bien-fondé d'une assistance afin de conduire un vrai processus de « recherche de problème » (Pounds, 1969) en vue d'un réel consensus entre les participants. Comme nous l'avons vu, il s'agit d'un cas « mal structuré », où la « recherche de problème » prend tout son sens (Mitroff and Emshoff, 1979), bien qu'elle ait été conçue pour de grandes organisations. Il s'agira d'examiner avec attention la stratégie envisagée, afin de découvrir les hypothèses sous-jacentes (comme nous l'avons fait en découvrant la formule rigidifiée de Cowcheese). Ensuite, on constitue un ensemble de

contre-hypothèses, opposées à celles sur lesquelles la stratégie initiale a été basée. Chacune des hypothèses précédemment identifiée est reformulé en contre-hypothèse. Elle est abandonnée si elle se révèle non plausible. L'ensemble restant est enfin passé au crible comme base potentielle pour définir une stratégie entièrement nouvelle. A la fin de cette phase, on a atteint le maximum de diversité d'options stratégiques. Un tel processus participatif éviterait des pertes de temps et d'argent, sur les voies sans issues auxquelles conduit parfois la formule rigidifiée. Même loin des orientations paternalistes, le développement rural ne peut pas se passer de méthode.

Annexe I : Comment établir la formule rigidifiée ?

La reconstitution de la logique actuelle du groupe Cowcheese a été effectuée à partir de six interviews conduites les 22 et 29 mars 2004, à domicile, auprès de six exploitants engagés dans le projet. Nous avons posé les hypothèses suivantes, principalement empruntées à l'approche interprétative des Conventions. Cette logique se compose de croyances du type III de Boudon (Boudon, 1999), c'est-à-dire de type normatif et appréciatif. Pour se coordonner, ces six personnes se sont dotées d'un modèle d'évaluation (Batifoulier, Thévenon, 2001) dont nous faisons l'hypothèse qu'il s'agit d'une éthique au sens de Thévenot (Thévenot, 1993), soit la déclinaison d'une conception universelle de la justice à un bien commun local. Pour construire un outil de détection de la logique actuelle du groupe, nous utilisons la grammaire de la justice découverte par Luc Boltanski et Laurent Thévenot (Boltanski, Thévenot, 1991). L'une des conditions pour recueillir des affirmations ou des infirmations des axiomes est de faire produire un discours de justification, par lequel l'interviewé tente de justifier sa conduite ou de dégager sa responsabilité. L'ensemble des affirmations sur le monde se présentent ainsi (les signes entre parenthèse désignent le nom de l'axiome auquel l'affirmation renvoie) : Je fais partie d'un groupe (a1) pour lequel existe un bonheur, qui est un bien. Tout le monde dans ce groupe a la capacité, la dotation nécessaire (a3) pour contribuer à ce bonheur. Au sein de ce groupe, il y a ceux qui sont proches du bonheur, « les grands » et ceux qui en sont loin « les petits » (a2). Pour se rapprocher de ce bonheur, il faut faire un sacrifice (a5). Si quelqu'un fait ce sacrifice, il va se rapprocher de ce bien, donc devenir plus « grand » (a4). Se rapprocher du bonheur va aussi profiter à ceux qui en sont éloignés, les petits, parce que ce bien est un bien commun (a6). Cette méthode a été exposée par ailleurs de manière détaillée pour un cas général (Macombe, 2004) et pour le groupe Cowcheese (Macombe, 2005).

Annexe II : La formule rigidifiée est ancienne (demonstration)

Les quatre résumés de documents suivants permettent de retrouver et dater les traces des apprentissages majeurs.

Rencontre du bureau du Comité de Développement avec les anciens Cowcheese le 25/07/2000
Conscience des menaces sur la production laitière et de la position non-concurrentielle de la région (BCL) (Group).
Le pari des hommes plutôt que de l'agrandissement (BCL) (CAHIER).
La perte que représente pour la région la disparition des exploitations de vente directe en lait (BCL).
Création d'outils collectifs de transformation serait une piste de valorisation (FRUIT).
Les systèmes d'exploitation locaux « *apparaissent aujourd'hui comme incompatibles avec les évolutions de l'agriculture qui tendent vers des exploitations extensives* » (CAHIER).
Veulent étendre la démarche d'identification de la fraise du Pays lyonnais au lait.
Ils veulent réfléchir sur les différentes pistes de développement possibles.
Première mention des GMS comme cible d'un groupe de producteurs de fromages de chèvre fermiers (GMS).
Décisions :

Etude de l'offre (motivation des producteurs) : état des lieux de la production laitière sur la zone, évolution de la production sur 10 ans, recherche d'initiatives similaires (voyage).

Dans ce premier compte-rendu, il est manifeste que l'intégration du bien commun local est déjà faite dans les mentalités et que des jalons sont posés pour que le futur cahier des charges de production intègre l'agriculture locale telle qu'elle est.

Compte-rendu voyage dans l'Aveyron de décembre 2000 le 06/02/2001
Logique de Jeunes Montagnes, à Laguiole : « sortir de la logique d'être des apporteurs de matière première, redevenir responsable de son métier, être à l'origine des choses, être autonome ».(CONVIC)
Le veau d'Aveyron et du Segala « **95% des ventes en GMS dont 75% Auchan (atypique car on garde notre Valeur Ajoutée) campagne de promotion réalisée par les éleveurs,** rigueur irréprochable du produit. » (GMS)

Les sujets des 5 visites sont bien adaptés, par leur dimension et leurs supports (produits agricoles bruts, transformés, artisanaux) au cas de Cowcheese. Il est étonnant de voir quelles lectures sélectives en fait le groupe. Leur conclusion exclut trois possibilités qui seraient intéressantes pour Cowcheese : travailler sur la proximité (exemples de viande de bœuf vendue localement), la démarche Laguiole (Fromages) « *S'appuyer sur le tourisme, créer des synergies entre les différents produits issus de la région, rechercher et identifier les points de cohérence entre les différents ingrédients qui composent le territoire.* », et la mise en réseau (au sujet d'un couteau) « *les personnes à l'instigation du renouveau ont dit : il faut tout faire sur le couteau en s'appuyant sur le réseau de relations (café/Paris)* ». Dès cet instant, des pistes de commercialisation prometteuses sont écartées, au profit d'une affirmation du choix des GMS pour la commercialisation.

Compte-rendu du 23 mai 2002 de trois rencontres d' entreprises laitières du 5 avril 2002
Rencontre des acheteurs actuels du lait industriel. D'après les interviews, Danone a affirmé ici sa politique de marques et son désintérêt pour une démarche spécifique locale (CONVIC).
Le compte-rendu rapproche la démarche de la coopérative avec celle du groupe Cowcheese : « *L'échange a permis de comprendre le positionnement stratégique de la laiterie de V. avec une gamme restreinte de produits frais commercialisés sur le bassin de consommation de proximité ( ) La réflexion conduite par [nous] démontre que les orientations prises (gamme de 4 fromages, 1 beurre et du lait frais) sont fondées sur des logiques similaires à savoir : la recherche d'une valorisation sur le marché de proximité.* » Opportunité de l'engagement avec un fromager (FRUIT)
Assimilation de l'idée de GMS avec celle de proximité « *réseau de commercialisation de proximité (GMS, petits détaillants)* » (GMS)
Les éleveurs affirment vouloir un ancrage au territoire, contrairement à la coopérative de V.(BCL).

La nécessité d'une démarche spécifique locale est affirmée (CONVIC).

Ce document montre que la gamme des produits à fabriquer n'est pas arrêtée mais que l'idée de la fruitière gérée par un fromager est déjà en place (FRUIT). L'assimilation de la vente en GMS avec la vente en proximité vient légitimer le choix des GMS comme débouché.

Compte-rendu Journée de travail du 5 avril 2002 à Av…
Les finalités énoncées pour le projet, lors d'un tour de table, confortent l'idée que le bien commun local est en place : « *maintien du plus grand nombre d'exploitations agricoles, une production laitière identifiée au territoire, reprendre du pouvoir dans la filière lait.* »(BCL)
Souci de la marque collective à trouver.
L'idée de la fruitière fait son chemin : « *Associer à la réflexion un fromager (partenaire pour ses compétences et sa logistique) (--) pour être maître du produit, il paraît difficile de travailler avec les entreprises. A plus long terme, création d'un outil de transformation collectif (**fruitière**) où une partie du quota des exploitations pourrait être livré.(--) Cet outil paraît essentiel pour transformer un produit [local, localement].* » (FRUIT)
La gamme des produits à fabriquer est toujours très ouverte (fromages en caillé lactique, beurre, lait)
Pour la commercialisation :
« *L'idée de travailler sans les grandes surfaces paraît exclue. Mais peut-on travailler avec toutes, ou ne faut-il pas avoir un partenariat avec une seule enseigne (c'est le cas du veau de l'Aveyron : une seule enseigne et une forte implication des producteurs) ? L'animation en grande surface paraît légitime et nécessaire dans un souci de communication. Associer les élus à la négociation avec la grande distribution.* »(GMS)
Cahier des charges de production :
« ***Accès de tous** à la démarche, sur la base du volontariat ; charte commune sur la base du cahier des charges lait de montagne (charte des bonnes pratiques, ration avec toujours une part d'herbe, pâturage) ; travail **sur la base des systèmes d'exploitation [locaux]*** ». (CAHIER)

Ce quatrième compte-rendu est particulièrement clair sur les éléments de la logique qui sont en place à ce stade : (BCL), (FRUIT), (GMS) et (CAHIER). En revanche, la gamme de produits commence à peine à se dessiner et aucune question n'est posée sur le type de consommateur que ces produits pourraient viser. Cette question ne sera abordée dans aucun des documents traces. Il semble que l'idée de commercialiser en GMS tienne lieu de repérage des consommateurs, qui seront simplement « les clients des GMS ».

Annexe III : Résultats des études et apprentissages mineurs : un écart

Nous repérons ici les demandes d'études et les conclusions tirées afin de mettre en évidence les apprentissages que ces études ont pu générer.

Liste des études successives faites pour Cowcheese de 2002 à 2003

Nom étude	Date et repère	Organisme	Nature du document remarques
Quelle stratégie pour la valorisation de la production laitière [locale] ? Données concernant le marché français des produits laitiers	Avril 2002 A	Ecole d'ingénieurs	Etude orientant l'intérêt sur les pâtes molles et persillées en GMS Etude nationale (2000) sur la consommation de produits laitiers et surtout de fromages de vache, avec zoom sur les pâtes molles et persillées, et parts de marché aux rayons libre-service et coupe des GMS.
Quelle acceptabilité des consommateurs pour une gamme de produits laitiers [locaux]	Avril 2003 B	Ecole d'ingénieurs	Etude des positions des consommateurs sur l'image, intérêt pour le projet, et appréciations portées sur la gamme, les lieux de communication envisageables, la communication et les emballages. Plus conclusions sur test de dégustation. Etude à partir de 2 réunions de groupe (11 et 12 personnes) d'amateurs de fromages lyonnais et stéphanois.
Résultats du test quantitatif sur les caractéristiques organoleptiques [de 4 fromages]	Mai 2003 C	Ecole d'ingénieurs	Etude livrant les résultats d'un test organisé à la foire de Lyon, de 7 fromages et une faisselle goûtés par 50 consommateurs chacun. Sont aussi disponibles des informations sur la perception des noms de produits, l'évaluation des prix et des lieux d'achat possibles.
Faisabilité du Référentiel de l'Agriculture Raisonnée dans les exploitations laitières [locales]	Janvier 2003 D	Ecole d'ingénieurs	Etude à base de 48 audits d'exploitations laitières réparties sur 3 cantons.
Les Fromonts du [-]	Juillet 2003 E	Entreprise de communication	Note d'intention et de préconisation stratégique qui présente des exemples d'étiquettes et d'emballages
Projet Lait – relevé de linéaires	Juillet 2003 F	Chambre d'agriculture	Etude complémentaire aux études B et C portant sur des produits (prix, poids, matière grasse, emballage, mentions communicantes) équivalents à ceux de la gamme projetée.
Radiographie de la production – Enquête auprès des producteurs.	Octobre à décembre 2003 G	Chambre d'agriculture	Enquête sur 26 exploitations potentiellement intéressées pour s'engager dans la démarche de livraison pour la fabrication artisanale des fromages de la gamme.
Etude de marché pour une gamme de fromages « [X]»	Octobre à décembre 2003 H	Chambre d'agriculture	Enquête auprès de 6 grossistes, de 9 crèmeries et de 8 GMS pour l'acceptation de la gamme.

Lait cru : atouts et contraintes	Mars 2003 I	GIS (Groupement d'intérêt scientifique)	Exposé pédagogique des avantages et contraintes de la production de fromages à partir de lait cru. Présentation du lait cru et de son utilisation en fromagerie

Etude A : Quelle stratégie pour la valorisation de la production laitière de L. ? Premières données concernant le marché français des produits laitiers

Il n'y a pas trace de commande pour cette étude. Elle est restituée devant les éleveurs le 05/04/2002 et relatée dans le « compte-rendu Journée de travail du 05/04/2002 ».

Un technicien effectue une présentation des différents produit laitiers existants sur la zone (fromages, beurre, lait) puis un enseignant chercheur restitue ses résultats (étude A), à l'aide

de transparents et anime des travaux en sous-groupes. Nous avons peu d'éléments sur ces travaux, mais il est possible de comparer les conclusions de l'étude avec celle du compte-rendu de la restitution et des travaux de groupe. Il est possible de voir de cette manière ce que les éleveurs ont retenu de l'étude.

Conclusions de l'étude A	**Conclusions du compte-rendu**
Etude nationale (2000) sur la consommation de produits laitiers et surtout de fromages de vache, avec zoom sur les pâtes molles et persillées (dont les marchés sont en légère baisse aussi bien en libre service qu'à la coupe) et parts de marché de différents fromages aux rayons libre-service et coupe des GMS. Note 414 références au rayon libre-service d'un hypermarché. Note que le marché des pâtes pressées cuites est en stagnation, alors que le marché des pâtes pressées non cuites est assez stable.	« Souhait de travailler sur une gamme de produits laitiers (existants) qui mette en avant [le local] sous couvert d'une marque collective ». « Cette gamme serait fermée et composée des petits fromages ronds, des apéritifs, des fromages blancs, du M. (fermier + laitier), du beurre et du lait (de consommation). Cette gamme serait fermière et laitière (à préciser selon les produits). » *Un certain nombre de points seront à travailler sur la cohérence et la spécificité de la gamme et donc sur les caractéristiques de chacun des produits :* *-les fromages : quelle technologie (caillé lactique ou présure) a priori il semble préférable de partir de ce qui existe déjà en production fermière sur le secteur, c'est-à-dire un caillé lactique, quel(s) nom(s) ? quelle taille (type Rigotte et/ou Margueton) ?* le beurre ; - le lait.

L'étude a servi de support de discussion pour le groupe d'éleveurs, mais aucune de ses conclusions n'a, semble-t-il, été retenue. En particulier, ni la contraction des marchés ni le très grand nombre de références ne sont mentionnés dans les travaux.

Etude B : Quelle acceptabilité des consommateurs pour une gamme de produits laitiers [locaux] ?

Lors du « compte-rendu Journée de travail du 05/04/2002 », le rédacteur note « *à faire : se renseigner sur les crémeries haut de gamme de la région lyonnaise et leur aptitude à commercialiser un lait identifié. Se renseigner sur la grande distribution : Christine M. pourrait intervenir pour présenter une approche des GMS.* »
Lors de la mise en place des groupes de travail (document 5 du 02/08/2002) il est noté parmi les objectifs du groupe 2 (chargé d'étudier et de proposer une stratégie commerciale spécifique au projet) : « *travailler avec des prestataires extérieurs (Université de Clermont, ISARA…) sur la conception d'une stratégie commerciale adaptée à nos besoins.* » Les études B et C sont dans la lignée de ses desiderata.
L'étude B est réalisée en interrogeant deux panels de consommateurs amateurs de fromages. Les principales conclusions réclament davantage de régularité dans la fabrication et portent sur la composition de la gamme prévue, qui paraît cohérente, sauf que le lait de consommation ne semble pas s'imposer et qu'il faudrait introduire des fromages de chèvre (ce qui n'est pas envisagé). Le lait cru n'apparaît pas comme une exigence indispensable (mais les éleveurs vont choisir de maintenir cette exigence). Le nom prévu pour la gamme est unanimement rejeté. Les consommateurs n'excluent pas la commercialisation en GMS, au motif que la présence en GMS n'est pas incompatible avec l'image artisanale de la gamme. Les circuits de distribution conseillés, au sein de la GMS, sont variés : « *avec une implantation plutôt au rayon coupe pour le M., au rayon coupe et au libre-service pour la Rigotte, au libre-service uniquement pour les faisselles et les cônes apéritifs.* » En réalité, les essais de commercialisation de 2004 vont se dérouler en rayon libre-service uniquement.

Il est à remarquer que l'étude a été commanditée avec l'idée que la commercialisation se ferait principalement en GMS. Il ne peut donc pas y avoir d'apprentissages portant ni sur la clientèle réellement intéressée par les produits, ni sur les lieux opportuns pour la commercialisation, puisque aucune question n'est posée à ce sujet.
De quels résultats de l'étude les exploitants ont-ils tenu compte ? Ils ont tenu compte des remarques concernant l'hétérogénéité des fromages, et changer de fromager. Ils ont renoncé à l'idée de vendre du lait cru. Ils recherchaient déjà un autre nom pour les fromages avant que ne soit signalée l'inadéquation du nom proposé pour la gamme.
Etude I : « Lait cru : atouts et contraintes » et Etude C : « Résultats du test quantitatif sur les caractéristiques organoleptiques des Rigottes, M., cones et faisselles »
et étude F « Projet Lait – relevé de linéaires »
Dès le document du 25/02/2003, est fait mention de « l'étude qualitative ISARA » puis d'une demande de confirmer l'analyse des avantages et inconvénients de chaque système (lait chaud cru, lait froid cru, lait pasteurisé, lait microfiltré).
Les résultats de l'étude C sont connus en mai 2003. Il s'agit d'un test quantitatif, organisé à l'occasion de la foire de Lyon (mars 2003) et mené par les éleveurs (nous avons un document de préparation du planning des présences sur la foire) avec l'aide de l'ISARA, pour apprécier huit fromages déclinés selon différents processus de fabrication : utilisation d'un lait cru (chaud ou refroidi) et d'un lait pasteurisé. Chaque produit a été évalué par 50 dégustateurs néophytes différents. Les prix de vente proposés sont également testés.
Cette étude recommande l'utilisation du lait cru et de mieux maîtriser la fabrication. Il est probable que la décision de travailler en lait cru a été renforcée à ce moment là.

L'étude F « Projet Lait-relevé de linéaires » a été commandée en complément « de l'étude qualitative et quantitative réalisée par l'ISARA sur la cohérence de la gamme et la qualité

des produits ». Elle « *a pour objectif de fournir un certain nombre d'éléments sur des produits équivalents à ceux de la gamme, présents en grande distribution.* » Les principales recommandations sont de présenter tous les produits de la gamme au rayon coupe, et regroupés afin de créer une synergie. Le rayon libre service connaît une forte concurrence pour tous les produits de la gamme (sauf les fromages apéro) et ne peut convenir qu'à condition « *de respecter certains formats, de tirer vers le haut de gamme et d'avoir une communication parfaitement identifiée et identifiable*. » L'hétérogénéité des prix proposés autorise à fixer assez librement ceux de la gamme. Il est aussi conseillé de réfléchir sur le développement des fromages apéro, assez bien valorisés. Suivent des recommandations pour le type d'emballage et les formats à rechercher. Concernant la communication, il est dit que le consommateur ne paraît pas sensible aux mentions portant sur l'origine de l'alimentation animale. Les mentions qui permettent au consommateur de différencier produit artisanal et industriel sont relevées.
Aucun de nos documents ne portent trace des résultats de cette étude. Il est donc difficile de dire si les partenaires en ont tenu compte ou non. Les résultats sont peut-être arrivés trop tard. Dans le document au sujet du cahier des charges, logo et étiquettes, de juillet 2003, la gamme de quatre produits est décrite, en précisant qu'ils seront dans un premier temps commercialisés au rayon coupe/traditionnel, mais que l'on peut tout à fait imaginer par la suite qu'ils soient au rayon libre service. En réalité, le test grandeur nature de l'été 2004 se fera en rayon libre-service.

Etude D : Faisabilité du Référentiel de l'Agriculture Raisonnée dans les exploitations laitières [locales].

Dans le compte rendu daté du 02/08/2002, sont récapitulées les tâches des différents groupes de travail dont les promoteurs du projet se sont dotés. Le Groupe 1 (dont le rôle est d'étudier et de proposer des orientations concrètes sur les thèmes : production laitière et spécificité locales ; transformation fromagère) fait mention de cette étude D parmi les objectifs : « *étudier et proposer la faisabilité d'un cahier des charges d'après le décret agriculture raisonnée, le projet lait de montagne de la FNPL*[2]. »
Les conclusions de l'étude, rendues en janvier 2003, montrent que le cahier des charges agriculture raisonnée ne peut pas s'appliquer en l'état. Les éleveurs vont en tenir compte, puisque ensuite, il n'est plus question de tenter ni d'adopter ce cahier des charges, jugé « hors de portée », ni d'adapter les exploitations dans l'immédiat. Ce n'est pas un problème important, comme en témoigne l'interview n°2.

Extrait de l'interview n° 2 :
« *- Pour en revenir à ce projet de transformation de fromages, est-ce que vous seriez prêt à remettre en cause votre système ?*
- Le système fourrager j'étais dans les clous du cahier des charges, bon après les évolutions…c'était pas le dossier le plus brûlant, on a d'autres soucis… »

Etude E : Les Fromonts du [.]
Le statut de ce document est mixte. Il s'agit à la fois d'une étude qui entend livrer des « préconisations stratégiques » et d'une proposition commerciale pour la communication du projet. Les prix des prestations possibles sont d'ailleurs précisés dans l'étude.

[2] FNPL : Fédération Nationale de la Production Laitière

Lors de la réunion commerciale et marketing du 11/06/2003 le très gros travail de réflexion sur la communication fourni par Cowcheese est mis en évidence. En fait, trois agences ont répondu au cahier des charges. Un document rappelle quelle agence a été sélectionnée, après audition le 24 juillet. Il s'agit du porteur de l'étude E (lettre de confirmation de commande du 8/09/2003).

Etude G : Radiographie de la production – Enquête auprès des producteurs.

D'après le document du 25/07/2000 : Rencontre du bureau CDML avec les anciens Cowcheese :
« *Les responsables du Comité de Développement décident de s'organiser pour connaître les motivations actuelles des producteurs de lait [de la région] sur une telle démarche. Il est proposé de présenter cette initiative au conseil d'administration du CDML de septembre, de prévoir pour le premier trimestre 2001 un état des lieux de la production laitière sur la zone (mémoire de fin d'étude d'ingénieur) (--)* »
Ce travail d'enquête et son analyse seront effectivement conduits d'octobre à décembre 2003. Il s'agit de « *faire un point sur les exploitations, les volumes disponibles, les conditions de production, les évolutions envisagées* », de « *repérer comment les éleveurs vivent la production laitière, leurs motivations générales, les questions qu'ils se posent, leur degré d'implication dans la filière et leur vision de l'avenir.* » et « *d'évaluer leur engagement potentiel dans la suite du projet lait* ». Il donnera lieu aux conclusions suivantes :
18 exploitants sont prêts à s'impliquer personnellement dans le projet, dont 17 à livrer du lait. Pour ce qui est des autres engagements, ils sont conditionnés par « l'avancement du projet et sa réussite ». Les producteurs voudraient, pour se projeter dans l'avenir :

- connaître la construction finale du projet (coûts de l'outil, trouver l'usine)
- être sûrs des débouchés commerciaux
- connaître le prix du lait
- connaître les conditions d'organisation du ramassage…etc.

Cette étude met en évidence que les éleveurs ont besoin de précisions avant de s'engager. Elle pose indirectement des questions sur des aspects essentiels du projet (comment réaliser concrètement le stockage, comment ramasser le lait, quelle est la taille de l'outil visé, quelle valorisation commerciale espérée…)

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Farmers Begin to Invent Water Saving Cultivation in Northeast Thailand

Masato Oda [1], Uchada Sukchan [2] and J. S. Caldwell[1]

[1]Japan International Research Center for Agricultural Sciences, Tsukuba, Ibaraki, Japan
[2]Department of Agriculture, Khonkaen, Khonkaen, Thailand

Abstract
We have developed the Invention Model, a new model for Farmer Participatory Research (FPR). With this model, farmers developed technologies to grow tomato using a small amount of applied water in the dry season. First, the researchers provided incomplete technology as knowledge transfer technology (KTT). Ten farmers first copied the KTT and then created 44 new technologies on 56 plots on their own initiative. Farmers independently experimented with watering before transplanting, transplant hole size, seedling quality, and bottom soil use.

Introduction

In Northeast Thailand, farmers have believed that vegetables need a vast amount of water. We begin with the objective of developing water-saving production technology for vegetables in the dry season. Initially, using plastic mulch, we succeeded in growing tomato with less than 5 mm total applied water over the crop cycle of 110 days. But we knew that plastic mulch is not desirable environmentally, and is too expensive for poor farmers. Then, we went on-farm with a new approach to technology generation. After only one season using this approach, farmers have invented new technologies by themselves. In this paper, we will explain our new approach and analyze why it enabled farmers to be successful as innovators and generators of technology.

The farmer participatory approach (FPA) is widely used for technology verification and adaptation, but many scientists and research administrators have negative opinions about Farmer Participatory Research (FPR). From their perspective, most of the methods of FPA leave less scope for creativity by both farmers and researchers. FPR appears to be simply a new method of extension that may facilitate better adaptation of technology to local conditions but creates no new knowledge. In the 'Selection Model,' our term for what others have called the "menu" or "basket" approach (Connell, J. G.. 1992), the role of farmers is primarily to select which technology to test from a set of technology options. The role of researchers is to select the technology options to present. The Selection Model is not suitable for the development of new technologies. Selection is not creation. Follow the principle of 'Farmer First' (Chambers R.), farmers themselves should develop new technology. On the other hand, usually researchers think their job is to provide as complete a technology as possible for farmers. But this leaves little room for farmers to create. On the other hand, if the technology offered by researchers is incomplete; it becomes necessary for farmers to modify it to be able to use it. If the technology is primitive, it is easy to modify. The most incomplete and primitive type of technology is pure knowledge.

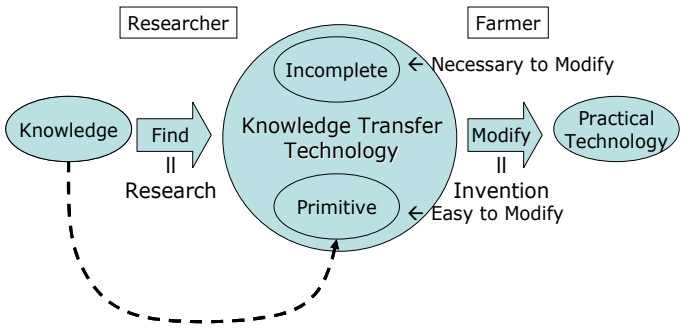

Figure 1. Use of incomplete technology

Researchers find new knowledge through scientific research and make incomplete technologies to transfer the new knowledge to the farmer. Farmers then modify the incomplete technology through invention to create practical technologies. This is the basic idea of what we call the 'Invention Model.' We call this incomplete technology 'Knowledge Transfer Technology (KTT)' (Figure 1).

Invention Model

In a typical Mother-Baby Trial design based on the Selection Model (Rusike 2004), the Mother trial has many plots with different technology alternatives. Baby trials are established on farmers' fields, based on farmer selection of technologies that farmers want to test. Baby trials typically have more than 1 plot, but fewer plots than the Mother Trial. Fig 2 is a modified Mother-Baby Trial Layout. In our modification, the Mother trial has only 1 or a few plots with incomplete technologies. First, farmers receive knowledge by copying the incomplete technology in their fields. Then, farmers establish grandchildren plots with new technologies that are created by farmers' invention. The number of grandchildren plots is determined by the ideas, interest, and time of each farmer. In this modification, we can thus start from a very small size and a very limited technology. Replications are not necessary in this design. We have to distinguish between the science of knowledge generation and the science of analysis. To generate new knowledge, we need to cast the net wide, opening the domain of possible new ideas and innovations as wide as possible. Then we can examine the ideas and innovations that emerge, identify what is most important, most innovative, and from there begin to analyze, determine causes, and assess how universal the new knowledge is.

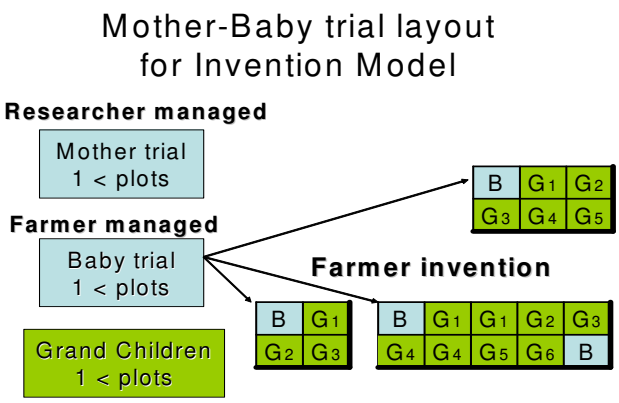

Fig 2. Mother-Baby Trial Layout

From the view point of the learning process, copying and reproduction of incomplete technology result in deeper understanding of knowledge than simple selection of complete technologies. And invention of complete technology through creation using incomplete technology "building blocks" requires the highest level of understanding.

FPR is an excellent approach for using farmers' knowledge, but the way it uses farmers' knowledge is different from the Invention Model. In the Selection Model, farmers' knowledge is used in selection among alternatives and in adapting them to local conditions. In the Invention Model, however, farmers' knowledge is used to produce new knowledge.

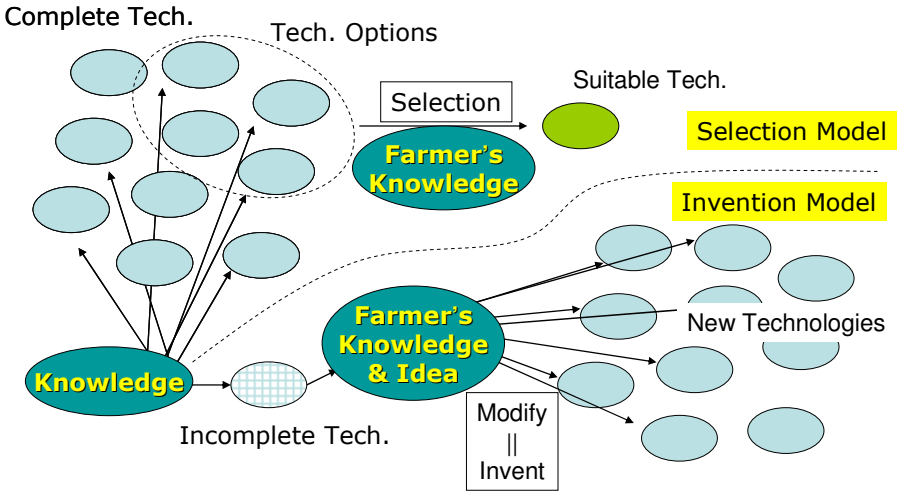

Fig 3 Differences in Uses of Knowledge between Selection and Invention

Moreover, not only farmers' knowledge but also farmers' ideas are combined with the researcher's knowledge that is carried by KTT. This increased information can be effectively used in the researcher's analysis. Of course, some technologies can still be used for extension following the Selection Model. For the above reasons, the Invention Model is very powerful for developing new technologies, and at the same time has an educational value as well (Fig 3).

Trial implementation

We took new knowledge expressed as, 'If we use plastic mulch, we can grow local tomato under conditions of almost no watering even in the dry season in Northeast Thailand.' and developed it into practical technologies using: (Figure 4)

- Plastic mulch or straw mulch
- Drip irrigation tape and a 20 L Tank for a 20m long experimental plot
- Watering schedule: 0,2,4,8, and 12 weeks after transplanting, each time using 20 L of 1/1000 12-9-6 liquid fertilizer
- Cooperative seeding

Figure 4. KTT

Straw mulch was added as a hidden message of the researcher to consider any and all changes of mulch materials. The white plastic mulch is a perfect incomplete technology because it is not sold in Thailand. The quality of seedlings is very important in water saving cultivation. To distinguish the effects of treatments, the quality of seedlings should be the same in all treatments. Cooperative work promotes friendship and solidarity among farmers in the group.

Researcher's statements are apt to accept no considerations by farmers. We didn't reply to questions about the researcher's expectations for results of the experiment and took care not

to give additional knowledge that might reduce the farmer's need to think on her/his own and innovate. Additional researcher's knowledge will become useful after the first trial.

Results and Discussion

Participants and modifications

We had a total of 10 participants. The experiment was carried on 9 fields (1 field was used by 2 farmers). The total number of plots was 56, and the number of the treatments was 44. An additional 5 farmers observed the experiments.

The new knowledge was accepted by farmers not because it was water saving, but rather because it was labor saving. The farmers were interested and tried to be conscientious, but they did not have adequate time to take good care of vegetables because of labor conflicts with sugar cane harvesting.

The two incomplete technologies provided by the researcher were modified to produce 44 new technologies by the farmers. All 44 technologies involved modifications in water or fertilizer management. The second most common modification, in 63% of the technologies, involved mulching materials. The third most common was means of watering, 39% of the technologies. In 25% of the technologies, farmers changed the crop to chili pepper (Table 1).

Table 1 Directions of farmers' modifications of incomplete technology

Direction	Fields (9)	Plots (56)	Note
(Baby Trials)	8	12	Farmer watering by hose before transplanting
Management	9	44	Watering Max 30 times
Materials	9	28	Include 10 un-mulch plots
Means of Watering	6	17	Furrow, hose, dipper, sprinkler
Crop	7	11	Chili pepper

Yields and level of water saving

Monthly rainfall in Nong Saeng Village during the experimental period of October 2004-April 2005 was 0, 0, 2, 0, 0, 6, and 6 mm, respectively. There were a total of 44 technologies. In 20 of these, farmers achieved yields equal to or above average local yields. These included 6 rice mulch plots and 3 unmulched plots. In addition, 2 rice mulch plots and 2 unmulched plots received only 6 to 11 mm of applied water over the crop growth period. The recommended level of irrigation for tomato in Northeast Thailand is 534 mm (Saenchan 1997). In this trial, 84% of the plots received less than 30 mm of applied water, and 82% of the plots were watered less than 10 times.

Farmers' ideas

Fig 5 Double Tube

Fig 6 Center Flood Irrigation

Fig 7 'Pre-plant Watering'

Farmers came up with a host of innovations. The following were especially useful:
Double Tube. Usually farmers plant 2 rows on a ridge. But in water-saving cultivation it is difficult to water 2 rows from a single drip tape line. A farmer came up with the idea of using twin lines tapes on the same ridge (Figure 5).
Center Flood Irrigation. Furrow irrigation is a common technology in this area. One farmer came up with the idea of digging a small furrow in the center of the ridge. She was able to irrigate about 30 m length of row, applying about 10 mm per time (Figure 6).
Pre-plant Watering. In water saving cultivation one major problem is that initial plant growth varies widely. One farmer decided to water the ridge before transplanting and succeeded in growing tomatoes with much variation among plants (Figure 7).

Experiments initiated and carried out by farmers that the researcher had also intended to do

Watering before transplanting for stabilization of growth. This was a farmer idea described in the previous section.
Effect of the size of transplant holes in the plastic mulch. One farmer compared the effect of the size of transplant holes in the plastic mulch. Her treatments were a round hole with a diameter of 10 cm and a simple slit in the plastic. The result was that there was no difference (Figure 8).
Effect of seedling quality. Farmers assessed the effect of the quality of seedlings by comparing standard plug seedlings and large seedlings with small roots mass. About half of the leaves of the large seedlings died after transplanting, whereas standard seedlings retrained their leaves (Figure 9).
Bottom soil use One farmer made a trench in the soil and tried to use the wet bottom soil directly for unmulched water-saving cultivation of chili pepper, but she was unsuccessful. This suggests that a dry soil surface keeps soil moisture just like plastic mulch, but if we turn the soil, we loose the protective effect, and soil moisture is rapidly lost (Figure 10).

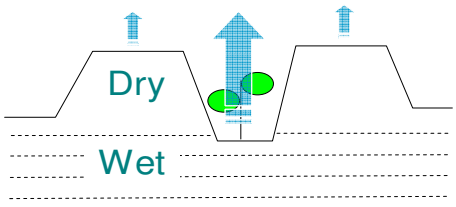

Fig 8 Transplant hole size Fig 9 Seedling uniformity **Fig 10 Bottom soil use**

The above farmers' research initiatives enabled the researcher to reduce the number of researcher-initiated trials. It also leads the researcher to shift research targets. Initially, we thought that plastic mulch would be necessary for water saving cultivation. The essential points were to find appropriate mulch materials and to determine how much water each material would need for successful tomato production. But we found that mulch materials are not necessary. Even without mulch we obtained yields greater than the average local yield. So

we changed the focus of research and surveyed field conditions. Secondly, we assessed the quantity of the watering depending on fertilizer level in water saving cultivation. But fertilizer had no effect on yield. From this, we identified a new research theme, fertilizer saving methods.

Farmer Evaluation

We have carried out two farmers' evaluations so far. The first time was held at the village center in February 2004 just after the initial experiment. At that time the atmosphere was more formal. The second farmers' evaluation was held at a farmer's house in February 2005. We prepared color photographs of each field and results of analysis of watering, fertilizer and yield in handouts. The atmosphere was less formal, and the level of participation in the discussion was much higher (Box 1)

Box 1. An example of farmer analysis in an evaluation meeting

Ampohon: Why the growth of tomato was different between the front and the back halves of the ridge?
Somjit: I think the position of the water tank was the reason why. For a sloping ridge, the water tank must be placed at the higher end of the edge.
Lau: I saw different growth in tomato plants in an ordinary flat field. It seems to me that the difference was not due to placement of the tank of water. Even where each plant was watered by a dipper, I observed the same differences.

Farmers' evaluations focused largely on water, fertilizer and the mulch materials, but they covered a very wide range of factors. Types of factors cited by farmers in evaluation of water-saving trials are as follows. Materials (drip irrigation tape, plastic mulch, straw mulch), fertilizer (quantity, type, usage), watering (frequency, effect of excess), location, topography, soil (moisture, hardness, type, structure, effect of the plowing method), leaf color, fruit (color, taste, softness, specific gravity, storability, effect of harvest frequency to yield) , roots (shape, activity) , weed (preceding crop, last years' land use, plowing timing) , disease, labor and market. Farmers came to the conclusion that they could carry out water saving production without plastic mulch and only needed straw mulch. Farmers also said they in the first trial they were reluctant to try more radical water-saving techniques, but after the better–than-expected results in the first time, in the next trial, they want to take on the challenge of testing more radical techniques.

Conclusion

The Invention Model is a new method of FPA is useful for developing new technology rapidly. It avoids duplication of researcher efforts because farmers anticipate many experiments that researchers want to do. It also leads researchers to focus their efforts on new problems. It has a deep and sustainable educational effect, leading farmers in trial evaluations to consider all aspects of production, the plant, the crop environment, and socio-economic environment. Finally, it opens the scope for creative work by both farmers and researchers, and thereby addresses the concerns and criticisms of many scientists and administrators that FPA is only extension. The Invention Model is knowledge generation, not just knowledge transfer or adaptation.

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From Reductionism to Farmer Innovation Systems: Implications for Multi-Stakeholder Collaboration and Learning in Uganda

Chris Opondo, Joshua Zake, Ann Stroud, Joseph Tanu, Ronald Lutalo, and Rogers Kanzikwera

African Highland Initiative, Environmental Alert, CGIAR, NARO

Abstract
Research strategies have tended to be overtly commodity focused when promoting agricultural development as has been evident in the strategies for Green Revolution. These strategies have limited impacts on the intended beneficiaries as the complexity of their livelihood and farming systems is ignored. The African Highlands Initiative (AHI) Environmental Alert (EA), African grassroots innovations, livelihoods and Environment (AGILE) and the National agriculture Research organization (NARO) in Uganda have championed participatory research approaches (such as use of integrated and multidisciplinary teams, promotion of participatory research and farmer- led innovations processes, multi-institutional collaboration for synergistic partnerships among others) to embrace farmer innovation systems and contribute to research and development (R&D) for improved livelihoods). These organizations are striving to change the mindsets of those with whom they work, while emphasizing a new focus on broader impacts of new innovation processes including a critical assessment of the actors involved in the R&D partnerships and how they learn from activities they engage in, as well as an orientation to impact by tracking and documenting changes that accrue in the process. This paper illustrates that the transition to promoting farmer innovation systems requires a total change in mindsets and in strategies for conducting formal research. The competencies of farmers, and other R&D actors needs strengthening as new approaches such as action- research processes, among others for equitable targeting, inclusion and sharing of benefits. There is need for embracing farmer innovation systems, multi-stakeholder collaborative partnerships based on experiences gained in R&D initiatives in Uganda.

Introduction

The reductionism approach comes from natural sciences experimental designs that are used to prove (or not) a hypothesis. The main elements include: repetition/replications, randomization to avoid bias, control of non-experimental variables to avoid interference with the treatment and a representative sample size as a way to maintain high quality research in the eyes of the scientific community and the general public (Gladwin, 2002). The reductionism approach underpins the positivist-realist paradigm, that the "science-is-best" (Douthwaite et al 2001). The experiments are designed using statistical rules and follow some standardized procedures. The research activity is designed and conducted on-station by individual scientists with specific interests in their professional line of work.

Low uptake

Working in farmers' environments to achieve impact provides additional challenges to the reductionism. Over time good technologies (high yielding and resistant varieties to pests and diseases among others) have been developed through the above approach, but they have not reached the majority of desired users and where they have reached, the desired needs are not addressed. Therefore, ownership and adoption is still low. These shortcomings have stimulated the need to involve other stakeholders through participatory approaches to meet the demands of R & D. Some of the approaches being promoted include, On-farm trial approach, Farming Systems Research (FSR) approach, Client Oriented Research, Farmer first and last approach (Chambers and Childay, 1985), Farmer field Schools,(FFS's), Participatory

Innovation development (PID), Farmer back to Farmer approach and Farmer Participatory Research (FPR) among others.

Bringing farmers on board

In Uganda the shift to embrace farmer innovation systems is evident by application of, participatory approaches (i.e., on-farm experimentation through participatory research, participatory technology and innovation development, and farmer field schools - FFS to R&D. They build on farmer local innovations, resources and indigenous knowledge. In this shift, the so-called 'context' or non-experimental variables can no longer be controlled making research process a challenge. Decision making is in the hand of the farmer in consultation with R&D actors play a facilitating role. Nonetheless, there are complexities in terms of researchers addressing the needs and priorities of the diverse stakeholders at the local level. None-the-less researchers must balance their requirements for scientific rigour and a community's need to address real-life, time-bound problems (Morford, et al 2004). This said, research and development actors need to develop different strategies for meeting the priorities of the farmers without compromising the scientific quality of research and agenda of the development initiatives.

Farmer Innovation Systems Approach

According to Prolinnova (2004) and World Bank (2004), local (farmer) innovation refers to the dynamics of indigenous knowledge i.e., knowledge that grows within a social group, incorporating learning from own experience over generations, but also external knowledge internalized within the local ways of thinking and doing. Farmer innovation fosters individuals or groups to discover and develop better ways of managing resources, by building on and expanding the boundaries of their indigenous knowledge through interactions. Innovations can occur both in technical and socio-institutional spheres.

Wu, (et al 2004) argued that innovations are broadly related to the introduction, adoption or creation of either or both elements of 'new knowledge' (ideas, skills or experience) and 'new organization' (principles, forms, networks or mechanisms). In this paper, the concept of farmer innovation is applied to agriculture technology processes that aim to improve rural livelihoods for sustainable development while ensuring inter-institutional and farmer learning.

Unravelling farmer innovation systems approach

Farmer innovation systems approach in agriculture include both users and producers of technologies, information, and linking them in a dynamic process that needs to be supported by appropriate framework conditions – not just policies but also financial, business and infrastructural systems. R&D actors play a key role in the innovation system, by being effectively linked or integrated with the other components of the system. In the reductionist orientation, research agenda is largely decided by scientists, with very little involvement of consumers and producers. Making R&D organizations more demand-led while building on farmer innovations is a key task that requires changes in organizational culture, structure and systems. Learning from R&D collaborations and learning from them to implement such changes is a major development challenge since innovations and technical progress are a result of a complex set of relationships among actors (public and private sectors, civil society and policy makers) producing, distributing and applying various kinds of knowledge as a system.

The push and pull

The driving forces for emergence of farmer innovation paradigm are constraints to crop and animal production e.g. pests and diseases infestation, soil fertility depletion and to which agricultural production is highly sensitive; increased population pressure while the natural resource base is constant; weak interactions among stakeholders such as R&D links, community-policy links, private-public links; economic globalization and market incentives through liberalized trade; currently, climate change. This implies that we need innovations that can meet demands of supply, standards and quality among others for the diverse market. Now, farmers need access to new and improved germplasm and new management practices, both to help them cope with such constraints. At the same time rising incomes and urbanization are altering the patterns of that demand. This results into duplication of efforts, contradictions in information flows, lack of continuity, learning and impact in the community.

These have led to the need to have new research methods and approaches that capitalise and build on the knowledge, creativity and management capacities of local people. They as well stimulate governments to develop innovative polices, to address the above challenges.

Why is it Important to Promote Local (Farmer) Innovation Systems?

The benefits of local farmer innovation systems include building on local knowledge, resources, leading to ownership and continuity of initiatives while addressing the priority needs of beneficiaries or communities for improved livelihoods. Prolinnova (2004) argues that, the key ingredients for livelihood improvement are not external inputs parse, but rather labour, knowledge and local management capacities that enable people to manipulate skilfully the local resources for their own benefits. Most rural development efforts have failed to mobilise and enhance these "internal inputs". The farmer innovation system approach allows for interactions and integration between stakeholders resulting in social learning. This enables the stakeholders to identify and recognise their experimentation efforts, responsibilities, strengths and weaknesses thereby strengthening participation and community innovations. The farmer innovations system approach has been adapted to integrated soil and waters conservation (ISWC), integrated pest management, farmer field schools among others. Consequently, there is higher adaptation of technologies by the farmers. Conversely, the R&D actors also learn from the farmers about their farming systems, the actual constraints and potentials of the communities.

Principally, "Farmer innovators are farmers or "land users" who innovate, test and try new methods of conservation or production, on their own initiative, often using ideas from various sources." Innovators tend to be curious, creative, proud of their innovations, willing to take risks and are skilful in blending their own ideas with ideas picked up elsewhere (Critchley et al, 1999).

Case Studies and their Implications

Case 1: Participatory Innovations Development (PID).
PID is used by PROLINNOVA[3], a global partnership Programme, which is NGO led, that promotes local innovation in ecologically oriented agriculture and natural resource management. Actors at the international level include ETC- Ecoculture, International Institute of Rural Reconstruction (IIRR), Free University of Amsterdam and LBL Switzerland. At national level actors include Environmental Alert (the coordinating NGO), Participatory Ecological Land-Use management (PELUM) Association- Uganda, Africa 2000 Network, Kulika Charitable Trust, Ministry of Agriculture Animal Industry and Fisheries (MAAIF), Africa highlands Initiative (AHI) and National Agricultural Advisory Services (NAADS) at the core team level who are responsible for operationalising the programme. Other actors at the Steering committee level are Development Network of Indigenous Voluntary Associations (DENIVA), National agriculture research organization (NARO), NAADS, CIAT, Uganda National Council for Science and Technology (UNCST), MAAIF and Uganda Local Authorities Association (ULAA) who play a supervisory role. The main activities of PROLINNOVA include identification, documentation and validation of local innovations; information exchange and networking; institutionalization of participatory approaches.

Situation and problem: Soil erosion on slopes of Kabale district resulting into soil fertility depletion is the key problem. This was followed by interventions by International center for research in Agroforestry (ICRAF) Afrena and local communities by practicing agroforestry by planting tephrosia on the slopes. However in 1998 through a farmer's (Ms Evelyn Tibemanya) innovativeness, she made an acaricide from tephrosia, in Kabale district in Uganda is an example among other activities being undertaken by Polinnova. Through assistance from Prolinnova in 2004, the innovation was identified and validated for value addition through joint experimentation process with the farmer and upscaling. The approach used in upscaling the innovation by R&D actors (i.e., Environmental Alert, Africa 2000 Network and National Agriculture Research organization) is participatory innovation development (PID). Before formal research and extension services existed, farmers' own experimentation allowed adaptation to new situations, to survive and to improve their livelihoods (van Veldhuizen, et al, 1997). The approach used in Kabale demonstrated PID whereby the farmer developed a solution to a problem using an opportunity that as availed by international center for research in agroforestry (ICRAF) Afrena).

The modification is the use of tephrosia for controlling grain pest, and secondly, its application of tephrosia on pigs and goats to control ectoparasites. The innovation is different from the original aim of controlling soil erosion. The R&D actors involved in PID were able to learn how an innovative farmer minimized post harvest losses, and controlled ectoparasites using locally made acaricide. The farmer learned that the use of tephrosia can be upscalled especially on the use of the right concentrations. Prior to these interactions, the farmer was mixing and applying without focusing on extraction of active ingredient. The challenge to the farmer and R&D actors is how to document the innovation process for scaling up and lesson learning.

[3] Promoting Local Innovation in Ecologically Oriented Agriculture and Natural Resource Management

Case 2: Farmer Participatory Research (FPR)

The African Highlands Initiative (AHI) is an ecoregional research program of Association for Strengthening Agriculture Research in East and Central Africa (ASARECA) that focuses on improving livelihoods and reversing natural resource degradation through farmer participatory research in the highlands of Eastern Africa. To this end, AHI promotes an "integrated natural resource management" by collaborating with stakeholders from national and international research organizations and extension in pilot sites of Uganda, Kenya, Tanzania, Ethiopia and Madagascar. INRM is an approach that aims at broadening the research and development methods and inputs to solve a complex of poverty-livelihood-environmental issues in a practical way that need a broader vision, a process orientation, new skills and roles, and changed attitudes.

*Situation and problem issue***:** soil fertility decline leading to low crop yields in the densely populated and intensively cultivated highlands of south western Uganda. In order to address this AHI since 1995 has used entry point approach in benchmark sites in which short term technologies such as promotion of priority crops (maize, potatoes and beans) in combination with organic fertilizers to improve soil and crop productivity. Benchmark sites were chosen as representative highland areas having high population levels, small farm sizes, degraded landscapes, and relatively humid conditions. The entry point approach entailed bottom-up problem identification, priority setting, planning and resource allocation, and use of participatory methods, a process called "PAM" (participatory agroecosystem management) by AHI teams. Research teams started using farmer groups, focused on "entry points" or introduction and testing of useful "on-the-shelf" technology options that could be quickly taken up by farmers in their farm plots.

In addition, other strategies used include use of multi- disciplinary and institutional teams; and community based farmer research groups while building on local innovations but also considering marketing opportunities for their produce. The stakeholders participated in joint visioning, planning, monitoring and evaluation while sharing the lessons with relevant policy makers. The R&D actors comprised NARO, Makerere university, non governmental organizations (NGO) (Africare and CARE), and Local government, International center for tropical agriculture (CIAT)/Tropical soil biology fertility (TSBF) (for soil fertility, seed systems and participatory research methods), ICRAF (for trees on- farm), International center for potato (CIP) (for potato IPM, seed systems and technology transfer),TSBF and International Institute of Tropical Agriculture (IITA (for banana IPM), AHI (for funding, participatory methods).

The farmer participatory research is a gradual shift from single discipline to multi disciplinary and nterdisciplinary modes of working and involvement of stakeholders in key stages of the research and development process. In so doing the research agenda is informed by the priorities and interests of the farmers in production and marketing. Six basic steps were used: (i) community facilitators encouraged the farmer groups think about the desired future state (and provided an example of a vision); (ii) to reflect on the current situation of their enterprises; (iii)reflect on the past situation of the enterprises; (iv) to come up with the desired change (vision); (v) to outline the obstacles to reaching the vision; and, (vi) what actions would be needed to tackle the obstacles, the actors that needed to be involved and their respective roles. The farmers in the groups also share their new knowledge and technologies with those that are not members of the groups due to the need to bridge food deficits. Consequently, they conduct informal experiments on new ideas either from their

own ingenuity or learned from other farmers, researchers, extensionists and other information sources like the mass media (Reij, and Waters-Bayer (eds). 2001).

In the process farmers gained more knowledge on crop pests and disease management, soil fertility management options, on farm record keeping, problem diagnosis, planning and visioning for the future among others. The R&D actors learned that farmers have their local initiatives of managing constraints. For example, they have rotational scattered plots for cultivation to allow soil fertility regeneration, while tephrosia dust was used as stores to prevent storage pests. For weed control some farmers use concoction of animal urine, ash and local herbs as compared to using organic fungicides that are costly. In so doing, the research processes through groups is aimed at shifting from analyzing community problems to perempting options that communities groups would provide themselves for their own development requiring minimal or (zero) external support. The idea was to build a strong sense of ownership of the processes for sustainability reasons and reducing dependency and culture of receiving handouts from donor projects.

The overall impact of the interventions is that some farmers are already realizing increase in household food security and income. At the same time there is gradual decrease in the use of pesticides as integrated pest management options have been adopted. For R&D impacts to be more visible other aspects like, credit facilities, road and communication need to be improved by other actors (the local government and microfinance institutions respectively). The challenge is not only to develop technologies that are appropriate and that respond to local needs, but also to ensure that the uptake pathways for these technologies function effectively.

Through the collaborative efforts we further learned that, incompatible time schedules among partners affect the extent for have having joint activities with farmers at the same time; potential conflicts in whom to attribute activity success or failure when joint activities are being undertaken wit diverse stakeholders; integrating farmers knowledge in research designs that use laid down scientific procedures is daunting; and continuous disciplinary bias when teams are working others is prevalent. The “proof” of a successful shift would be the enhanced capacity of farmers to innovate and create various “win-win” technologies, practices, arrangements and policies.

Case 3: Farmer Participatory Research

The National Agricultural Research Organisation (NARO) in Bulindi Agricultural Research and Development Centre (ARDC) as well is using FPR approach in its R&D activities. NARO Bulindi is one of the twelve (ARDCs), were decentralized from NARO to conduct research and technology dissemination with respect to major Agro - Ecological Zones of Uganda. Its mandate is within the Lake Albert crescent zone and is responsible for production of foundation seed, establishment of ‘mother’ gardens for multiplication and technology adaptation. The ARDC has demonstration plots for outreach activities that act as zonal information nodes to maintain technical documentation, and stakeholder collaborations.

Situation and problem: NARO has developed many improved agricultural technologies. However, more than 50% of these technologies have not been adopted by farmers because of there inappropriateness of the technology with respect to local environment, their complexity, social implications and predominately linear approaches used in their development and dissemination.

Conventionally, research has had little participation of stakeholders in research planning, implementation and evaluation processes. Local community dynamics, constraints, opportunities and systems component interactions and local innovations are not well understood and incorporated in research agenda. It is only recently that farmer innovations systems approach have started being considered while designing research projects.

The new 'science' in this work is the use of farmer participatory research and enabling Rural Innovations in R&D). The farmer participatory research (FPR) approach provides for on-experimentation involving farmers and R&D actors (extensions, NGO (such as Action Aid, World Food Program, CBO (Virudi) as facilitators. This involved the following steps; farmer group selection, participatory diagnosis of constraints and opportunities, priority setting to inform R&D, and participatory market research to confirm that the commodities they have selected to take on have a ready market. This was followed by on-farm experimentation and evaluation of the selected enterprises interspersed with feedback sessions. The process was documented and monitored according to the developed participatory monitoring and evaluation framework.

In the course of interactions, farmers learned that, NARO has many technological options which they are not aware of. Additionally, that they can contribute tremendously to research outputs in terms of local knowledge, time, and in kind contribution. They also realized that they have a right to demand research services based on their needs and influence priorities and its direction.

Conversely, R&D actors learned that farmers have a lot of untapped knowledge that can enrich the mainstream research and make it more relevant. For example concoctions farmers make from different plant diseases in bananas and also mulching bananas with tobacco stocks to control banana weevils. In addition, besides the joint on-farm experiments farmer often superimpose their own trials without the knowledge of R&D actors (facilitators). This because the treatments and designs are not covering all their criteria for selection of a technology; e.g., researchers is interested in pods of beans while the farmers are interested in leave size for food; farmers own the technologies since they are involved in their development and evaluation; for acceptability and upscalling there is need to consider the socio-economic concerns of the communities. Also farmers have priorities that shift from time to time and therefore the need for flexibility.

The impact of this work is evidenced by increased scaling out of research technologies as the number of farmer research groups increased from 8 to 33 in the zone. There is increased demand of technologies as a result of linking farmers to markets.

Case 4: Farmer Field Schools (FFS)

Environmental Alert uses FFS approach in the implementation of INMASP[4] project. (FAO 2000). The major objective is to contribute to improved livelihoods of smallholder farmers intensive farming systems facing serious decline in soil fertility and crop productivity. In Uganda, the project is implemented in Wakiso District in Central Uganda.

[4] Integrated Nutrient Management to attain sustainable productivity increases in East African Farming systems in Kenya, Uganda and Ethiopia.

*Situation and problem***:** Soil fertility depletion as a major problem leading to prevalence of soil borne diseases and soil degradation all resulting in low soil and crop productivity and subsequently poor livelihoods (Zake *et al*., 2003).. Consequently, the INMASP project embarked on innovation processes that encompassed participatory identification of constraints and opportunities (PDCO), participatory technology development (PTD) and on farm testing using integrated nutrient management (INM) technologies including: use of organic/inorganic fertilisers; use of both organic and inorganic fertilisers; Rhizobia innoculum/inorganic fertiliser (Single Super Phosphate) combinations in either case integrated with soil and water conservation measures (fanya chini, fanya juu among others). These were established as simple pair wise INM designs at central learning plots by farmers with guidance EA facilitators for purposes of testing, demonstrating and evaluating various INM technologies that improve soil and crop productivity (LEISA 2005; Zake and Kaggwa 2005).

The main approaches used include use of Farmer Field Schools (FFS)[5] that were established with agreed upon guidelines; multi-disciplinary teams to foster holistic approach of solving even the other problems beyond the major constraints to agriculture production; Involvement and participation of all stakeholders including: Local farmers, local leaders, policy makers, NGO's and international stakeholders such as Wageningen University (LEI), National Agricultural Research Foundation - Greece (NAGREF), ETC-East Africa, Kenya Agriculture Research Institute, Makerere University, Debub University and SOS – Sahel in project activities through backstopping, experiences and lessons learnt sharing; training of trainer (TOT)[6] for community FFS facilitators in FFS principles and methodology, integrated soil fertility management among others; Exposure and exchange visits; Monitoring of INM designs through season long observation and data collection; Capacity building of participating farmers through FFS curriculum and special topics based on participatory needs assessment (e.g., gender, HIV/AIDS aspects, livestock management); Participatory evaluation and selection of most appropriate among tested technologies for upscaling on farm; Sharing experiences among farmers to enhance technology and information transfer; Ppolicy analysis and advocacy to influence conducive policies and practices for sustainable land use at National and Local levels. In all these efforts farmers are the experts while researchers and extension workers are facilitators.

The 'new science' in this work include use of soil microorganisms (Rhizobia)[7] to improve soil fertility and productivity; integrated nutrient management were more than one technologies are applied at the same time; building on local knowledge/innovations e.g. drawing FFS membership from existing farmer's groups and maize-bean intercrop in which the beans were inoculated with rhizobia innoculum; demystifying myths e.g. that mineral fertilizers spoil soil structure; facilitating establishment of FFs into community based organization (CBOs) as self-sustaining farmer's institutions to deal with some of the community constraints with minimum external influence.

The overall impact of this work is increased soil and crop productivity through up scaling of appropriate INM technologies on farm; Farmer's capacities built in analysing their farming systems for constraints and opportunities to over come them; Farmer's expression and

[5] FFS refers to farmer field schools i.e. a school without walls. Usually located at the farmers field and comprises of 20-30 members (FAO, 2000).

[6] TOT – Training of Trainers i.e. community FFS Facilitators.

[7] Rhizobia are soil microbes, which fix nitrogen in the soil through mutualistic relationship with legumes.

leadership enhanced; Increased appreciation for locally available farm inputs (e.g. manure, urine, ash) for soil fertility restoration; Better manure management and handling techniques; More awareness on sustainable agriculture and environmental conservation through trainings and exposure visits; Community social capital enhanced i.e. participating farmers assist each other in good and bad times, FFS registered as CBOs with District Directorate of community services to deal with a number of issues such as access to better markets for farm produce, access to farmer friendly credit among others; FFS/CBO with clear objectives, formal leadership, operation savings accounts, and independent work plans for sustainable initiatives (Zake *et al* 2005).

Key lessons learned by farmers include: that even with a small piece of land ranging between 0.5-3 ha, one can obtain high yields through intensive farming; that soil is a living thing, which lives and dies, but when exhausted can be rejuvenated. For example, before the intervention, when farmers' soils were depleted they turned to other livelihood opportunities such as brick laying, encroachment on wetlands and charcoal burning.

On the hand the R&D actors learned that it requires a lot of time to explain the principles and application of FFS to farmers and collaborating partners being a new extension approach in the area. In addition, exposure and exchange visits are vital supplementing explanations, while at the same time roles and responsibilities for all stakeholders should be clearly shared right from the start. Further more, continuous farmers' training, facilitation and technical backstopping enhances participants' understanding of the new methodologies; central learning plots [8] should be centrally located for easy accessibility. The farming communities have a dependency syndrome whereby they expect free farm in inputs from R&D actors. Therefore it is important to explain clearly the objectives of the interventions right from the start.

Case 5: Landcare

The African Grassroots Innovation for Livelihood and the Environment (AGILE) is a project of AHI that integrates land care approach based on experiences from Philippines and Australia) into the East African setting, drawing on knowledge of African institutions, technologies and enabling policies. These efforts are undertaken in the context of vexing problem of lack of sustainability in NRM "projects" and collective action through existing groups, networks and institutions.

Situation and problem issue: There are a number of methodological and policy constraints and complexities with reference to agricultural land use management as an effective means in alleviating poverty while maintaining the integrity of the environment for sustainable development. AGILE seeks to unravel these complexities by championing a people centered initiative that strives to achieve gains in social capital, by encouraging and assisting the development of collective action for natural resource management.

The AGILE concept is developing and gaining insights into community livelihoods and environmental conservation, through an African Landcare approach, inferred from in the

[8] Central learning plots are field plots were simple pair wise INM designs are laid. In addition FFS sessions and agro ecological systems analyses (AESA) are conducted here.

Philippines experience[9] as a method to rapidly and inexpensively diffuse Agroforestry practices among thousands of farmers (Garrity, et al 2000). Furthermore, Landcare is viewed[10] as a movement led by the grassroots to foster improved livelihoods & environment and spreads through social energies of individuals, communities and supporters. It is considered as a basis for autonomous farmer-led organizations concerned with the long-term health of the land.

In addition, AGILE provides a platform, forum, market in which various technologies, practices, innovations, conditions are discussed analyzed, adapted, adopted and disseminated, with the community at the grassroots taking a leading role. AGILE tries to understand and influence positively the mindset of the farmers, policy makers, government and partners such as the civil society, on the interrelationship between land use, livelihoods, and environment for sustainable development.

In this regard, AGILE brings other R&D actors in leveraging the energy of existing groups, networks and institutions; linking farmers to existing resources and innovations such as the local governments financial and technical support; Promoting networking and the building of a grassroots movement that empowers farmers to seek resources and needed policy changes. Landcare groups in the 3 pilot districts of Kapchorwa, Kabale, and Bundibugyo have recognized areas of comparative advantage in their areas and have consequently initiated collaboration and cross-site learning, through field visits, joint meetings and exchange of progress reports and methodologies

Through action research, acquired information based on farmers felt needs, identified strengths and defined livelihood and conservation objectives is used to further understand, develop and refine the AGILE process. Through a joint and iterative prioritization process main issues are identified and solutions sought. The implementation of these solutions may require policy formulation mainly at local levels for example the formulation of local by-laws on grazing rights in Kapchorwa , Mount Elgon region. It may also require lobbying through the local government at district level for national level policy interventions. The AGILE work has created an “infrastructure” that has enabled communication and exchange of ideas amongst development partners, researchers and farmers, thus creating a conducive environment for identification development and dissemination of farmer innovations.

As a result of this work AGILE is cognizant of the fact that the availability of good information lies at the heart of effective and equitable decision making . These comes with identification of NRM strategies that are locally relevant and feasible, while networking community level is a prerequisite. The management and attainment of farmer’s livelihoods and conservation objectives have been subject to achieving a buy-in of local farmer groups, identifying and developing rapport with partner institutions and seeking collaboration amongst the civil society, the community and the local government. Though efforts in this regard appear daunting, the emergences of champions of Landcare are vital in sustaining the efforts of AGILE roll out.

Through the process the R&D actors have learned that there is the need to appreciate the role of governance in NRM, but also responsibilities of all R&D actors and communities at the

[9] ICRAF has been working with Landcare groups in the Philippines for more than a decade resulting to a robust and dynamic movement where more than 300 groups from five municipalities in northern, central and Eastern Mindanao are involved.

[10] Reflects understanding of the approach by the Landcare East Africa team members

local and national levels. For example, the champions of Landcare have played a big role in creating awareness and implementation of Landcare ideals amongst communities resulting in local chapters that seek to inculcate these ideas in their community based activities. In addition, there is growing realization of the great diversity existing amongst community. This has in turn raised the question of exclusivity amongst the various community groupings, recognition of the vulnerable and the need to gather insights to guarantee their participation. Further more, there is need for a holistic approach to development. A better understanding of poverty and its ramification, a conscious efforts of its alleviation through better market access, encouraging the propensity to save, adoption of high value crops and developing mechanisms for reduction of input costs.

Implications for Multi-Stakeholder Collaborations

All the cases are based on on-going work by different R&D actors in Uganda. It is evident that synergy and complimentarity among R&D actors is gained. Each R&D actors addresses what is within their strength, while learning from others. Although funding, approaches, harmonizing time schedules and workplans still remain a challenge.

Due to the systemic nature of constraints, there is need to bring on board new R&D actors to "fix" new challenges such as roads, communication, credit among others which are outside the mandate of the existing R&D actors. In the diagnosis phase participatory research innovations are not necessarily the true priorities of the communities as compared to water and infrastructure. But confining to mandate propels actors to focus on their agenda ignoring the community priorities.

As projects or development initiatives wind up, a feeling of a vacuum by farmers creeps in and it appears that there is nobody to take on the roles of the departing R&D actors. More so for those R&D projects that do not have sustainability mechanism.

Presence of R&D actors with different development agenda/approach in community results into competition for participating farmers. Further more new R&D actors who come in the community may have a fixed agenda and approach to research and development thereby undermining existing local knowledge and opportunities.

Absence of natural resource management policies (e.g. land, land use and soils) and use at national and local level poses a risk of unguided management of natural resources resulting into degradation and impacting negatively on livelihoods.

Participatory principles and approaches are not fully in institutionalised and operationalized in the national agricultural policies for R&D. This is linked to on-going reform processes on roles and mandates among R&D organizations. An assessment framework and agreeing on standards of good R&D processes will give the stakeholders option on which to make decisions.

There are mixed reactions by farmers during scaling up of innovations. Some farmers respond negatively, due to lack of feedback on the findings from the research undertaken. Likewise within the organizations, discussions with managers are needed to build ownerships and clarify expectations to understand the potential, added value and constrains to uptake of innovation systems approach.

Blending local knowledge with scientific knowledge to fit in each others domain, but also to meet the expectations of the farmers and R&D. Local people, including farmers, local artisans, and cattle keepers are the custodians of local knowledge over generations. As such, they are knowledgeable about their own situations, their resources, what works and what doesn't work, and how one change impacts other parts of their system. R&D facilitators are challenges to blend their "new" knowledge with the local knowledge systems.

Conclusion

It is evident that R&D efforts are moving from reductionism to embrace farmer innovations systems. However, this comes with various implications as discussed above. There is still the need to balance farmer innovations systems with quality R&D processes without compromising scientific concepts and principles to ensure sustainable development. Fostering partnerships for complementarity and inter-institutional learning is still needed.

The innovation in these cases above range from crop and livestock management, soil fertility management, soil and waters conservation to social organization for having cohesive and functioning social groups able to articulate their demands and link with various service providers. They have a bearing on quality of scientific outputs and they contribute to poverty reduction and improved livelihoods. Solutions are rarely single components, but rather the "win-win-win" combinations of options that generate more income, more food and improve the environment. Lastly, natural resources (soil, water, vegetation, livestock and fish) are integrated in themselves and as such cannot be dealt with in practice exclusively.

It is also important to have a clear sustainability strategy to ensure their continuity in the community. The strategies would encompass linking with local administration, competencies in facilitation, partnerships, feedback loops, conflict resolution, planning, continuous technical backstopping, and formation of community structures that move beyond experimentation to marketing and upscaling of innovations.

An impact assessment for all the cases is needed to capture local innovations and transfer mechanisms and implications therein, but also inform new R&D initiatives to foster learning and innovativeness. In addition, the level and intensity of farmer participation in all the approaches needs to be determined. The fact that R&D actors are embedded in a changing environment and impact assessment would catalyze the shift in notion that fixed inputs lead to pre-determined outputs in linear fashion while paying attention to skills to facilitate the "processes" rather than merely focussing on technological dimensions.

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Supporting Farmer Innovations: "Bridging the Gap between Scientific Theory and the Diverse Farming Practices of Smallholders"

Willem A. Stoop and Tim Hart

Human Sciences Research Council

Abstract

Agriculture, in both industrialised and developing countries, is a unique sector, characterised by complex issues and problems, ranging from macro-economic policy levels to the micro farming-household and field-plot levels. This paper suggests how research aimed at development could deal with agro-ecological and socio-economic diversity at field level and could help to bridge the gap between scientific theory developed by policymakers and scientists, and the practical realities of smallholders.

The paper concludes that to handle diverse and complex, location specific problems inherent in development, sustainability and poverty alleviation issues, require that national research and development (R&D) institutions be strengthened and adopt comprehensive, people-centred approaches. Such approaches would seek first to mobilise local communities and their indigenous or local knowledge, as well as local farmer-to-farmer communication systems. Such strengthening will depend critically on: 1) the (university) training of a young generation of scientists, 2) the leadership and management of agricultural research and development institutions, and 3) the continuity of (financial) support that these institutions receive from national governments and other donors.

Introduction

Agriculture in both industrialised and developing countries is a unique sector, characterised by complex issues and problems, ranging from macro (economic) policy levels all the way to the micro (smallholder) farming household and field plot levels. Agriculture being predominantly a (small-scale) family and/or communal enterprise differs in fundamental ways from the administrative services and industrial sectors in terms of relative unpredictability, uncertainty and variability in bio-physical (soil and weather) conditions on which the primary production processes rely. In addition there is a huge social diversity in production strategies and objectives among farming households and even among individuals within a household. Contrary to an industrial production process, farming[11] is mostly seasonally determined; it faces relatively high levels of risk, that in many developing countries, are compounded by poor infrastructure and the relative isolation of rural communities. Fluctuating market and trade conditions further add to farmer uncertainty. Agriculture therefore faces rather unique problems with respect to research and development including the planning, implementation and evaluation processes that are involved as well as the assessments of impacts at various levels.

[11] The term "farming" is used in a wide sense to refer to the activities of all people who produce and/or harvest from plants, animals and aquatic resources. "Farmers" include peasant/family smallholders, pastoralists, forest dwellers and artisanal fisherfolk among others.

Because of the various uncertainties, farmers have to continuously adjust and even improvise their practices and the timing of different field operations during the course of the seasons, besides being alert to optimising new production and marketing opportunities. Farmers simply have to be innovative and flexible, and the most dynamic among them will certainly not wait until policymakers and scientists have agreed on appropriate technologies and new policies[12]. Consequently, in the realities of the field, policymakers, agricultural scientists and development agents often perceive confused and even chaotic situations for which their standardised (i.e. blueprint) approaches and techniques are inappropriate. Irrespective of those conditions, the common push continues to be towards intensified and specialised, large-scale farm operations that are supposed to operate according to standardised models and management principles derived mostly from the industrial sector. Smallholder farms are being treated merely as a scaled-down version of large commercial farms (Waters-Bayer & Bayer 2004) despite the vast differences between the two, even in developed countries.

In early 2002 a comprehensive study (Stoop, 2002) was conducted in the West and Central African region for the Technical Advisory Committee (TAC) / interim Science Council (iSC) of the Consultative Group on International Agricultural Research (CGIAR) into the reasons "why" so few of the results from agricultural research where eventually adopted by farmers. Among other conclusions the study points out that in general:

- donors, policymakers and scientists have not come to terms with how to cope effectively with the huge diversity in natural resources and consequently production systems of resource-poor farmers, who among themselves, are highly diverse in terms of skills, motivations and production objectives; and consequently
- the complexities involved in transforming agricultural production processes tend to be widely underestimated, particularly in Africa where the aim is often to transform a traditional subsistence agriculture into sustainable, permanent and commercially-oriented systems.[13]

These conclusions imply that agricultural and rural development is constrained in many different respects but *primarily at national and local levels*. Obviously there are also serious political and trade constraints at international levels, but these are outside the realm of direct action by local decision-makers and producers. The objective of this commentary therefore is two fold. Firstly, it seeks to provide suggestions for coping with the *diversity* (agro-ecological and socio-economic) of issues at the field intervention level. Secondly, it seeks to contribute to a bridging of the gap between (scientific) theories developed at macro levels by policymakers / scientists, and the practical realities including the living conditions that farmers encounter at local / micro levels.

The Diversity Issue in Agriculture

Diversity is an integral element of agriculture in general. For most African agricultural activities, its significance for policy formulation and particularly for agricultural research and development towards more productive and intensified (yet sustainable) production systems is

[12] In a compilation of independent studies carried out in parts of South Africa researchers and extension officials identified local innovations at each site they visited (de Villiers, *et al*., 2005). Innovations involved natural resource management, social networks and technology improvement and development. Most farmers felt that without these innovations they would no longer be involved in agricultural activities, while researchers noticed a number of ways in which they could collaborate with farmers to improve some of the innovations.

[13] Ambitious development goals and objectives are written mostly in administrative and scientific jargon remote from and largely hiding field realities where the production changes are to occur.

gradually being recognised (Eicher 1996; IAC, 2004). Yet, the wider scope and the implications of the diversity issue for policy formulation, as well as for research and development strategies and their subsequent field implementation, tend to be overlooked. A general trend is to simplify complex situations to a few manageable standard systems that can be conveniently studied and modelled (the reductionist approach). This was also done by the IAC study (2004) that proposes to focus future research on just °four major production systems and a limited number of supposedly major production constraints for the whole of sub-Saharan Africa.

In an excellent paper, Toulmin and Guèye (2003) provide a wide-ranging assessment of the on-going changes in West African agriculture and of the numerous alternatives that evolved locally as a result of farmers responding to changing agro-ecological, social, economic, organisational and political conditions. Subsequently, different patterns towards intensification, occasionally extensification and diversification in agricultural production systems and sources of revenue (including the increasingly important "non-farm" revenues) are revealed. In addition Belières*, et al.* (2002) noted the flexibility of diverse small family farms in West Africa in responding readily to changing market and policy conditions, whereas the large-scale, mechanised commercial farms often faced exceedingly serious financial problems, having lost flexibility because of large prior capital investments.

Likewise, van der Ploeg (2003) illustrates for Dutch dairy farming the very diverse strategies that are being followed by individual farmers in coping with changing economic conditions. Individual farmers arrived at a wide range of solutions that all differed remarkably from the prevailing *intensification and scaling-up* models developed by agricultural scientists that tend to be at the basis of the Dutch government agricultural policy decisions. A weakness of these models is that they view agriculture increasingly (yet incorrectly) as an industrial sector that operates largely through standardised technologies implemented routinely and supposedly most efficiently at large scales. Chambers et al., 1989 pointed out that the industrial agricultural model is only one of three types of agriculture and that it divers vastly from the resource poor type. As such, the diversity of individual farmers and their diverse strategies, in economic as well as sociological and technical terms, is being ignored. Not surprisingly, Dutch farmers in general don't view the propositions by policymakers and scientists very favourably.

Internationally, a rather similar situation occurs. The actual developments in agricultural and rural livelihood systems for smallholders in the developing, and particularly in sub-Saharan Africa as described by Toulmin and Guèye (2003), differ profoundly from the development theories that are put forward by international agricultural scientists, most of whom implicitly rely on the industrial model. Yet, these theories, which are out of context, largely guide the strategies and funding decisions of major international donor agencies. They also guide the policies of many governments as manifested in the South African Government's Land Reform for Agricultural Development sub-programme, which focuses on large-scale agriculture requiring intensive, and often unsustainable, external inputs. Most South African farmers involved in these projects have subsequently achieved very little and in worst case scenarios they have gone bankrupt or had their hopes dashed (Hart, 2003).

In summary, gaps between macro-level theories and field-level farming originate largely from a common, but flawed, comparison with industrial production processes where *diversity*

and *variability* are of much less significance. Strategies to deal with the diversity issue in smallholder farming are of critical importance, but should evolve mostly at national and local (field) levels. Therefore, theoretical concepts debated at conferences and symposia can never substitute for hands-on field experience.

Major Strategies in Dealing with Agricultural / Rural Development

In view of the complexity and multifaceted nature of agricultural / rural development, it is not surprising that, over the years, widely different ideas and strategies have evolved. In broad terms one could distinguish between three extremes:

- a *science and technology-/ policy*-centred strategy (IAC, 2004), which -in spite of all the "demand" rhetoric- tends to operate in a top-down and largely reductionist fashion, being initiated mainly by formal public-sector institutions operating at the macro / meso level,
- a *people*-centred strategy (Reij and Waters-Bayer, 2001; Waters-Bayer and van Veldhuizen, 2004), that is rooted at the (micro) level of local communities and consequently operates in a more bottom-up fashion, and
- *a demand- / problem-led* strategy that has evolved mostly over the last decade under the influence of increased privatisation of public sector research and extension services.

The first strategy finds its origin in the linear "research – technology transfer – development" model under which scientists operate largely out of experiment stations and laboratories. Starting in the late1970s, disappointing impacts led to the "Farming Systems Research (FSR)" approach that was structured largely around "on-farm" experimentation with various degrees of farmer participation. This approach was, however, highly technology-biased and the human aspects remained under-exposed, since the FSR teams were generally composed of agronomists and economists. Only rarely were sociologists and anthropologists included. Unfortunately, donors started to look upon this *research* approach as a means to accelerate technology adoption and rural development, for which it was inappropriate. Something similar is currently happening with the formulation of unrealistic and over-ambitious projects by international agricultural research and development bureaucracies in their quest to impress donors and to obtain scarce international funding. The Challenge Program for Sub-Saharan Africa with its Integrated Agricultural Research for Development (IAR4D) approach is a noteworthy example[14] (FARA, 2004). This trend may eventually jeopardise research credibility. Equally hazardous, it undermines the funding of other, more modest, yet crucial, research projects of a more fundamental nature that ultimately would be of greater significance to development.

By comparison the "people-centred strategy" is fundamentally different in that local people have largely the initiative and external people / agencies play facilitating roles in guiding the locally identified needs and demands for various services. Consequently, this strategy is much more appropriate to cope with diversity issues in both agro-ecological and socio-economic terms; it also helps to create an awareness about how agricultural practices are intrinsically intertwined with local culture and customs. This latter relationship is often overlooked, thereby reducing the likelihood of adoption. Moreover, a greater awareness about the diversity in human nature, motives and individuality, be it farmers, scientists or technicians, is fundamental to understanding variations in

[14] Mistakenly, an essential *holistic perspective* (including multiple scales and interdisciplinarity) is being translated into a *"new science"* and a *"theoretic approach"* for which the required professional human resources are generally non-existent. Together with a plethora of co-ordinating bodies and of bureaucratic regulations non-workable and ineffective approaches are being proposed. Agricultural research and development processes are being stifled by administrative procedures and inherent delays in the disbursement of funds.

yield levels between farms and in appreciating the frequently biased nature of scientific outputs as well as the questionable quality of much rural survey data.

In the case of the "demand-led strategy", neo-liberals somehow assume that it will resolve many of the priority-setting and targeting problems commonly faced by Research and Development (R&D) services. This trend, set in motion by the World Bank and subsequently followed by many developing country national governments, focuses on privatising R&D services and institutions assuming that the costs will be paid for by the client – in virtually all cases the poor smallholder farmers and rural families. However, as for the "science and technology" strategy, the lack of a people-centred focus will result in national R&D institutions identifying specific local problems without understanding the wider local context and true nature of the problem. Subsequently general solutions –rather than specific ones- will be elaborated and disseminated routinely and widely. Whether such a strategy can provide the correct signals to address complex and multifaceted, mostly local, issues of sustainability and poverty, remains doubtful. Major undesirable side effects on income distribution and the natural environment will go unnoticed, because the focus of interventions will be increasingly on short-term, single-issue, problem-solution while bypassing the more complex and fundamental issues.

When dealing with complex situations, comprehensive strategies and approaches are obviously required to permit the introduction of change, thereby establishing new types of order. In that respect, a livelihood perspective is not a matter of *either-or*, but must rely on elements of all three -above mentioned- strategies. It needs to be multifaceted and multidisciplinary in dealing with the entire range from macro- to micro-level issues, including the links between levels and the respective stakeholders and institutions involved (Peat, 2001).

On the one hand these links would have to translate into a favourable and dynamic national policy environment concerning the creation of infrastructures, marketing facilities and occasionally even the use of subsidies as described by Dorward, *et al*. (2004). At the other end the links must be rooted largely at local levels to ensure responsiveness to real farming circumstances and the needs of rural communities. Especially for many of the *science and technology* proponents, this implies some rather fundamental changes in perspective, if they want their contributions to become more relevant in a livelihood context. More than before, they will have to accommodate a *people's* factor in their activities. Unfortunately most technical scientists are unlikely to have ever received any formal training in this respect. Yet it is a crucial element in agricultural and rural development processes.

University Training in Agricultural Research and Development Disciplines

The implications of adopting a more comprehensive and more people-centred strategy are many and of a quite fundamental nature. An essential start would be to adjust the respective university curricula, so that young graduates will be better equipped to recognise and to handle the social diversity issues by having been taught some professional skills to communicate and dialogue effectively with various stakeholders. Secondly, changes will be required in field approaches and methodologies, including a better appreciation for the relative value / precision of field measurements and of the quantitative data collected by rural surveys (see also section 6.).

University training in agricultural sciences generally includes the use of statistical methods. Less emphasis is paid (unfortunately) to the precision (and the associated costs) with which various parameters can be measured and the ensuing limitations and limited relevance of various types of data. A widespread (and costly) misconception in general understanding of statistical theory is that *more data* leads automatically to *greater accuracy*. However, in the absence of a broad, general understanding of a complex system (such as a livelihood system), accuracy of isolated parameters is of very limited value. The interpretation of such data is open to multiple biases and therefore of little significance, as was also pointed out repeatedly by Toulmin and Guèye (2003) in their study on the evolutions of agriculture in West Africa.

Conspicuously absent from the technical (including agricultural sciences) university curricula are elements related to humanity, notably anthropology, psychology and communication / facilitation / interviewing skills. This is an extraordinary shortcoming in view of the need for "development-oriented" scientists to collaborate with a wide range of other stakeholders –in the first place farmers, but also the commercial and political parties- involved in the development process. An awareness of the various pitfalls in human communication during interviews and data collection processes is crucial in view of the serious consequences for the relevance and accuracy of the collected information. In fact, the vast group of technical scientists -in spite of the high-powered rhetoric about participatory approaches and need for partnerships- is, in fact, very poorly equipped to handle this subject at the field implementation level. No doubt this will be a fundamental reason behind the disappointing impacts of many large-scale technology transfer and development efforts conducted in the past and certainly in Africa (Stoop, 2004).

In summary it is in the domain of the human sciences that universities have an obligation to prepare their agricultural graduates better (or at least to a minimum) to cope with psychological elements and facilitation skills. These elements are of critical importance in getting behind the real nature of complex problems and to distinguish between fact and fiction of the rhetoric widely used by various stakeholders.[15]

Viable National Agricultural R&D Institutions and their Effective Management in View of Limited Resources

In both developed and developing countries the agricultural sector is currently under considerable pressure, and with it the research and extension services. While in the former, *over*-production and environmental issues are major concerns, these are fundamentally different in developing countries. For the latter the agricultural sector generally constitutes the backbone of the national economy and often directly touches on the wellbeing of a majority of the population. Certainly for most African countries it is therefore vital to maintain a functional and operational research and development / extension capacity, following realistic approaches given the prevailing financial constraints. This must be considered *a prime responsibility of respective national governments*. Apart from a facilitating role and the creation of an enabling policy environment stimulating a competitive private sector and reliable market system, *this must also involve direct funding support to*

[15] At one stage it was very fashionable among government officials, extension agents and farmers in West Africa to urge scientists to conduct on-farm experimentation at operational scales (en vraie grandeur); presently a similar trend occurs as the testing of *best-bet practices*. In either case farmers are primarily participating for personal motives of status and short-term benefits (seeds and agricultural chemicals for free or on easy credit conditions) rather than an interest towards agricultural innovation for which the above approaches are largely inadequate and inappropriate.

national institutions including operational costs. Only then, can the continuity of long-term programs for vital national interest such as food security and sustainability be ensured.

The institutional restructuring efforts and large development projects of the eighties and nineties –often under guidance and coordination of the World Bank- made great progress in most African countries in decentralizing research and extension, and in bringing it closer to the major client: the resource-poor farmer. Yet, it has also led to relatively *over-sized* institutions, that lack sufficiently experienced personnel and that are financially unsustainable due to limited national funds. The subsequent response by donors to stimulate privatization of these services and the simultaneous creation of a multitude of ad-hoc partnerships (North-South; public-private) is rather inappropriate in the African context, because it contributes little to building the required, coherent and permanent national institutional capacity. Moreover, the present trend to go for competitive bidding for R&D contracts through sub-regional (sometimes even local) organizations leads to an undesirable bureaucratization of agricultural R&D, rather than a strengthening of the National Agricultural Research and Extension Services (NARES). Consequently, weak national institutions and programs tend to be sidetracked from what should be their main preoccupation of addressing practical problems faced by resource-poor, farmer communities attempting to improve their local production systems.

National agricultural R&D institutes should in the first place design long-term programs that mirror the major agricultural preoccupations and environmental concerns of their respective countries. These programs should be well balanced between *commodity* and *systems research* components and among scientific disciplines, implying combinations of *experiment station / laboratory* and *on-farm (systems)* based activities implemented by interdisciplinary teams of scientists (with an increased emphasis on the human sciences, yet without jeopardizing technical and biological professionalism). Likewise research management should play a more transparent and pro-active role in the allocation of the –necessarily– limited funds. Thus the expansion of -already heavily loaded- R&D agendas with subjects wherein others, such as the International Agricultural Research Centres (IARCs) and the Agricultural Research Institutes (ARIs) clearly have the comparative advantage could be avoided.

Program *relevance* and *continuity* -albeit with regular reviews and necessary adjustments in implementation- must be considered as much more essential than the frequent and costly restructuring efforts that result from the ever-changing fads of donors and external experts. In particular for research programs and their funding, continuity is crucial, even when this funding in absolute terms is relatively modest. As financial constraints are likely to become increasingly serious in the future, NARES management must be prepared to face tough decisions in ensuring that:

a) their programs are not getting over-stretched by following R&D approaches that are unrealistic, given the limited availability of national human and financial resources, and
b) they are not being sidetracked by the many regional / international collaborative projects and initiatives that -though interesting and financially attractive in the short-term, are yet of limited practical relevance to the immediate concerns of the national farmer community.

In the absence of sound strategies by the respective NARES to cope with the *realities* of on-farm conditions and their diversity, the creation of international partnerships at sub-regional, regional and global levels will unfortunately lead mainly to a strengthening of the development *rhetoric* and of R&D bureaucracies. Yet, the impacts of R&D efforts to

intensify farming and to improve the overall wellbeing of the rural poor at the grass root level will remain marginal. In this context the next section will deal with some alternative field approaches.

Field Approaches to Cope with Diversity

The entire process, ranging from diagnosing a coherent array of constraints for rural communities and the progressive development of diverse solutions followed by the monitoring of actual change (and impact or lack thereof) at field levels, requires a critical re-assessment. Rather than pushing a pre-conceived, package of technological, best-bet, practices (originating from the experiment station and often inappropriate for smallholders' marginal, diverse and risk-prone conditions) or a technological gadget, the emphasis should be on creating a *broad understanding* of the assets, needs, motives and innovations of local farmers, and of the overall context under which they operate. Failure to do so leads to ineffective research and inappropriate solutions and consequently to no, or even negative, impact.

Instead, an appreciation for a wide range of (technical and organisational) options that seek firstly to capitalise on local farmers' know-how, experience and local initiatives, and secondly to try out ideas coming from external solutions (whatever their origin) would increase the relevance of actions jointly conducted with farmers. After all, farmers are the users and adapters of technology and other resources, be they locally or externally derived. Quantitative data of questionable accuracy, the output of formal surveys will contribute little to an in-depth understanding of farming. Instead, dialogue based on semi-structured / informal interviews are the appropriate tools, albeit following considerable preparatory efforts by the scientists and development workers wanting to interact with farmers in learning through joint actions (not just interviews). Here the use of tools such as Participatory Rural Appraisal (PRA)/Participatory Learning in Action (PLA) and approaches such as Participatory Technology Development or Participatory Innovation Development have important roles in maximising interactions between farmers, research and development workers (Van Veldhuizen *et al.*, 1997; Waters-Bayer and Van Veldhuizen, 2004).

In a similar sense, the dissemination of most innovations would be much more effective when left primarily to local communities through rather informal *"farmer-to-farmer"* mechanisms (for an example see Ouedraogo and Sawadogo, 2005), than to an external agency, be it a public sector extension service or a NGO. Such a development and dissemination process would of course profit from some form of professional facilitation and technical backstopping. This would help to create and support essential local organisational structures of producers and to assist in the identification of entry points (local initiatives, local innovations, local leaders; local issues) while maintaining a longer-term momentum in the field activities. As the emphasis is on *people,* organisational issues for farmers and other stakeholders will be crucial to such an approach (Béavogui, *et al.*, 2000).

Apart from their local effectiveness, the mechanisms described above operate at a fraction of the costs of most formal intervention systems. The "Training and Visit" system that was promoted for years by the World Bank; but also presently a standardised use of the Farmer Field School model by development projects provide examples of approaches that become ineffective when implemented on a large scale and on a routine basis. Rural / livelihood development goes far beyond the provision of "one-off" solutions for isolated problems; it will have to be a long-term, continuous process through which improvements in general

welfare are achieved gradually as driven largely by the rural communities and their representatives.

Concluding Remarks

It is an alarming feature in to-day's post-modern world that, at all levels, so many debates are conducted in polarising fashions using structuralist dichotomies such as "*either-or*", "*them-or-us*" and "*with-or-against-us*" to convince relatively uninformed and non-knowledgeable parties and individuals to support certain specific actions. This is reinforced by popular rhetoric viewing issues in terms of wars, fights and battles that lead to unrealistic and false perceptions of "easy and quick solutions" for complex problems and situations. The same holds for imposing certain formal rules and regulations, which -when undermining, for instance, the livelihoods of certain groups in a society- will always be dodged and remain ineffective in the absence of consensus-building efforts like participatory workshops, dialogue and joint actions. Likewise, there are unrealistic expectations about patents and intellectual property rights (IPR) becoming sources of revenue for research and development institutions and communities of smallholders in developing countries. This is based on a misunderstanding of what is meant by development, and results largely from the current overemphasis on economics and commoditisation of agricultural produce. The questionable benefits of IPRs for *some* are likely to be dwarfed by the negative effects on the free flow of information and livelihood resources between rural communities and individual farmers that is crucial to a development process (Kuyek, 2002). IPRs are likely to threaten smallholder agricultural sustainability rather than promote it

Presently, "partnerships" and "stakeholder platforms" are widely considered as pre-conditions for achieving scientific breakthroughs and development progress. Some partnerships are valuable and achieve much, but often the result has been an endless circuit of meetings, workshops and (e-mail) conferences where the use of popular one-liners and ever-more sophisticated theories tends to hide an increasingly widespread ignorance and lack of field professionalism about practices of farming. Partnerships also tend to promote standardised group thinking, with the result that the most innovative propositions made by a minority are readily eliminated from common action. Moreover, the outputs from many partnerships are largely "blueprint" approaches, including crop-growth models and decision-support tools, but also various technical and organisational recommendations / models. In spite of the increasing sophistication of these outputs, it should be questioned how effective these can be in addressing complex and diverse environmental situations and agricultural systems. Particularly the conditions in many developing countries demand *local* creativity, flexibility and professionalism in order for the "international recipes" to materialise into the desired benefits for the target group of (poor) smallholders.

The saying "think globally, act locally" remains highly relevant today. While obviously international and co-ordinated research and development interventions are important, viable *national* and local initiatives in stimulating and facilitating a local dynamic towards rural development and agricultural production are essential to achieve impact at the grass-roots level. In handling the problems of complex and diverse (agro-ecological and socio-economic) situations typical for smallholder farming, strong national research and development institutions using *people-centred* approaches are a pre-requisite. Together with producer organisations, locally adapted innovation and dissemination to neighbouring communities could be achieved most effectively. Coherent national policy environments (particularly for land rights, infrastructures and markets, occasionally even involving the use of subsidies)

would be an essential condition for success, in particular for African countries where smallholders largely dominate the agricultural sector.

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Socio-Economic Impact of a Cocoa Integrated Crop and Pest Management Diffusion Knowledge through a Farmer Field School Approach in Southern Cameroon

Njankoua Wandji D., , Lapbim Julius N. James Gockowski and Tchouamo Isaac

International Institute of Tropical Agriculture; University of Dschang, Cameroon

Abstract
We focus on the Socio-Economic Evaluation of Farmer Field School Training on Integrated Pest Management in the humid forest region of Cameroon. The main objective was to assess the impact of the training on integrated pest management (IPM) on cocoa farmer field school graduates.
The results indicate that shade management, phytosanitary harvest, pruning, improved spraying practices and grafting of improved materials were adopted at the rate of 94, 93, 90, 66 and 35 % respectively, with the overall rate of adoption of 76 %. There was a 47 % reduction in the frequency of spraying fungicides and a 17 % reduction in the number of sprayers applied per treatment following the implementation of the training. Labour inputs increased significantly for pruning, phytosanitary harvest, and shade management but decreased for spraying. A partial budget analysis reveals that the IPM practices lowered overall costs of production by 11 % relative to previous practices.

Introduction

Cocoa is one of the most important cash crops and it is grown largely (>80%) by the small-scale farmers (Assoumou, 1977). In 1900, Africa's share of the total world cocoa production was merely 17%. In 1996, total production from the four largest producing countries accounted for 65% of the global output (ICCO, 1997). Compared to other agricultural activities, cocoa has been a leading sub-sector in the economic growth and development of these countries.

However, since the late 1980s, the cocoa sector has been subjected to several major economic shocks that have led to new institutional and organizational frameworks. This was particularly the case with country such as Cameroon. Cameroon cocoa farmers have typically received subsidies and state support to control pest and disease. Until the early 1990s, the government provided fungicides at no cost to the farmers and treated their plantations with insecticides. The cost for the service was recovered through a state controlled cocoa marketing system. Following the fall in price and subsequent liberalization of the marketing sector, the government discontinued the service. In the depressed cocoa markets, farmers were unwilling to pay for inputs or if they were willing, they had difficulty finding private suppliers. Consequently, cocoa production suffered of neglect and in some cases was abandoned (Losch et al., 1990). When devaluation of the FCFA occurred in 1994, the weak institutional development of privatized input market liberalized in 1992 inhibited a strong supply response; in contrast to Côte d'Ivoire where current production of 1.3 million tons is double the level in 1993.

The increase in price of cocoa from 1998 led to greater interest on the part of small farmers. This has encouraged farmers to intensify their production and by use of input such as pesticides and fertiliser on their farms. According to FAO (1992), it has become apparent that a dependence on pesticides may not be an effective and sustainable way to manage pests.

Some of the problems, which have become apparent with the widespread use of pesticides include: the elimination of natural enemies, resistance to pesticides (over 500 pests have now developed resistance to one or more type of pesticides), pesticides can be dangerous, and pesticides are expensive. Developing cost effective and environmentally sustainable integrated pest and disease management is thus a possible strategy towards promoting cocoa agro forests. Equally important is the need to minimize risk to farmers' at times of drastic institutional changes and fall in commodity price (Duguma et al., 2002).

A new approach to pest management has developed which attempts to make the most use of economical and environmentally safe pest control methods and to minimise pesticide use. This approach is called the Integrated Pest Management (IPM)-the integration of available techniques to reduce pest populations and maintain them below the level causing economic injury in a way, which avoids harmful side effects (FAO, 1992). However, there is insufficient implementation of general known crop management practice by farmers. This implies that there is need for additional activities. Asiaka (2003) pointed out that for research to be effective there must be an efficient mechanism whereby the end users can use its results, and that the process of making available the fruit of research is the function of extension. The experience of extension systems over the past few decades have been mixed. Some studies estimate high rates of return to the investment in extension (Birkhaeuser et.al, 1991), or to farmer education (Jamison et al 1982; Lockheed et al., 1980). Yet many observers document poor performance in the operation of extension and informal education systems, due to bureaucratic inefficiency, deficient program design, and some generic weaknesses inherent in public-operated, staff-intensive, information delivery systems (Feder et al., 2003) .One deficiency highlighted by researchers and practitioners is the tendency of many public officers dealing with the transmission of knowledge to conduct their assignment in a "top-down" manner. Often the information conveyed is presented, as a technological package comprised of recommended practices. This is perceived as a less effective method for improving knowledge compared with more participatory approaches (Braun et al. 2000) .Vos (2002), also noted that current extension services are often demotivated due to reduced capacity and poor pay. As a result, research extension linkages are generally weak.

In recent years, a number of development agencies, including the World Bank, have promoted Farmer Field Schools (FFS) as a more effective approach to extend science-based knowledge and practices (J.N. Binam et al., 2004).. The Sustainable Tree Crops Program (STCP) is testing the Farmer Field School (FFS) approach which is a participatory approach of diffusing new science base knowledge and information to farmers (The World Bank, 2002) in integrated pest management through pilot projects in Cameroon. The FFS training program utilizes participatory methods "to help farmers develop their analytical skills, critical thinking, and creativity, and help them learn to make better decisions" (Kenmore, 1997). Such an approach, in which the trainer is more of a facilitator than instructor, reflects a paradigm shift in extension work (Roling and van de Fliert, 1994).

Area Description and Survey Methodology

In Cameroon, cocoa is grown in Southwest, Littoral, East, Centre, and South Provinces (MINAGRI, 1993). Cocoa is frequent in the forest agro eco-system because of its tolerance to shading. The traditional cocoa based multi-strata agro-forestry plantations are characterized by a combination of cocoa trees, fruit trees, non-fruit trees, and other vegetable and leguminous species like cocoyams, cassava, and sweet potatoes. Food crops are usually associated in the agro forestry systems during the creation of the plantation and often

disappear after some years leaving a monospecific cocoa field (Tonye et al., 1987). This study concerns only the Centre Province, which is one of the two provinces (South and Centre) that cover the STCP pilot project sites of Cameroon. The pilot project sites are where the Farmer Field Schools were implemented. The Centre Province was purposefully selected for convenience of accessibility; and also because it is second only to the South-West province in terms of cocoa production. The vegetation in this zone is secondary forest. The climate is equatorial, with four seasons (two rainy season and two dry seasons). Rainfall is 1654mm in Yaoundé 1624mm in Ebolowa (Sonwa, 2002). Soils are ferralitic, nutrient poor, acid and fragile. Yaoundé is considered as a high population density zone with about 50-100 persons/Km^2 (Coulibaly, 2002). Land shortage is increasing and fallow lengths are being shortened from 20 to almost less than four years (Weber, 1977; Russel, 1993). In the Mbalmayo area the population density ranges from 13 to 25 inhabitants/Km^2 .The secondary forest is gradually disappearing with fallow periods varying from 5 to 10 years for mixed food crop fields. Land pressure has intensified as a result of population pressure but is lesser here than in Yaoundé zone.

Sampling Technique and Sampling Size

The sample study was got by a systematic sampling from a list of 284 farmer field school graduates who fulfilled the criteria for selection (were included in the 2002 baseline survey and also applied fungicides in their cocoa farms).

Primary data were collected from September to October 2004 in the Mefou and Afamba ,Nyong and So'o, and Lekie divisions of the Center Province of Cameroon. These data were supplemented with baseline data that were collected prior to the implementation of FFS training.

Results and Discussions

Application of IPM practice by respondents

The purpose of this section is to present the degree of application (adoption) of IPM technologies exposed to the respondents by the FFS .To achieved this, average adoption rate for each technology and overall adoption rate for all the IPM technologies have been calculated

Table 1: Application of IPM practice by respondent

IPM technology	Number of respondent exposed to	Number of adopter	Average adoption rate
Pruning	89	80	89.89
Shade management	89	84	94.38
Grafting	69	24	34.78
Phytosantitary harvest	90	84	93.33
Improved spraying practices	90	59	65.56
Overall adoption			**75.59**

The major management requirements of cocoa agroforest are shade control, weeding, pest and disease control, harvesting of pods and processing of beans (Wessel, 1987). According to Wessel, (1987), the role of shade in the management of cocoa agroforests is rather complex

as it affects or is related to several other growth factors. It reduces light intensity, temperature and air movement, and influences relative humidity, which indirectly affect photosynthesis and pest and disease management. Several reports suggest that, all other factors being equal, a level of shade that allows 20 to 30% of full light to reach the cocoa is needed for optimum growth and productivity (Lemée, 1955; Okali and Owusu, 1975). It should be noted however, that depending on the age of the tree and the intensity of light, there could be a significant variation in the level of shade requirement. This may vary from place to place and even from provenance to provenance. Farmers in Cameroon are quite familiar with the importance of shade in cocoa cultivation but they receive little assistance, if any, on how to better manage shade at various stages of the plant development.

The most severe problem faced by cocoa farmers in the region is pest and disease control. At a global level, yield loss due to disease is estimated at about 30% (Padwick, 1956). In West Africa, it ranges from 10 to 80% (10 to 30% in Côte d'Ivoire, 30 to 50% in Ghana and Togo, and 50 to 80% in Cameroon (Lass, 1987; Nyasse, 1997; Bakala and Kone, 1998). Among the several diseases that are responsible for such loss, black pod (*Phytophthora* species) is the most important (Bakala, 1981; Lass, 1987). Similarly, several insects are reported to attack different parts of the plant at different stages of development. Depending on the prevailing climatic conditions in a given area, chemicals, cultural practices or biological control methods can be used to control cocoa pests and diseases. Enhancing air circulation through regular weeding and pruning, ensuring there is adequate drainage, and removing pod husks immediately after harvesting and extracting the beans are some of the cultural practices recommended (Muller, 1974; Maddison and Griffin, 1981). Copper-based fungicides are also reported to be very effective to control *Phytophtora* pod rot (Bakala and Kone, 1998).

Table 1 above reveals that shade management has the highest average rate of adoption (94.38 %). Phytosanitary harvest ranked second with an average rate of 93.33 %. Pruning also had a high adoption rate of 89.89%. Improved spraying practices and grafting occupied the second to the last and the last rank with adoption rates of 65.56 and 34.78 % respectively. The high rates of adoption of shade management, improve spraying practices and pruning could be associated to the fact that farmers consider them to have high impact on potential yield.

Low application of grafting techniques could be due to the fact that farmers considered it to have non-immediate low impact on potential yield. Insufficient grafting material could also have been the reason that hindered it application.

The overall adoption rate was 75.59 %. This is slightly lower than the findings of Bahadur and Siegfried (2004) where the rate of adoption was 78.3 % but lower than those of Belle (2003) where only 36.78 % was recorded. It is important to note that the general high adoption rate may be associated to the fact that the season long training helped farmers to explore some of the benefits and cost of various IPM technologies. This implies they are sure of their net benefit.

Change In Farm Management Practices

This section presents the change in spraying practices, sprayings per seasons and number of sprayers per farm.

Spraying practices

Before the FFS a small percentage of the farmers (26.4%) applied the recommended spraying practices, i.e. spray until fungicide had moistened cocoa pods, but would not spray until runoff (table 2). However, some farmers (32.2%) still apply the wrong spraying practices after receiving the FFS training. This could be attributed to their usual habit spraying practices ie spray until fungicides would runoff cocoa pods.

Table 2: Pre and post program spraying practices

Spraying Practices	Year	Number	Percentage
Spray until fungicide would run off cocoa pods	2002(N=87)	64	73.6
	2004(N=87)	28	32.2
Spray until fungicide had moistened cocoa pods, but would not spray until runoff	2002(N=87)	23	26.4
	2004(N=87)	59	69.8

There was a significant change in spraying methods (table 2). This implies graduates in the majority no longer spray until saturation of cocoa pods.

Sprayings per season and number of sprayers per farm

It is important to note that there was a significant reduction in the number of sprayings per season between the pre and post program periods. The mean number of sprayings reduced from 7.37 during the pre program period to 3.86 after the farmer field school training. Therefore there was a 47.22% reduction in the frequency of application of fungicides. The significant change could be as result of the fact that most farmers did not depend on the calendar bases to spray but take decision to spray based on the powers of observation in the field. Significant changes did not only occur with the number of sprayings per season but also with the number of sprayers per farm(s). The average number of sprayers per farm(s) by participants was found to be 18.86 before the program intervention; the average number of sprayers per farm(s) by participants was found to be 15.65 after program intervention. Thus, there was a 17.02 % reduction in the number of sprayers applied by participants. This is not surprising as table 2 indicates that about 70 % of respondents spray until fungicide had moistened cocoa pods, but would not spray until runoff. By spraying in this manner, farmers avoided wastage of fungicides.

Table 3: Pre and post sprayings per season and number of sprayers per farm

		Mean	Std	Min	Max	2-tail sig
Number of sprayings per season	2002	7.3671	3.830	0.00	16.00	0.00
	2004	3.8608	2.341	0.00	19.00	
Number of sprayers per farm(s)	2002	18.86	19.693	0.00	98.00	0.00
	2004	15.6456	18.646	0.00	90.00	

Change in Labour Input and Amount of Fungicides use

Also reported in Table 4 are the fungicide costs incurred. In effect we see that labour is substituted for fungicide. Both variables show significant differences in the pre- and post-FFS situations. In terms of the sum total costs the post-FFS costs are slightly higher than the

pre-FFS cost although not significantly so. But it is important to note that the farmer has reduced his cash outlays for fungicides by nearly 40%. Given the cash constraints facing poor households this seemingly modest outcome can offer an important incentive for adoption.

Table 4: An evaluation of the effect of farmer field school training on the cost structure of cocoa farming.

Management practices	Pre FFS2002labour quantity (man/day)	costs	Post FFS 2004 labour quantity (man/day)	costs	Change in cost (FCFA)	T-test	Prob
Pruning of cocoa trees	7.573	7,573	15.152	15,152	7,579	4.36	0.000
Phytosanitary harvest	3.854	3,854	7.044	7,044	3,190	3.04	0.0036
Shade adjustment	1.292	1,292	7.266	7,266	5,974	6.75	0.000
Spraying labour	28.815	28,815	17.900	17,900	(10,916)	-3.62	0.0005
Sub total labour	41.5	41,534	47.362	47,362	5,827	7.72	0.0000
Fungicide use (sachets)		37,215		22,876	(14,339)	-2.84	0.0063
Total		78,749		70,238	(8,511)	-1.26	0.2122

Conclusion and implications for policy

The main objective of the study was to evaluate the impact of FFS training on Integrated Pest Management on cocoa Farmer Field School Graduates in the Centre Province of Cameroon. Working within the framework of the adapted logic model of program evaluation and based on the findings arrived at, certain conclusions can be drawn.

There was a significant difference in spraying method before an after the program intervention. In the majority, farmers no longer spray until saturation of the pods. There was a 47 % reduction in the frequency of application of fungicide. Also worth mentioning is the significant change in the number of sprayers per farm (17 % reduction in the number of sprayers per farm.).

The cost of labour and fungicide cost incurred showed significant difference in the pre- and post –FFS situations. In terms of sum total costs, the post-FFS costs are slightly higher than the pre- FFS cost although not significantly so. But it is important to note that the farmer has reduced his outlays for fungicides by nearly 40 %.

The policy implications are clear. Strengthening extension services by promoting FFS training approach. This farmer-to-farmer extension approach is expected to bring about cost-effective knowledge dissemination and financial sustainability, issues that have hampered

many public extension systems in developed and developing countries (Quizon et al., 2001; Hanson and Just, 2001).

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