

AGRICULTURAL INNOVATION FROM ABOVE AND FROM BELOW: CONFRONTATION AND INTEGRATION ON RWANDA'S HILLS

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Abstract

In its 2008 World Development report, the World Bank pleaded for a 'Green Revolution' for sub-Saharan Africa, pointing particularly to the importance of including smallholder farmers. This article focuses on the banana cropping system in Rwanda, and on the agricultural innovations introduced within this system. We first consider macro-level innovations that insert themselves into a broader logic of a modernized agricultural sector, and are thus in line with the rationale of the Green Revolution. We analyse how such 'top-down' innovations are received on the ground and show how smallholders seek to evade new government policies when they fail to reflect local economic and social realities. This demonstrates how some rural Rwandans are challenging the authority of the government in disguised ways in order to protect their local livelihoods. The Rwandan experience should inspire continent-wide Green Revolution policies to take account of the risk-coping rationale of small-scale farmers and their capacity to innovate 'from below'.

IN ITS 2008 WORLD DEVELOPMENT REPORT, the World Bank pleaded for a 'Green Revolution' for sub-Saharan Africa, pointing to the importance of including smallholder farmers in agricultural modernization. After 25 years of silence from the World Bank on the importance of agriculture for development, accompanied by a dramatic decrease in aid to the agricultural sector, the report received a warm welcome for putting agriculture back on the development agenda. However, the report was also strongly criticized for being 'the logical culmination of prior rural policy and practice at the World Bank'¹ and 'staying very close to the assumptions of the old and still dominant paradigm [of neoliberal policies embedded in the post-Washington consensus]'.² It was also said to provide very little insight into how the fundamental dynamics of rural poverty can be countered within the new globalized economy.³ As Haroon Akram-Lodhi stated, the 'WDR does not support smallholder farming *per se*, but

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¹ A. Haroon Akram-Lodhi, '(Re)imagining agrarian relations? The World Development Report 2008: Agriculture for development', *Development and Change* **39**, 6 (2008), pp. 1145-1161.

² Henry Veltmeyer, 'The World Bank on "Agriculture for development": a failure of imagination or the power of ideology?' *Journal of Peasant Studies* **36**, 2 (2009), pp. 393-410.

³ *Ibid.*

commercially-oriented, entrepreneurial smallholder farming', which in reality will only be applicable to a minority of entrepreneurs. He interprets this as the commitment of the World Bank to facilitate the integration of a relatively small proportion of competitive smallholders into the global economy, whereas the majority of so-called 'non-competitive farmers with limited productive capacity' would be left out of the picture.⁴

A similar evolution seems to be taking place in Rwanda. Over the last decade, the Rwandan economy has been characterized by an average growth above 8 percent per year.⁵ While there is little space for democratic dialogue and freedom of expression, the country has been applauded for the quality of its technocratic governance and for the way in which authorities manage to maintain macro-economic stability.⁶ David Booth and Frederick Golooba-Mutebi, for example, describe Rwanda as a developmental patrimonial state in which close business-politics interconnections lead to constructive economic outcomes because of the elites 'politically inspired economic activism'.⁷

The agricultural sector occupies an important place in the visions and ambitions of the Rwandan authorities.⁸ Within the framework of the implementation of the principles of 'Vision 2020', the Rwandan government adopted the National Agricultural Policy (NAP) in 2004.⁹ In 2005, it applied the NAP through the Strategic Plan for the Transformation of Agriculture, SPTA(I), which was updated in the SPTA(II). Rwanda's agricultural policies aim to achieve agricultural modernization, intensification, professionalization and enterprise development through innovative strategies that promote monocropping and regional crop specialization, land registration and the consolidation of plots, as well as market-orientation in all production activities.¹⁰ These policies seem to be paying off in terms of overall productivity growth. However, Ansoms has previously analysed how such modernized and innovative techniques pose significant risks to the fragile livelihoods of the majority of Rwandan smallholder farmers, while not living up to their expectations in terms of improved well-being.¹¹

In this article, we focus on the banana cropping system. Banana is a common crop for the majority of smallholders in the region, and therefore a privileged entry point for studying agrarian systems. The importance of banana for Rwanda's smallholders can be explained by the multiple functionalities of the crop as a food and cash crop; but also for its agronomic aspects in terms of prevention of erosion and renewing of soil fertilization.¹² In line with regionalization policy, the Rwandan government wants to break with a tradition of banana growing at the level of each household, and wants to concentrate banana production in a few regions with suitable agro-ecological conditions for banana growing. Moreover, policy makers aim to significantly innovate production methods in order to increase overall output.¹³

⁴ Akram-Lodhi, 'Reimagining agrarian relations?', p. 1156.

⁵ IMF, 'Rwanda: 2012 Article IV Consultation and Fifth Review under the Policy Support Instrument and Request for Modification of Assessment Criteria' (IMF Country Report No. 13/77, Washington, 2013).

⁶ An Ansoms and Donatella Rostagno, 'Rwanda's Vision 2020 halfway through: what the eye does not see', *Review of African Political Economy* **39**, 133 (2012), pp. 427-450.

⁷ David Booth and Frederick Golooba-Mutebi, 'Developmental patrimonialism: the case of Rwanda', *African Affairs* **111**, 444 (2012), pp. 379-403, p. 403.

⁸ An Ansoms, 'Reengineering rural society: the visions and ambitions of the Rwandan elite', *African Affairs* **108**, 431 (2009), pp. 289-309.

⁹ MINAGRI, 'Strategic Plan for the Transformation of Agriculture in Rwanda - Phase II (PSTA II) - Final Report' (MINAGRI, 2009).

¹⁰ Ansoms and Rostagno, 'Rwanda's Vision 2020 halfway through'.

¹¹ An Ansoms, 'Views from below on the pro-poor growth challenge: the case of rural Rwanda', *African Studies Review* **53**, 2 (2010), pp. 97-123. See also An Ansoms and Jude Murison, 'D''Arabies Saoudite'' au ''Darfour'': L'histoire d'un marais au Rwanda', in Filip Reyntjens, Stefaan Marysse and Stef Vandeginste (eds), *L'Afrique des Grands Lacs: Annuaire 2011-2012* (L'Harmattan, Paris, 2012).

¹² Hubert Cochet, *Crises et Révolutions agricoles au Burundi* (Karthala, Paris, 2010).

¹³ Interview, employee of MINAGRI-CIP project, 17 February 2011, Kigali.

Our methodology is based upon in-depth qualitative research, conducted at various times (each farmer was interviewed from two to four times) with a limited sample of farmers (n=18). Most of them grow bananas, but they live in three diverse agro-ecological environments.¹⁴ In the first phase, in 2009, we conducted semi-structured interviews with 18 farmers living in three regions: the Gatore sector in the Eastern Province, the Kinazi-Musenyei sectors in the Southern Province and the Nzahaha sector in the Western Province. Our sample in each setting included three farmers adopting “traditional” cultivation patterns, and three “innovative” farmers in terms of practices adopted in the banana-based cropping system.¹⁵ We gathered information on the rationale behind their cultivation practices, and the constraints they faced in sustaining their daily livelihoods. We also conducted interviews in Burundi (Cibitoke, a sector of Cibitoke province) and DRC (Lurhala, a *groupement* in *territoire* Wallungu). In the second phase, in July 2010, we combined individual semi-structured interviews with focus group discussions to share views on ‘pathways of innovations’.¹⁶ For the focus groups, our interviewees were invited to a group discussion accompanied by two guests of their own choice. Two group discussions of six to twelve participants were organized per setting. For both research phases, our purpose was not to be representative, but to gather in-depth information on cultivation systems, local livelihoods and pathways of innovations in banana cropping.

We use these data to analyse the impact of agricultural innovations on the banana cropping system. On the one hand, we focus on macro-level innovations that form part of a broader policy framework that aims for a modernized agricultural sector. On the other hand, we illustrate how smallholders also develop their own innovations “from below” in response to or independent of top-down innovations. We analyse smallholders’ response to both types of externally-induced innovations, ranging from obligatory adoption with hidden or open resistance, to hesitant integration within local-level farming systems. In this way we are able to show that government efforts to reduce the production of beer bananas fail to take into account the fact that beer bananas are a less risky investment, are more easily marketable, and play an important social function within rural communities. As a result, farmers have sought to evade new government policies, using a range of innovative strategies to sustain prior practices. In doing so, they demonstrate how some rural Rwandans are quietly challenging the authority of the government through every day acts of resistance.

Externally-induced innovations: confrontation and integration

¹⁴ The qualitative data collection consisted in comprehensive interviews (around two-three hours). In this way, the sample is varied and represents the diversity of the banana-based cropping systems in the region. That is why the sample is limited but contrasting.

¹⁵ To differentiate between the “traditional” and “innovative” farmers, we made a typology on the basis of a large sample of farmers (344) previously surveyed by CIALCA (Consortium for Improving Agriculture Based Livelihoods in Central Africa). To refine this typology and increase the diversity of farmers beyond those included in the initial CIALCA sample, we did a preliminary survey (with a sample of 24 farmers) that gathered data on farm characteristics, banana practices in terms of intercropping or monocropping, adoption of varieties, etc., and ability to innovate). On the basis of this information, we selected a limited sample of more “traditional” and more “innovative” farmers in three sectors. A quantitative agricultural diagnosis completed the characterization of the regional sample. See Julie Van Damme, *Analyse systémique des processus d’innovation dans les systèmes agraires de la région des Grands Lacs basés sur la culture de banane* (Université catholique de Louvain, unpublished PhD dissertation, 2012).

¹⁶ While opposing to the concept of ‘transfer’ or ‘diffusion’ of an innovation from the conceiver to the farmers, Neils Röling introduces the concept of a ‘pathway of innovations’, defined as ‘a process of technical and institutional change at farm and higher system levels that impacts on productivity, sustainability and poverty reduction’ in ‘Bananas (*Musa* spp.) and New Thinking about Pathways for Science Impact’. (Proceedings of International conference on banana and plantain in Africa, edited by T. Dubois et al., Monbassa, 2008).

Vanloqueren and Baret define the relevance of an innovation as ‘the efficiency to solve problems in agricultural systems without creating new problems’.¹⁷ However, in many circumstances the introduction of innovations inevitably causes disruption with traditional practices.¹⁸ The farmers’ feelings associated with these disruptions are not always noticeable on the surface. Indeed, while farmers often seemingly comply with innovation-inspired policy directives, hidden forms of resistance may exist. Resistance to externally-induced policies has always existed throughout history. These ‘everyday forms of peasant resistance’¹⁹ typically avoid any direct, symbolic confrontation with authority²⁰. In his later work, James Scott referred to the discrepancy between the public transcript, ‘designed to be impressive, to affirm and naturalize the power of dominant élites’; and the hidden transcript that takes place ‘offstage’.²¹

In the context of Rwanda, hidden forms of resistance to externally-induced agricultural innovations have always been present. In colonial times, farmers silently sabotaged the colonial authorities’ obligations in terms of coffee production. Even under the Habyarimana regime Johan Pottier found that ‘it is encouraging that the agronomist’s advice is not heeded in blinkered fashion’.²² The contemporary examples in this article fit into that same tradition, showing that the extent of ‘hidden resistance’ crucially depends upon the scale and the level at which the innovation takes place.

Whereas innovations can be introduced at all levels and for many different crops, this article focuses on the banana cropping system. A classic banana plantation in the Great Lakes region is a plot in which different crops and different banana types are mixed. Intercropping increased during the 1950s-1960s when rising demographic pressure reduced the available cultivated land area per household.²³ Banana groves (intercropped with food crops like for example beans) are generally located near the house; other scattered fields, on which farmers practice complex intercropping, are located further away from the homestead (on farm fragmentation).²⁴

There are three types of banana: the beer banana, the cooking banana and the dessert banana. According to an estimate by the Ministry of Agriculture,²⁵ these different crops represented 60, 30 and 10 percent of acreages in 2005, respectively. The beer banana is used to make juice or beer, the latter having a particular role in Rwandan social life.²⁶ Cooking bananas are a staple food but can also provide an important source of revenue when sold on the market.²⁷ Dessert bananas are most often grown in the proximity of larger markets and can be an important source of income in those regions. When consumed at the local level, the main consumers are children. Some varieties of dessert bananas can also be used in beer brewing for sweetening.

¹⁷ Gaëtan Vanloqueren and Philippe V. Baret, ‘Systemic “relevance assessment” of transgenic crops: bridging biotechnology regulations and sustainable development policies?’ (Preprints of the 5th congress of the European Society for agricultural and food ethics, Leuven, 2004).

¹⁸ Eric Mollard, ‘L’innovation est-elle risquée? : un point de vue agro-économique’, in Jean-Pierre Chauveau, Marie-Chirstine Cormier Salem and Eric Mollard (eds), *L’Innovation en Agriculture : Questions de méthodes et terrains d’observation* (A Travers Champs, Paris-IRD, 1999), pp. 43-64.

¹⁹ As framed by James C. Scott, *Weapons of the Weak: Everyday forms of peasant resistance* (Yale University Press, 1985).

²⁰ *Ibid.*

²¹ James C. Scott, *Domination and the Arts of Resistance: Hidden transcripts* (Yale University Press, London, 1995).

²² Johan Pottier, ‘Three’s a crowd: Knowledge, ignorance and power in the context of urban agriculture in Rwanda’, *Africa* **59**, 4 (1989), pp. 461-477.

²³ Cochet, *Crises et Révolutions agricoles au Burundi*.

²⁴ See Danielle De Lame, *A Hill among a Thousand: Transformations and ruptures in rural Rwanda* (University of Wisconsin Press, 2005).

²⁵ MINAGRI, ‘Programme national pour le développement de la banane’ (MINAGRI, Kigali, 2005)

²⁶ See De Lame, *A Hill among a Thousand*.

²⁷ Claudine Picq, Eric Fouré and Emile A. Frison, ‘Bananas and food security’ (Proceedings of the INIBAP International symposium, Cameroon, 1998).

In 2005, the Rwandan government adopted a banana programme - in line with its SPTA - that aimed to reduce the proportion of beer bananas (from 60 to 40 percent) and raise the proportion of cooking (from 30 to 45 percent) and dessert bananas (from 10 to 15 percent) between 2005 and 2010. This policy was based upon policy makers' dislike of the consumption of traditional banana beer, because drunk people are perceived to fight and the tradition of banana beer is accordingly not in line with their objectives to create a modern society.²⁸ As one of our focus group discussions highlighted:

In the past, the inns (*cabarets*) served banana beer and it was a source of income. Now, the government bans the traditional transformation process. Authorities would like to industrialize the process.²⁹

Furthermore, policy makers consider that the production of other crops may result in higher market value. As expressed by a local agronomist in Rwanda East:

Indaya [beer banana] means “*whore*” because it cannot be controlled, and the plants produce a lot of suckers. They only produce little bunches. We [the extension officers], do not like this. But the bananas grow almost wild and they do not require a lot of maintenance such as mulching for example.³⁰

The authorities' moral dislike of beer bananas is not new. During the mid-1980s, the Habyarimana government aimed to reduce beer production by reducing banana cropping 'to a maximum one-sixth of the family farm, or one-fourth in areas where bananas grow really well. Regions where the growth of the banana tree is inappropriate [defined as above 1,900 metres] should substitute crops such as sunflowers, wheat, groundnuts and cassava'.³¹

In the fields, however, we see that the policy of converting from beer to cooking banana has been met with scepticism by the banana-growing farmers. Despite the supply of cooking banana plants by governmental agents, and the fact that prices for this banana type on the market are higher,³² farmers are not ready to switch. This can be explained by the fact that the current policy neglects the complexity of the decision process that smallholder farmers make when choosing between different banana types (See figure 1).

²⁸ As one informant put it: 'The authorities perceive that as drunkenness and lack of hygiene'. Personal communication, inhabitant, Gatore, 17 June 2010.

²⁹ Interview, banana farmers, 23 June 2010, Kinazi.

³⁰ Personal communication, extension officer, 28 October 2009, Gatore.

³¹ Johan Pottier, 'Stock taking: food marketing reform in Rwanda, 1982-89', *African Affairs* **92** (1993), pp. 5-30.

³² The banana programme of MINAGRI gives the estimate of 40 RwF/kg for beer bananas, 55 RwF/kg for cooking bananas and 75 RwF/kg for dessert bananas (2005).

		Beer banana	Cooking banana	Dessert banana
Agroecological conditions	Disease resistance	resistant	sensitive	very sensitive
	Soil	poor	fertile	mostly fertile
Cultural practices	Labour intensity	medium	high	high*
	Intercropping	works well	better without	generally better without
	Density	high	low	low*
	Manure needs	low	high	high*
Market	Proximity	local	local market	Kigali
	Preservable	medium	low	very low

*For marketing.

Source: Summary on the basis of interviews with farmers included in our sample and other stakeholders.³³

Figure 1. Banana types and farmers' risk assessment

First, different banana types (and varieties within each type) respond differently to agro-ecological stresses. Beer bananas are generally perceived as more resistant to abnormal weather conditions than cooking bananas, which are 'are widely viewed as poorly adapted to withstand stresses such as untimely rainfall, drought...'.³⁴ Farmers also mentioned that cooking bananas are disease-prone:

Some grow cooking banana. I don't have it because cooking bananas are more sensitive to disease. There is only one variety without symptoms [referring to vulnerability to disease]: a beer variety. If this variety is attacked, it survives. The cooking varieties, [however], cannot last more than a year after the attack.³⁵

Field observations revealed that dessert varieties of banana are the most sensitive to disease, most notably the *Kamaramasenge* variety, but also for *Gros Michel*. The vulnerability of dessert bananas is illustrated by a new disease that is currently spreading in the Great Lakes Region, which has had the biggest impact on dessert banana plantations.³⁶

³³ Agronomists from the National Agricultural Research Systems (ISAR), a parastatal research institute that provides extension services to agronomists at the level of districts and sectors.

³⁴ Svetlana V. Gaidashova, Suleman H.O. Okech, Clifford S. Gold and Innocent Nyagahungu, 'Why beer bananas: the case for Rwanda', *InfoMusa* 14, 1 (2005), p.2.

³⁵ Interviews, banana farmers, Cibitoke, Burundi, 28 October 2009. Some general considerations on bananas were taken from interviews in the neighbouring countries of Burundi and Democratic Republic of Congo.

³⁶ Since 2002, the Banana Xanthomonas Wilt (BXW), a bacterial disease, have ravaged the banana plantations of the Great Lakes region. The spread of this disease has increased since 2011-2012. The first varieties affected, as reported by a diagnosis survey in Idjwi (South Kivu, DRC), were dessert varieties such as *Kamaramasenge*.

When confronted with a disease, farmers who have sufficient financial means can replace the affected plants with new resistant varieties like *Cavendish*, *Poyo*, *FHIAs*.³⁷ Most smallholder farmers, however, lack those means and extend or reintroduce indigenous highland beer or cooking bananas which they hope will be disease resistant. As mentioned by a farmer:

Those who have the necessary means can buy new varieties to replace bananas on their entire plot. However, those without the necessary means mix with traditional varieties [already present at the local level].³⁸

The same farmer highlighted the importance for farmers of cultivating indigenous banana varieties next to new species as a risk-coping mechanism in case an introduced variety is affected by a disease.

Soil fertility is another agro-ecological aspect that affects the choice of the banana type. Cooking bananas tend to grow better in areas where the soil is fertile.³⁹ In less fertile regions, farmers prefer to grow beer bananas. In Musenyi (Southern Province) – a less fertile area - one of our respondents mentioned: ‘The land of my parents was stony. It was not a good soil to start with, but we can grow traditional beer banana varieties.’⁴⁰ Another added: ‘If the soil were more fertile, I would grow *Inyamunyu* (cooking bananas) next to only beer bananas. However, the *Ndaya* variety (beer banana) is more tolerant to our type of soil.’⁴¹ In 2005, Gaidashova concluded likewise: ‘Beer bananas (of the ABB variety) perform better on poor soils than cooking bananas and beer bananas of variety AAA-EA’.⁴²

Furthermore, beer bananas are more resistant to windy conditions. As a result, switching to cooking or dessert bananas involves a great deal of additional labour in supporting banana trees to prevent them from falling down. As one of our interviewees mentioned:

Even with wooden supports, the wind makes banana trees fall down. We only do that [place wooden supports] for the *Injagi* type (cooking banana) because they grow in height.⁴³

In Musenyi (Southern province), one of our respondents had developed quite an innovative system for his banana production by placing the most fragile banana trees (cooking bananas) in the centre of the plot, then surrounding them by a ‘belt’ of traditional beer banana trees that functioned as a natural wind shield.

Not only do farmers consider agro-ecological factors when making crop choices but they also look at their own cultivation capacities and take into account market opportunities. Dessert bananas, first of all, can only really be sold in Kigali and thus require farmers to be embedded in a trade chain linked to the capital city. This is rarely the case for more remote areas. Cooking bananas are more often sold at local markets, but again, not all smallholders have access. In one of our research settings (Gatore, in the Eastern Province), farmers grew a high proportion of dessert and cooking bananas. The presence of a cooperative, organizing the collection and transfer of bananas from Gatore to Kigali, was of major importance. However, for regions where markets are less accessible, growing beer banana may have several advantages.

Indeed, a fresh bunch of cooking bananas is more perishable than a bunch processed into beer. Furthermore, market-oriented banana growing requires heavy and high quality banana bunches. One of our respondents described a ‘good cooking bunch’ as having ‘a minimum weight of 50 kg for the variety *Injagi*, with long fingers, an intense green colour and easy to cook’.⁴⁴ Logically, growing such high quality bunches requires more labour and sustained attention in comparison to the management of a beer banana plantation. In addition, cooking

³⁷ Varieties from the Fundación Hondureña de Investigación Agrícola

³⁸ Interview, banana farmer, Cibitoke, Burundi, 28 October 2009.

³⁹ Anacleto Nsabimana, Svetlana V. Gaidashova, G. Nantale, Deborah Karamura and Johannes Van Staden, ‘Banana cultivar distribution in Rwanda’, *African Crop Science Journal*, **16** 1 (2010), pp. 1-8.

⁴⁰ Interview, banana farmer, Musenyi, 3 November 2009.

⁴¹ Interview, banana farmer, Musenyi, 3 November 2009.

⁴² Gaidashova, ‘Why beer bananas’, p.5.

⁴³ Interview, banana farmer, Nzahaha, DRC, 11 July 2010.

⁴⁴ Interview, banana farmer, Gatore, 28 October 2009.

bananas require more manure as outlined by several of our interviewees. Finally, to grow big bunches, cooking banana plantations have to be less densely planted. In fact, whereas beer bananas can easily be intercropped with other crops, this is less the case for cooking bananas. A farmer observed ‘Beyond this resistance to the disease ... [a variety of beer banana] is also a variety that lends itself to intercrop with other crops like beans’.⁴⁵ Gaidashova also found that ‘brewing bananas are more tolerant of adverse growing conditions and low levels of management’.⁴⁶ At the same time, beer bananas can be transformed into juice and/or beer that can be sold locally on an *ad hoc* basis, and in this sense offer farmers greater flexibility.

So, overall, beer bananas are quite popular for several reasons: they grow in poorer soil, they require less manure, labour and management; and banana beer is more easily marketable at the local level – especially in remote areas. Another factor that motivates farmers to cultivate beer bananas is the fact that banana beer has an important social function at the local level. It is an essential present to be given at various ceremonies: ‘The last transformation was in August during which I produced two jerrycans to give as a present at a wedding’.⁴⁷ Sharing banana beer symbolizes a shared bond of friendship; and banana beer is an important commodity to exchange for services.⁴⁸ One of our respondents mentioned:

The beer makes it possible to solve certain problems at home: the construction of a house [he paid the labour force to build his house with two cans of *Gasigisi*], social relationships - marriage, friends. You can use it for an exchange of services, like money.⁴⁹

An additional important element is that banana juice is often a crucial element in children’s nutrition, used as a substitute for cow’s milk in contexts where livestock holdings have decreased. As mentioned by a female respondent in Eastern Rwanda:

Here, there are no cows and we have to drink something. ... Even if it does not bring in a lot of money, we keep our beer bananas, this gives us something to drink, our children have access to the juice.⁵⁰

By not taking into account these agronomic, economic and social dimensions that influence farmers’ choices, the government’s policy to replace beer bananas with alternative cooking or dessert varieties has been met with little enthusiasm. During interviews, respondents were at first reluctant to openly defer from the official line and cited for example the advantages of cooking bananas over beer bananas. In their meeting with a foreign researcher, they thus confirmed at first the “public transcript” as set by Rwandan authorities. Our field visits, however, showed that many of them resisted the switch from beer to cooking/dessert bananas. In later conversations, we were able to capture parts of the hidden discourse⁵¹ on why beer bananas are preferred.

Some farmers have developed inventive strategies to circumvent forceful intervention by local authorities, by planting the “desired variety” at the visible borders of the plot, while placing their own preferred variety away from the official radar. Maintaining a few mats of beer bananas seems to be the rule in the South setting: ‘Even if there are few mats, we need a minimum for our own consumption’.⁵² In the Western province, one of our respondents argued ‘There are cooking bananas to eat at home and to sell at the market, but we cannot remove all beer bananas because we must make beer at least once a month’.⁵³ And even in Eastern Rwanda, where growing beer banana is rather exceptional, farmers mentioned how it can result in higher earnings than other types of bananas during certain periods:

⁴⁵ Interview, banana farmer, Cibitoke, Burundi, 3 November 2009.

⁴⁶ Gaidashova, ‘Why beer bananas’, p. 3.

⁴⁷ Interview, banana farmer, Lurhala, DRC, 18 November 2009.

⁴⁸ See De Lame, *A Hill among a Thousand*.

⁴⁹ Interview, banana farmer, Lurhala, DRC, 18 November 2009.

⁵⁰ Interview, banana farmer, Gatore, 28 November 2009.

⁵¹ See Scott’s terminology in *Domination and the Arts of Resistance*.

⁵² Interview, banana farmer, Kinazi, 9 November 2009.

⁵³ Interview, banana farmer, Nzahaha, 27 October 2009.

A kilo of beer banana costs 50 RwF at this moment, whereas it is only 30 RwF for cooking banana. This price difference can be explained by the relative lack of beer bananas. The price also varies during the season. At this moment, the weather is hot and people need to drink beer.⁵⁴

With regards to the policy objective to shift from beer to cooking and dessert bananas, forms of resistance tended to occur beneath the surface. Some farmers hid their beer bananas in the middle of their plots, surrounded by cooking or dessert bananas. Interviewees were also reluctant to directly share their objections to new banana types, and only through our field observations, and after repeated returns to the field, did we collect farmers' true opinions about the government's policy guidelines.

Monocropping versus intercropping: top-down reforms meet open resistance

The Rwandan government's banana policy does not only foresee the replacement of beer bananas with cooking or dessert bananas; it also aims for the adoption of "modern" production techniques. It seeks, for example, to replace intercropping (combination of different crops in the same plot) with monocropping – in line with the overall agricultural policies mentioned previously. This implies a considerable change in traditional banana-based cultivation systems. Indeed, traditionally, the banana plantation is located close to the house (*rugo*) where different varieties of bananas are intercropped with shadow crops - mainly beans.⁵⁵ The intercropping system is the product of a long process of intensification of land use by the peasants. The cultivation of several crops in the same fields requires constant attention and intense labour,⁵⁶ but the diversification of crops also allows farmers to balance their diet and to better manage the risks imposed by climatic conditions or crop diseases affecting particular crops.⁵⁷

The recent monocropping policy guidelines include a ban on intercropping⁵⁸ and thus implicitly places a ban on the combination of bananas with other crops. The assumption is that monocropping will increase productivity rates and that farmers will sell their produce on the market and then buy what they need. By and large, the measure has been forced upon farmers. A whole chain of administrative agents and local authorities – from the national to district, sector, cell, and village level – is made responsible to implement the rule.⁵⁹ Meetings with agricultural extension services are organized during which farmers are informed about the importance and advantages of the new measure, and about technical details on how to adopt it. After such meetings, farmers are supposed to adopt monocropping, and the same chain of agents is tasked with the supervision and control of effective implementation. Farmers risk being fined if they do not apply the recommendations.⁶⁰

During our field research, we immediately noticed that our respondents were quite open in discussing their dislike of this externally driven innovation. Several interviewees complained about the feasibility of shifting from intercropping to monocropping. Several respondents highlighted that the constraints imposed by land scarcity simply do not allow for monocropping. Only producing one crop also places farmers under greater economic stress because while

⁵⁴ Interview, banana farmer, Gatore, 29 October 2009.

⁵⁵ Suleman H. Okech, Svetlana V. Gaidashova, C.S. Gold, Celestin Gatarayihya and P. Ragama, 'Banana pests and diseases in Rwanda: A Participatory Rural Appraisal and Diagnostic survey observations' (Proceedings of the Integrated Pest Management symposium, Kampala, 2002).

⁵⁶ 77.4 percent of the sampled farmers use external labour. See J. Van Damme, *Analyse systémique des processus d'innovation dans les systèmes agraires de la région des Grands Lacs basés sur la culture de la banane* (Université catholique de Louvain, unpublished PhD dissertation, 2013).

⁵⁷ Narpat S. Jodha, 'Intercropping in traditional farming systems', *Journal of Development Studies* 16, 4 (1980), pp. 427-442 and Ansoms, 'Views from below on the pro-poor growth challenge'.

⁵⁸ MINAGRI, 'SPTAII' and IFDC, 'Crop Intensification Programme (2008-2009) – Evaluation Report' (MINAGRI/CIP, 2010).

⁵⁹ Ansoms, 'Views from below on the pro-poor growth challenge'.

⁶⁰ Field observations, 2009.

bananas and beans are crucial for local nutrition, prices for both crops on local markets can be highly volatile. Moreover, farmers assess the overall output generated on a plot with banana-bean intercropping as higher than the output generated on a plot with monocropping of banana or beans.⁶¹ A respondent claimed that the ‘yields are the same for beans and bananas when they are intercropped. It is even profitable’.⁶² Another interviewee suggested that ‘There is no difference [referring to banana productivity] between the banana plot associated with beans, and a banana plot in monoculture. There is no competition.’⁶³

In addition, the adoption of monocropping techniques implies an increase of labour, which women are particularly conscious about because they are in charge of annual crops (while men are responsible for the bananas). A widow argued that in the past,

The management (weeding, mulching) could be done at once for all three crops [the intercropped yam, squash, pepper]. Now, it has to be done independently for each culture. Thus labour is multiplied by three. Everyone does not have the same means to change. We [in his family] do it gradually because there is only me as the labour force.⁶⁴

Another respondent reasoned in the same way:

Intercropping allows for a limitation [of labour required for] the management of the crops (weeding). When there are no beans [in between banana trees], more work is required.⁶⁵

In these farming systems, labour shortages are likely at particular times of year.⁶⁶ The productivity of labour is a limiting factor in the systems and each extra work is critical.

Following the implementation of the reform, most of the farmers stopped intercropping bananas with crops such as yam, or annual crops such as squash. However, there are farmers who are trying to circumvent the policy by combining bananas and beans on the more hidden parts of their plots that are not visible from the road. While some kept their resistance to the policy hidden, others engaged in more open forms of resistance. One interviewee told us that he prefers to pay the fine for multicropping (between 2,000 and 5,000 RwF in that area) rather than remove the beans.⁶⁷ Some administrative agents are sympathetic to this stance. Although elements in the administrative chain have been mobilized in the implementation of the monocropping policy, those operating at the most local level appear to recognize its problematic consequences. In November 2009, an *umudugudu* official (lowest administrative level) in the Eastern province expressed her profound disappointment with the rule. She argued that it was conceivable to remove all crops from the banana groves, except for beans. In her opinion, ‘a Rwanda household without beans has nothing as this is the main source of proteins - in the absence of meat.’⁶⁸ Furthermore, she highlighted how the production of beans in combination with bananas is a way to cope with risks: ‘if the banana plantation is damaged by wind, you still have another crop to harvest’. Following this rationale, they maintain intercropping practices despite regulatory pressure to change.

These concerns did reach state agents higher up in the administrative chain. During our interview with a RADA agent,⁶⁹ he acknowledged the fact that banana-bean intercropping may

⁶¹ Van Damme, *Analyse systémique des systèmes agraires*.

⁶² Interview, banana farmer, Gatore, 29 October 2009.

⁶³ Interview, banana farmer, Kinazi, 9 November 2009.

⁶⁴ Interview, banana farmer, Gatore, 28 October 2009.

⁶⁵ Interview, banana farmer, Kinazi, 9 November 2009.

⁶⁶ Sara Berry, *No Condition is Permanent. The social dynamics of agrarian change in sub-Saharan Africa* (University of Wisconsin Press, Wisconsin, 1993).

⁶⁷ Interview, banana farmer, Nzahaha, 21 November 2009.

⁶⁸ Interview, banana farmer, Gatore, 29 October 2009.

⁶⁹ RADA is the former national Rwanda Agricultural Development Authority, today grouped with ISAR in the RAB, or Rwanda Agriculture Board.

have good results. However, other types of intercropping were, in his opinion, more problematic. He defended the radical ban on intercropping by stating that farmers are not capable of understanding a nuanced rule where some types of intercropping are permitted (for example with beans) and others not. This is why, in his opinion, the policy had to forbid all types of intercropping. Another state agent of the same institution mentioned that banana-bean intercropping as such does not cause problems if done properly. However, he felt that farmers were not capable of adopting the appropriate technique, given that ‘during the rainy season, farmers dig to plant beans and they cut the banana roots’.⁷⁰ This justified, in his view, the prohibition on intercropping. However, his statements were entirely contradicted by our observations. In Gatore (Eastern Province), for example, we observed how farmers were meticulous in facilitating the co-existence of both crops. They planted beans at a certain distance (often 60 cm) from the banana mat; and used miniature hoes to sow beans in non-tilled soil covered by mulch. Such gentle, superficial and localised tillage for sowing beans does not destroy the root network of the soil and as a result does not significantly affect banana output.

Over time and through lobbying efforts of academics and development practitioners with extensive field experience,⁷¹ protests against monocropping seemed to reach agricultural policy makers. In November 2009, for example, we interviewed a RADA agent who was aware of such resentment. He expressed his strong belief in the usefulness of the agrarian reforms in improving the performance of the agricultural sector and reinforcing local livelihoods but also acknowledged that there were occasional problems in implementation. He however narrowed this down to a faulty interpretation of well-intentioned policies by local authorities.⁷² After we left in November 2009, the ban on banana with bean intercropping was withdrawn.

During our next field visit in June 2010, we learnt that a RADA training course was being planned for September 2010 in Gatore (Eastern Province) to promote “correct” practices of intercropping banana and beans. At the end of October 2011, during our next field trip, an *umudugudu* official in Gatore sector reported that in the end this did not take place as the authorities had changed their mind again. This lack of consistency in policy guidelines enhances farmers’ reluctance to follow nationally defined policy objectives.

In this case, most farmers are radically – and quite openly - opposed to monocropping requirements as these do not suit local realities. In the end, most of them reluctantly adopted the approach because of extensive government control; however, policy makers were made aware of the problems with the monocropping system and the strength of opposition appears to have caused the government to re-think.

Mediating government policy with local knowledge

Even when local farmers adopt externally-induced policy objectives, they use their own experience and knowledge to adapt and transform these top-down innovations in line with local needs.⁷³ In Musenyi (Southern Province), for example, we met with a farmer involved in a CIALCA experiment with new mulching techniques. Mulching involves placing a protective cover around the banana plants, which consists of organic material such as leaves and straw (banana self-mulch and when possible with application of external grass). Mulching adds

⁷⁰ Interview, government official, Kigali, 2009.

⁷¹ These include the first author of the paper in collaboration with other academics at the Université catholique de Louvain, but also development practitioners from CIALCA, and even government officials from within RADA.

⁷² He pleaded for an improvement in communication between the implementers and the farmers. It seems however that this ‘problem in interpretation of the policy’ was reinforced by the way in which the administrative system is organized. Local authorities at every level of the administrative chain have to prove through performance contracts how they rigidly implement policies, which encourages them to interpret policies literally without room for adaptation to local conditions. See Ansoms and Rostagno, ‘Rwanda’s Vision 2020 halfway through’.

⁷³ Jean-Pierre Chauveau, Marie.-Christine Cormier-Salem, Eric Mollard, *L’Innovation en Agriculture: Questions de méthodes et terrains d’observation* (Institut de recherche pour le développement (IRD), Paris, 1999).

nutrients, prevents the evaporation of moisture and the growing of weeds and reduces the risk of erosion. A covering mulch of 2 cm is effective.⁷⁴ One of our interviewees explained that he had been recommended to ‘apply a mulch of 5 – 10 cm on the soil of the banana plantation except in a circle of 60 cm around the banana mat/stem [to avoid contamination by diseases]’,⁷⁵ although he had not strictly respected the 60 cm rule. In the dry season, he covered the entire soil with mulch to protect the soil from drying out. By the time the rainy season started, he reapplied the recommended rule and removed the mulch in a circle of 60 cm around the stem of the trees to avoid them rotting or being affected by disease.

In addition to local adaptation of top-down externally-induced innovations, innovative ideas may also come from farmers themselves. For example, Rwandan farmers who had returned to the country after residing for decades in Tanzania introduced specific farming techniques more suited to the Eastern region. A returnee farmer explained that ‘those from Tanzania bring back a lot of practices’ that allow for intense management of the banana plantation. They developed particularly successful cooking banana techniques, favouring bigger bunches. They introduced specific de-suckering, mulching, and cow manure usage techniques that are now largely applied in the Eastern part of the country which is now a model in terms of banana management.

Furthermore, farmers have developed their own innovations over decades of experience with environmental stress and social challenges. For example, through careful trial and error, they have determined the most suitable types of intercropping for banana groves. Intercropping started with the introduction of American crops (bean and maize) during the seventeenth and eighteenth centuries. But the complex generalization of intercropping is more recent. In the middle of the twentieth century, a typical farm generally included the banana plantation surrounding the *ruogo*, more intensively cultivated plots (succession of maize/beans and sorghum, or of sweet potatoes and/or cassava), less intensively cultivated plots (only one crop cycle followed by fallow), and pasture. In the first stage, increasing population pressure reduced pasture space in favour of cropped spaces.⁷⁶ Then, the cultivation intensity on available land increased, and increasingly, multi-cropping was practiced during the transition stage from one crop system to another. After that, the borders between the plots disappeared until plots were covered with six or more crops: a dense banana plantation with shadow crops and food crops in complex intercropping (maize, bean, sorghum, sweet potato, cassava, and so on).⁷⁷

Another peasant innovation – triggered by increasing land scarcity – is the evolution in methods for soil fertility protection. Traditionally, fertility management was largely based upon the integration between agriculture and husbandry.⁷⁸ At the beginning of the 20th century, however, diseases led to drastic decreases in cattle stocks. In response to this agrarian crisis, farmers increasingly relied on alternative methods for fertility protection, in which banana cropping came to occupy a central place. The banana tree is first of all an important “factory” in terms of biomass production. Moreover, the residue of the beer brewing process can be used to fertilise the fields and thus provides an important source of organic materials in a context where manure has become increasingly scarce. In fact, when being transformed into beer, only the juice of the bananas is extracted. The remains of this transformation process are very useful as a source of fertiliser for the banana plantation. A farmer explained: Here, there are no cows. [...] We use waste from the transformation of beer bananas – mixed with compost - to make manure and fertilize the plot.⁷⁹ Another mentioned: We prefer to make juice rather than sell the bananas as such. This gives us something for our children, and at home we can use the residue as

⁷⁴ Personal communication from the Banana programme coordinator in ISAR.

⁷⁵ Interview, banana farmer, Musenyi, 24 June 2010.

⁷⁶ Daniel C. Clay, ‘Fighting an uphill battle: population pressure and declining land productivity in Rwanda’ (Working paper, Michigan State University, Department of agricultural, food, and resource economics, 1996).

⁷⁷ Hubert Cochet, ‘Agrarian dynamics, population growth and resource management: The case of Burundi’ *GeoJournal* 60, 2 (2004), pp. 111-120.

⁷⁸ Cochet, *Crises et Révolutions agricoles au Burundi*.

⁷⁹ Interview, banana farmer, Gatore, 2009.

fertiliser.⁸⁰ Over the last few decades, cattle holding has been substituted by banana cropping as an engine of fertility reproduction, and as a strategy for capital accumulation. Cochet describes this evolution as the “banana revolution”.⁸¹

Farmers’ knowledge may also be of particular use in times of stress because of crop disease.⁸² In 2005, a fungi disease devastated a large part of Rwanda’s banana plantations, particularly affecting dessert varieties such as *Kamaramasenge*. This variety was grown in a large part of the country to make juice or to be consumed as such. Farmers therefore turned to another dessert variety, resistant to the disease (the cultivar *Poyo* from the Cavendish subgroup). It appeared, however, that this variety was more sensitive to wind due to the morphology of the plant and the heavy weight of the bunch. A farmer in the Southern Province explained:

Now, I grow mostly the *Poyo* variety. It worked well, but recently there has been a wind problem that brought down the banana plants. The *Poyo* variety is weaker than the others. It requires two [wooden] supports. [...] The other varieties are not profitable due to diseases. The *Poyo* variety gives fewer bunches but they are bigger.⁸³

To protect banana plants against the effects of wind, farmers have started to use two wood supports instead of one. However, wood is an increasingly scarce resource in Rwanda, and recent government policies promoting reforestation have banned the cutting of wood. Accordingly, wood is difficult to find and prone to theft. In our research area in the Southern Rwanda, the problem of theft is even more difficult because people have been obliged to move away from their scattered settlements surrounded by their banana plantations to live in grouped settlements in the framework of the villagisation policy. As a result, farmers have to leave behind their banana plantations – traditionally surrounding their houses – at the bottom of the valley without surveillance. This makes farmers more vulnerable to theft of wood and of banana bunches. Moreover, the increased distance between their houses and the banana plantation has increased the labour requirements of banana cultivation. The fact that villagisation occurred in parallel with the fragile transition from one banana variety to the other imposed severe stress upon local livelihood systems.

These examples illustrate the value of “indigenous knowledge” that farmers have developed over generations while living and farming in extremely challenging agro-ecological environments. They are capable of using this knowledge in evaluating the relevance of externally-induced innovations, but also in developing their own local-level innovations.

Conclusion: innovation and resistance in contemporary Rwanda

On the basis of an in-depth study of innovations introduced in farmers’ banana groves, this article illustrates how the Rwandan government’s policy objectives, in line with its vision to ‘reengineer’ the agricultural sector, are not blindly adopted by farmers at the local level. The externally-induced innovations are often resisted on the ground, and in some cases openly challenged. However, the degree of farmers’ reluctance and resistance is shaped by the scale and the level at which the innovation takes place. The scale at which an innovation is

⁸⁰ Focus group, banana farmer, Musenyi, 2010.

⁸¹ Cochet, *Crises et Révolution agricoles au Burundi*.

⁸² In an earlier footnote, we mentioned the spread of the BXW disease. Plants are contaminated by bees through infection of the male bud. Therefore, farmers are advised to cut the male bud to prevent the disease from spreading. However, this technique existed ‘already before BXW: farmers used to cut or wrap the male bud of the banana plant to prevent [the spread of] diseases’ (Personal communication, researcher, UCL). On Idjwi island (part of DRC, but located in the Kivu lake between DRC and Rwanda), farmers explained during a focus group that ‘the *Kimojo* disease was spread by a butterfly. To combat it, we wrapped the male bud and the elders advised us to brush the bunch with some herbs’. In the case of BXW, farmers explained that the wrapping or cutting of the male bud is not sufficient, as – in contrast to the *Kimojo* disease - BXW attacks not only the bunch but the entire banana plant.

⁸³ Interview, banana farmer, Kinazi, 2009.

implemented specifies the type of innovation. A ‘simple’ innovation (or ‘additive’ innovation)⁸⁴ introduces limited changes in the exploitation while a ‘systemic’ innovation (‘transformative’ innovation) implies a major change in the entire organization of the agricultural system.⁸⁵ Between these two types, the ‘radiant’ innovation (‘modifier’ innovation) addresses a sectoral problem but with repercussions on the broader farming system.

These three types of innovation are evident in the case of banana cultivation. The mulching technique, first of all, is an example of a less-intrusive ‘simple innovation’ that limits itself to the banana plot, and even only to part of the banana mats. Resistance to this mild form of innovation was limited, and mainly consisted of adapting the technique to local conditions and needs. Second, the shift from beer bananas to cooking and desert bananas can be classified as a ‘radiant innovation’ as it affects the way in which the farm level is exploited. Here, many farmers disagreed more profoundly with the official policy guideline, but they framed their resistance in disguised forms, such as hiding their beer bananas from the eyes of official authorities. In the case of the promotion of monocropping, finally, the entire organization of smallholders’ livelihood activities is called into question. Indeed, the promotion of monocropping is closely linked with the principle of regional specialization, which calls into question the subsistence-orientation of farmers’ agricultural production system.⁸⁶ This is therefore a ‘systemic innovation’. Bal et al. highlight that systemic innovations are the most complex and risky because they entail a reconfiguration of the entire system in place. And – as mentioned above – the risk notion is crucial in the rationale of peasants.⁸⁷ It is the risk factor that explains the reluctance of farmers to implement reforms and their decision to engage in more open forms of resistance when innovations involve changes in the overall agricultural system, such as systemic innovation or regulations affecting the whole systems such as the ban on intercropping.

Most analyses assessing the success of an externally-induced innovation highlight the obvious efficiency of a straightforward solution, but ignore the secondary effects. This article shows that, even for technical implementation, there should be many more channels for hidden discourses to reach the surface. It is important to consider the trade-off between the positive effects of an innovation, and its possible negative direct and indirect effects. This should be done ex-ante, but also ex-post to learn from on-the-ground experience and adapt accordingly. In our assessment, local farmers’ know-how and knowledge is of crucial importance to the success of agricultural reforms and should be taken into account at all levels. This will allow policy makers to consider the relevance of an innovation not only on the technical and agro-ecological level, but also on the economic and social level. A complicating factor is that there are multiple types of farmers, for whom these technical, agro-ecological, economic and social contexts differ profoundly. Given this, what is required is a flexible and comprehensive approach that allows these complexities to be taken into account.

Rwandan policy makers should be much more responsive to innovations that arise “from below”. Indeed, the best solutions to local problems often do not come from outside. Farmers’ unique expertise is based upon generations of experience of survival in extremely complex agro-ecological and social circumstances. This makes Rwandan farmers the most skilled experts, specialised in all the possible threats and challenges with which Rwandan farming systems may be confronted. They should not be ignored or treated in paternalistic ways by policy makers and outside “innovators”; on the contrary, their voice should be the main reference point for assessing the relevance of externally induced innovations.

⁸⁴ According to Jacques Lefort ‘Innovation technique et expérimentation en milieu paysan’, *Les cahiers de la recherche-développement* 17, (1988), pp. 1-10 and Jean-Michel Yung, Pierre-Marie Bosc, ‘Terrains et innovations’, in *Le Développement agricole au Sahel* (CIRAD-DSA, tome IV, 1992), pp. 175-264.

⁸⁵ Pierre Bal, Christian Castellagnet, Didier Pillot, ‘Faciliter l’émergence et la diffusion des innovations’, in *Mémento de l’Agronome* (Cirad-Gret-MAE, Paris, 2002), pp. 373-405.

⁸⁶ Ansoms, ‘View from below on the pro-poor growth challenge’.

⁸⁷ *Ibid.*