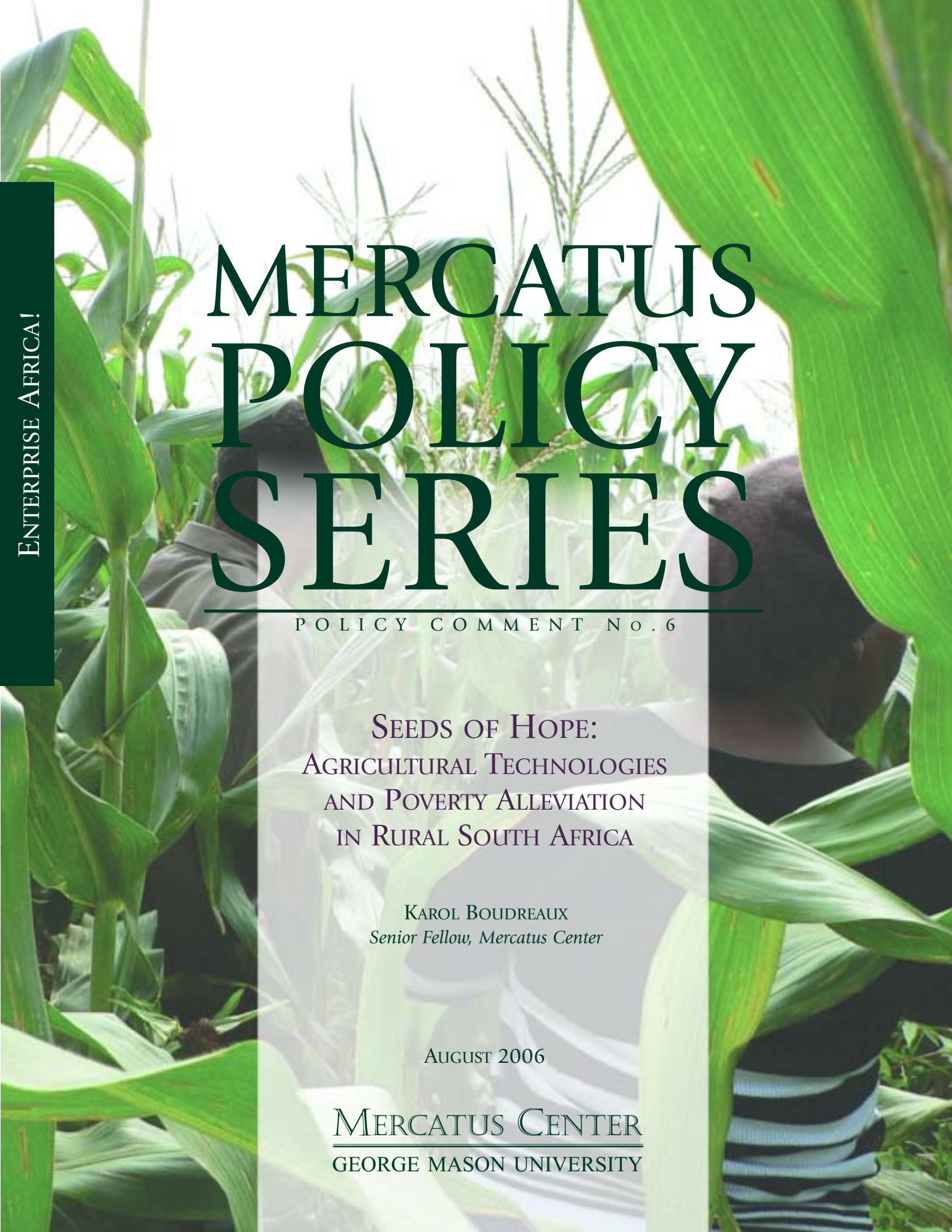

ENTERPRISE AFRICA!

MERCATUS POLICY SERIES

POLICY COMMENT No. 6

SEEDS OF HOPE: AGRICULTURAL TECHNOLOGIES AND POVERTY ALLEVIATION IN RURAL SOUTH AFRICA

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MERCATUS CENTER
GEORGE MASON UNIVERSITY

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About *Enterprise Africa!*

Enterprise Africa! is a research project that investigates, analyzes, and reports on enterprise-based solutions to poverty in Africa. The project is uncovering some of the hidden success stories in Africa—stories of people and policies that make a difference in the lives of Africa's people today. In essence, it documents African solutions to Africa's problems. These success stories involve intrepid, committed entrepreneurs across the continent, who are developing an amazing array of businesses—from the smallest-scale shops to multinational corporations—and the institutions that support them. These entrepreneurs are promoting economic growth and are an unheralded key to poverty alleviation. *Enterprise Africa!* is a joint initiative with the Free Market Foundation of Southern Africa and the Institute of Economic Affairs of London, England, and is supported by a generous grant from the John Templeton Foundation.

For more information about the *Enterprise Africa!* project, visit us online at www.mercatus.org/enterpriseafrica or contact Karol Boudreaux at (703) 993-4941 or kboudrea@gmu.edu

Cover photo: Susan Anderson—George and Queen Thango in their maize field

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SEEDS OF HOPE:

AGRICULTURAL TECHNOLOGIES AND POVERTY ALLEVIATION IN RURAL SOUTH AFRICA

KAROL BOUDREAUX

EXECUTIVE SUMMARY

Despite tremendous worldwide economic progress over the past 50 years, hunger and food insecurity remain the daily reality for millions of people around the world. In Africa alone, millions struggle against the ravages of hunger. What can be done to relieve these burdens? The traditional strategy has been to look to government for relief. And yet, in countries where corruption is rampant, where it is difficult or impossible to deliver food and other aid, or where fighting interferes with the movement of aid and aid workers, this solution too often fails.

Critics of globalization argue that it is implausible to expect the profit-driven private sector to address such needs. This study examines how the Combi-Pack, an innovative product created by the Monsanto Company, is helping to chase away hunger.

This study reveals the following key lessons:

- Markets are pervasive. Even with less-than-perfect institutional arrangements, people and businesses, including large corporations, seek ways to trade to the benefit of all involved.
- Innovative products, such as the Combi-Pack, that allow farmers to save time and money create opportunities for increased entrepreneurship, which benefit all members of the community.
- South Africa should amend land tenure, banking, and labor policies to improve the institutional environment within which smallholders operate. The developed world should eliminate agricultural subsidies in order to create freer agricultural trade.

Although critics argue otherwise, for-profit companies can address the problem of food insecurity and hunger. They do so by creating products, such as the Combi-Pack, that low-income consumers are willing to purchase. The Combi-Pack, together with no-till agriculture, is just one exciting example of how markets can respond to the world's most pressing needs.

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Enterprise Africa! Research Approach

Local Solutions from Local Knowledge

This study, as with all the studies conducted by the *Enterprise Africa!* research team, is based largely on information gathered in Africa from Africans. Our core research team was comprised of the Mercatus Center's Karol Boudreaux and Susan Anderson and South African-based Free Market Foundation's Eustace Davie, Temba Nolutshungu, and Jasson Urbach. The unique approach of the *Enterprise Africa!* team helps ensure that our studies reflect what's actually happening in the communities in which we work, rather than an outside view of how things might be.

Eustace Davie with Monsanto smallholder representative Charles Matlou

For *Seeds of Hope: Agricultural Technologies and Poverty Alleviation in Rural South Africa*, research team members from the Free Market Foundation drew from their many years of experience with smallholder and other rural economic issues in South Africa. In addition to the local information, the team incorporated insights from the existing literature on agricultural, smallholder, and rural economic issues in South Africa and other countries. The team also arranged conversations with Monsanto executives and employees in charge of introducing Combi-Packs to South African smallholders.

With the groundwork for a productive stint of field work laid, Mercatus Center researchers joined fellow team members in South Africa to speak with several farmers in three communities in South Africa—Mlondozi in Mpumalanga, Belgrade in KwaZulu-Natal, and Hlabisa in KwaZulu-Natal—and to Monsanto personnel.

Susan Anderson with smallholder Queen Thango

This local information was then cross-referenced with literature and other relevant data. The picture that emerged was captured and peer-reviewed by colleagues in South Africa and the United States. The goal of our study is to provide a unique view of how the institutional environment created by local policy enables or inhibits productive enterprise-based solutions to poverty and ultimately affects the well being of members of the community in question. Our unique approach to this research, which relies substantially on local experience and knowledge, helps to ensure that the picture we paint is tied to the world it intends to depict.

Seeds of Hope:

Agricultural Technologies and Poverty Alleviation in Rural South Africa

INTRODUCTION

In the late 1990s, the South Africa office of Monsanto Company (Monsanto) developed a product called the Combi-Pack. The Combi-Pack is a relatively inexpensive box of materials designed specifically for use by smallholder farmers—farmers who work anywhere from 1/4 hectare (1/2 acre of land) to five hectares of land. The box contains a package of hybrid maize seed, some fertilizer, some herbicide, and pictogram instructions for illiterate users.

The farmers call the Combi-Pack, *Xoshindlala*, a Zulu word that means "chase away hunger," a name Monsanto has since adopted. The farmers chose this name because they believe the product helps them chase away their hunger by offering them higher crop yields on their small holdings. These higher crop yields translate into increased food security.

This product is an example of a multinational corporation creating a product for poor consumers, a phenomenon that C.K. Prahalad identifies as marketing to "the bottom of the pyramid" (BOP).[1] The idea behind BOP marketing is that the poor represent a huge, if diffuse, market with aggregate purchasing power in the trillions of dollars.[2] Companies can profit from selling to this market, so long as their products are developed and packaged to meet the poor consumers' needs. Characteristics of BOP goods are "small unit packages, low margin per unit, high volume, and high return on capital employed."[3] Prahalad identifies affordability, accessibility, and availability as the key factors involved in serving this market. Companies that use innovation to meet these challenges will find a vast network of consumers.

As more companies adopt BOP strategies, poor consumers have increased access to goods and services. Increased choice empowers poor consumers and treats them with greater dignity—poor consumers can be active participants in a market exchange rather than passive recipients of aid. Prahalad argues that BOP consumers and the private sector can develop a symbiotic relationship that leads to:

> the co-creation of a solution to the problem

We thank the farmers and their families who met with us and shared their stories. Without their help, this study would not have been possible.

[1] See C.K. Prahalad, *The Fortune at the Bottom of the Pyramid* (Upper Saddle River, NJ: Wharton School Publishing Pearson Education, Inc. 2005).

[2] Ibid., 10.

[3] Ibid., 24.

> of poverty. The opportunities at the BOP cannot be unlocked if large and small firms, governments, civil society organizations, development agencies, and the poor themselves do not work together with a shared agenda. Entrepreneurship on a massive scale is the key.[4]

This vision recognizes that the world's poor are both "resilient entrepreneurs and value conscious consumers."[5] When companies market to these consumers, Prahalad argues the resulting symbiotic relationship will create an answer far more sustainable than traditional foreign aid to the problems of poverty that continue to plague the developing world.

With a relatively stable and dependable institutional environment, this trade should flourish. Such an environment would allow entrepreneurs and consumers to exchange without coercion, encourage respect for property rights, and offer parties to an exchange recourse in the case of fraud or other contractual irregularity. Even when these conditions only partially exist, as is often the case in African nations, trade will occur. A key lesson from this study is that markets are pervasive.[6] Even with deficient institutions, people and businesses, including large corporations, seek out ways to exchange with others. This is immensely beneficial to all citizens.

A. The purpose of this study

The purpose of this study is to examine how an innovative product is helping to alleviate poverty for subsistence farmers in South Africa. The product, the Combi-Pack, is having positive, though limited, results at raising maize crop yields. These productivity gains give farmers extra time and, in some cases, extra income that they can use to pursue other entrepreneurial activities. The division of labor expands when space is made for entrepreneurship. The innovative Combi-Pack thus not only addresses problems of food insecurity and hunger, but also prompts entrepreneurship to the benefit of farmers, their families, and their communities.

We begin the study by tracing how the idea for the Combi-Pack developed within Monsanto. We look at how coupling the technology in Combi-Packs with "no-till" farming[7] produces higher crop yields at lower cost for farmers who adopt both technologies.

Next, we discuss the ways in which Combi-Pack plus no-till agriculture helps to alleviate

[4] Ibid., 2.
[5] Ibid.
[6] For a sustained look at the pervasiveness of markets, see Mancur Olson, *Power and Prosperity* (New York: Basic Books, 2000).
[7] No-till is a minimally invasive conservation farming technique, so named because farmers do not plow or till the land. Instead, they cut a small furrow for the seeds.

Maize fields in Hlabisa, KwaZulu-Natal

poverty in three communities in South Africa: Mlondozi in Mpumalanga, Belgrade in KwaZulu-Natal, and Hlabisa in KwaZulu-Natal. Together, these technologies yield a solid foundation of positive farming experience and a surplus of maize. With this foundation, farmers often move towards larger-scale planting, increased food security, and poverty alleviation. Increased productivity allows some farmers to pursue other entrepreneurial opportunities, expanding the division of labor and increasing specialization in rural South Africa. Thus, a lesson of this study is that innovative products like the Combi-Pack, which allow farmers to save time and money, create opportunities for increased entrepreneurship. Some farmers might spend more time making crafts; others might invest in livestock; yet others might open a small grocery, a spaza shop. By freeing time and capital for other uses, Combi-Packs, also popularly known as Combis, help create an expanded division of labor in rural South Africa, which helps diversify the economy and promote prosperity.

Rural poverty is a complex phenomenon. Combi-Packs are one product that may help address these problems, but they are not a panacea. They are a commercial product that helps farmers grow more. Growing more, in turn, allows farmers to consume and sell more. This surplus is what allows some subsistence farmers to move towards larger-scale farming. However, differences in the institutional environment in which smallholders operate limit the extent of this success. By imposing significant transaction costs, these institutional constraints help to promote, not alleviate, rural poverty.

We present evidence drawn from interviews conducted with farmers in these areas in September 2005 and March 2006. Although

evidence is limited, farmers have expressed satisfaction with the product. They experience higher crop yields and increased food security as a result of using Combi-Packs. In addition, some farmers use Combi-Packs as a tool to step up a ladder of economic empowerment. Success using the Combi-Pack in conjunction with no-till technology gives farmers confidence and greater financial stability (vis-à-vis alternative products). Once farmers achieve higher crop yields, and the reduced labor and input costs associated with these technologies, some plant larger areas and move towards commercial farming. Thus, Combi-Packs may serve as a transition tool between subsistence farming and small-scale commercial farming.

However, these farmers continue to face institutional barriers and other constraints that make it difficult to move beyond a life of subsistence farming. For example, although the institutional environment in South Africa is generally conducive to trade, labor laws are relatively rigid, limiting formal employment opportunities on and off farms; laws make banking services costly and limit rural credit; and there is continuing uncertainty in rural areas concerning property ownership and tenure. Another lesson of the study is that the changes to the institutional environment in South Africa, particularly changes related to land tenure, banking, and the labor market, would help subsistence farmers, as would the removal of developed world agricultural subsidies.

Next, we focus on several policy implications that flow from recognizing these constraints. These policy implications have both domestic and international elements. For example, agricultural subsidies in developed nations create hardships for smallholder farmers in developing nations because these farmers are forced to compete with artificially cheap imported commodities. Such subsidies should be removed in order to promote freer trade among the developed and developing worlds.

We conclude that the Combi-Pack is a valuable transition tool for smallholders—one that offers some of them a step up the ladder of economic empowerment. Monsanto's efforts to market to a BOP audience are generating positive results. As Prahalad might say, Monsanto and smallholders are co-creating a solution to poverty. While some critics suggest that profit-motivated companies will not develop products suitable for poor consumers, Monsanto has done this with positive results for South Africa's smallholders. If other African nations can improve their institutional environments, it is likely that Monsanto, as well as other businesses and entrepreneurs, will look for more opportunities to trade in the developing world.

By developing products for poor consumers, Monsanto and other companies are doing what some critics of globalization said was impossible or improbable: they are serving the poorest segments of society with the hope of making a profit. While multinational corporations are

often chided (or worse) for ignoring the needs of the poor, Monsanto recognizes those needs and is producing materials for a very low-income market segment. So long as this profit motive remains, and so long as the institutional envi-ronment is relatively stable, we can expect Monsanto to continue to serve low-income farmers. With over 70 percent of the continent's poor living in rural areas where agricultural growth rates are low, the need to increase agricultural productivity is pressing.[8] Products like the Combi-Pack offer one way to address this problem. While the market for Combi-Pack is relatively small in South Africa, this product holds substantial potential for helping to alleviate poverty in rural Africa.

B. Background

> The evidence is compelling that sustained income growth for the poorest strata of the rural population will depend on agricultural growth in most countries, even though the poor generally lack the land and other productive resources to respond directly or immediately to policies and investments to stimulate agricultural growth. Agricultural productivity growth, while most easily generating gains for better-off smallholder farmers, is likely to offer the best potential for pulling the poorest and land-constrained household out of poverty.[9]

Mpumalanga lies in northeast South Africa. KwaZulu-Natal runs along the eastern coast of the country. Both provinces are home to many smallholder farmers who work small plots of land. These hardworking people eke out a living growing maize (corn), spinach, pumpkins, cabbage, and onions. They also may raise cattle, goats, pigs, and chickens. To a large extent, their lives depend upon these crops. If the crops fail, if the harvest is poor for whatever reason, the people suffer. If the crops flourish, if there is an abundance of produce, then the farmers of these regions flourish. They trade their excess produce and earn money to fix their homes, pay school fees, buy new tools, or purchase clothes for their children.

[8] See Jonathan Kydd, Andrew Dorward, Jamie Morrison, and George Cadisch, "Agricultural Development and Pro-Poor Economic Growth in Sub Saharan Africa: Potential and Policy," *Oxford Development Studies*, 32 (2004): 37. Kydd et al. note that: "Growth in agricultural production over the last 30 years has been disappointing. Rates of productivity growth in sub Saharan Africa have been slower than other regions, although growth rates in the different regions [of the developing world] have converged somewhat in the 1990s . . . thus sub Saharan Africa is the only region with agriculture growing at a rate below overall population growth from 1965–1998, and at a lower rate than growth in the agricultural labour force from 1980–1998."

[9] T.S. Jayne, Takashi Yamano, Michael Weber, David Tschirley, Rui Benfica, David Neven, Anthony Chapoto and Ballad Zulu, "Smallholder Income and Land Distribution in Africa: Implications for Poverty Reduction Strategies," *MSU International Development Paper No. 24* (2001): 26, http://aec.msu.edu/fs2/papers/idp24.pdf.

The agricultural population in South Africa is approximately 14 percent of the country's population, compared with all of sub-Saharan Africa in which the agricultural population is approximately 65 percent of the total population.[10] There are approximately 240,000 black South African farmers, as compared to 45,000 white South African farmers.[11] White farmers tend to run larger, commercial farms while black farmers tend to be smallholders. In 2005, the majority of South African farmers made less than 2,500 rand (approximately $381 U.S) per month, and a significant number, about 34 percent, have no measurable income.[12] Although agricultural production contributes less than 4 percent to South Africa's gross national product (GNP), the sector provides 10 percent of total reported employment.[13]

These farmers are part of the poorest segment of South African society, and they suffer from the problems of poverty rampant throughout Africa. They have poor access to clean water, electricity, and education; poor nutrition and health care; poor housing; and few comforts. Approximately 75 percent of South Africa's poor live in rural areas, and "81% of the ultra-poor are rural inhabitants."[14] In such an environment, it makes a tremendous difference to the farmers and their families to be able to grow more food or to grow it more efficiently. But just how would this needy segment of society get access to the technology and services that make improved crop yields possible?

Traditionally, subsistence farmers could turn to extension agents—government workers who

[10] FAOSTAT Agricultural Data, 2006, http://faostat.fao.org/faostat/collections?version=ext&hasbulk=0&subset=agriculture.

[11] See *OECD Review of Agricultural Policies: South Africa* (Paris: OECD Publishing, 2006), 39, 51. See also Noel Oettle, Saliem Kakir, Wilfred Wentzel, Steven Giddings, and Martin Whiteside, "Encouraging Sustainable Smallholder Agriculture in South Africa," (Environment and Development Consultancy, Ltd., Stroud, Glos., UK, 1998): 15, http://www.eldis.org/fulltext/rsa.pdf and "Report on the Survey of Large and Small Scale Agriculture," *Statistics South Africa* (2002): 15, Chart 1.1, http://www.statssa.gov.za/publications/LargeSmallScaleAgri/LargeSmallScaleAgri.pdf.

[12] See *Labor Force Survey*, September 2005, Statistical Release P0210 (Pretoria: Statistics South Africa, 2005).

[13] OECD (2006: 14). As NEPAD reports: "Agriculture, providing 60 percent of all employment, constitutes the backbone of most African economies; in most countries, it is still the largest contributor to GDP; the biggest source of foreign exchange, still accounting for about 40 percent of the continent's hard currency earnings; and the main generator of savings and tax revenues." NEPAD, "Comprehensive Africa Agriculture Development Programme" (2002): Sec. 1.3, http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/005/Y6831E/Y6831E00.htm.

[14] Oettle et al. (1998: 19). Machethe states: "Poverty is more pervasive in rural areas particularly in the former homelands. The majority (65 %) of the poor are found in rural areas, and 78% of those likely to be chronically poor are also in rural areas." Charles L. Machethe, "Agriculture and Poverty in South Africa: Can Agriculture Reduce Poverty?" (2004). http://www.sarpn.org.za/documents/d0001005/P1125-Agriculture-Poverty_Machethe_2004.pdf.

The Combi-Pack is designed to meet the needs of subsistence farmers in South Africa by providing small quantities of hybrid maize seed, fertilizer, and herbicide together in a single, affordable package. Farmers use these products, along with "no-till" agriculture, to improve soil conditions and increase the amount of maize they grow. The results to date, while limited, are positive: farmers grow more maize with less effort, less pesticide, and with reduced labor costs. Larger yields make it easier to feed their families and grow surplus maize to sell on the market. Moreover, the positive experience provided by the Combi-Pack encourages smallholder farmers to plant larger plots. This may help them to move, incrementally, towards commercial farming.

Pictograms on the exterior of a Combi-Pack (Photograph courtesy of Monsanto)


The interior of a Combi-Pack

specialize in promoting agricultural improvements and who visit sporadically to provide information and other services. There were few other sources of information for this group aside from the deep knowledge held by the farmers themselves. Until recently, private companies did relatively little to help these poor farmers with little to spend on agricultural products or technology. Given the strength of South Africa's commercial agriculture sector, agricultural-products companies focus on providing goods and services to South Africa's large, well-established farmers.

However, this does not mean that smallholders are completely ignored. For several years now, Monsanto has helped smallholders grow maize with the Combi-Pack.

B1. One face of African agriculture

Swelekile Alina Nkosi is a soft-spoken woman and the mother of 10 children. She lives in Mlondozi in rural Mpumalanga province. For many years now she has taken care of her large family. For many years she has also spent long hours outdoors, tending the fields that help feed the family. She does this because, like

African women across the continent, she is largely responsible for raising the crops her family relies on for their food and for animal feed.[15] In South Africa, the key staple is maize.

Mrs. Nkosi tends three hectares (approximately six acres). In the past, she grew her maize as many still do in Mpumalanga. Her husband would plow a field, turning the soil to make it ready for planting. Once the plowing was done, she would go into the field and plant her maize seed by hand. Each day during the rest of the season she would spend many hours weeding the field by hand, looking out for insects called stem borers that destroy maize, trying to keep the neighbors' cattle or goats out of the field. At the season's end in May, she would harvest by hand the ears of corn that remained. After this, she would help store the grain and use it to prepare meals.

Back then, Mrs. Nkosi had a lot to worry about. There is no irrigation in Mlondozi, so she worried about having sufficient rain to grow the crop. When the rains did come, she worried about soil erosion and her fields washing away. She worried about having enough maize to feed her family. She worried about having enough to pay for school fees and clothes.

Today, Mrs. Nkosi's life is different. She still worries. But now that she and her husband use no-till technology and Combi-Packs to grow maize, she doesn't worry as much about erosion. As Mr. Nkosi no longer needs to plow the field, they save money. And they do not worry as much about feeding their family or paying for school because they produce a surplus of maize.

These positive changes are the result of adopting new technologies. In 2005, for example, Mrs. Nkosi planted four Combi boxes in the field, which yielded approximately three tons of maize, enough to feed her family with some surplus. Before Combi and no-till, their field yielded around two tons of maize per season. This low yield made it difficult for them to feed their large family. For the Nkosis, no-till plus Combi has meant less labor time and effort, reduced costs, and higher yields. In turn, these translate into more time to do other things with their family, more opportunities to earn cash income, more opportunities to save, and increased food security.[16]

[15] On its "Gender and Food Security/Agriculture" website, the Food and Agriculture Organization (FAO) says: "Rural women in particular are responsible for half of the world's food production and produce between 60 and 80 percent of the food in most developing countries. Yet, despite their contribution to global food security, women farmers are frequently underestimated and overlooked in development strategies. Rural women are the main producers of the world's staple crops—rice, wheat, maize—which provide up to 90 percent of the rural poor's food intake." http://www.fao.org/gender/en/agri-e.htm.

[16] The cost savings associated with no-till can be quite substantial. Monsanto estimates that it can cost on average R2,000 per hectare to plow fields in this area. However, local extension agents cited a R500/hectare figure for plowing costs in Mlondozi. Interview with Lucia Sanelisiwe Makhanya (extension agent, Mlondozi, South Africa), September 29, 2005.

Swelekile Alina Nkosi

Under the new system, not only does Mrs. Nkosi grow more, giving her family greater food security, but she also grows more using less of her labor. She spends less time in the field because she does not need to do the intensive weeding she did in the past. This frees her to do other things, such as sew for the family, make crafts for sale at market, or spend time with other ladies.[17] Saving time is one of the major benefits of using Combi-Packs with no-till. This time-saving allows people to engage in other entrepreneurial activities: sewing, crafts, livestock, etc. This, in turn, allows the division of labor in South Africa to deepen, and as economists have pointed out since Adam Smith's time, a deeper division of labor is a major source of prosperity.[18]

Using no-till agriculture and Monsanto's small-holder-friendly product, the Combi-Pack, has improved Mrs. Nkosi's quality of life. She said, "I'm so happy with this way of farming. What will happen when I'm old I don't know, but one thing is good, and that is now there's no water cutting through, so my soil is conserved."[19]

The Combi-Pack was not designed specifically for women, but, when combined with no-till agriculture, this product produces clear benefits for women and older men: they grow more food with

[17] The local extension agent, Ms. Lucia Sanelisiwe Makhanya, told us that this new approach to planting has been especially beneficial to the women of the Mlondozi community who feel less stress than before—particularly those in single-parent households, who had a very difficult time with the costs and time involved in traditional farming.

[18] See Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations* (1776; repr., Indianapolis, IN: Liberty Press, 1981).

[19] Interview with Swelekile Alina Nkosi (farmer, Mlondozi, South Africa), September 29, 2005.

less back-breaking work. With more and more families in sub-Saharan Africa becoming female-headed due to conflict and HIV/AIDS, there is a pressing need to provide women with tools to take charge of their families. They surely need safe environments where a rule of law exists, but they also need to feed their families. Monsanto's Combi-Pack is one tool that they can use to help achieve this goal.

C. Monsanto and the South African smallholder

> Agricultural productivity growth, while most easily generating gains for better-off smallholder farmers, is likely to offer the best potential for sustained income growth among the poorest and land-constrained households as well. The literature on growth linkages indicates that the first-round beneficiaries of agricultural growth generate important multiplier effects by increasing their expenditures on a range of local off-farm and non-farm activities that create second-round benefits for a wide-range of other households in the rural economy.[20]

Monsanto started in 1901 as the Monsanto Chemical Works, producing saccharin in St. Louis, Missouri. Over time, Monsanto produced a wide range of products, including aspirin, sulfuric acid, plastics, and synthetic fibers. In the 1960s, the company created an agriculture division and enjoyed great success with herbicides such as Roundup, now the world's most popular herbicide.

Monsanto became involved in biotechnology in the early 1980s when its scientists created the world's first genetically modified plant cell. By the mid-1990s, Monsanto had developed a variety of genetically modified seeds with traits designed to improve crop yields and farmer efficiency. These included Roundup Ready soybeans, YieldGard insect-protected corn, Bollgard insect-protected cotton, and NewLeaf insect-protected potatoes.[21] In 2003, Monsanto scientists were able to increase omega-3 levels in soybean oil, suggesting that genetically modified soybeans could provide an economical source of this beneficial fatty acid.

Today, Monsanto is a multi-national corporation. In 2005, its sales topped $6 billion. The company produces a wide variety of agricultural products, including hybrid and biotech seeds and herbicides, as well as animal products.[22] The company has offices in 46 countries around the world. In 2004, it spent $500 million on research designed to provide new solutions for farmers.

[20] Jayne et al. *MSU International Development Paper No. 24*, 30.
[21] Roundup Ready, YieldGard, Bollgard, and NewLeaf are all registered trade names of the Monsanto Company.
[22] See Monsanto Company, *2005 Annual Report*, http://www.monsanto.com/monsanto/content/media/pubs/2005/MON_2005_Annual_Report.pdf

The Combi-Pack is one such farmer-oriented solution. Monsanto has worked in South Africa for decades. The idea for the Combi grew out of projects Monsanto worked on in conjunction with the national and provincial departments of agriculture, conservation, and environment in KwaZulu-Natal and in Mpumalanga and with agricultural extension offices as part of the LandCare project.[23] In Mpumalanga, the provincial Department of Agriculture had partnered with the South African Agricultural Research Council and the Australian government to identify ways to improve soil quality.

The study identified one possible way to address the problem of poor soil quality in the province: the introduction of no-till farming.[24] No-till is a sustainable farming practice that reduces labor inputs, increases crop yields, improves the local watershed, and improves the environment because less fertilizer is used. This approach also reduces soil erosion. It is particularly beneficial for the smallholder farmer because he does not need to use a tractor, a major cost saving.[25]

Pilot projects were launched in KwaZulu-Natal and Mpumalanga to show how no-till improves soil conditions. The original projects started with farmers themselves planting 1/4 hectare plots using no-till, though the size of demonstration plots increased over time. Once planted, farmers around the pilot areas were invited to watch the progress in these demonstration fields. Many farmers became interested in adopting no-till because the benefits were clear. For them, "seeing was believing." No-till produced several benefits.

- It was cheaper because farmers did not need to plow.

[23] "LandCare South Africa is a community-based and government-supported approach to the sustainable management and use of agricultural natural resources. The overall objective of LandCare is to optimise the productivity and sustainability of natural resources, leading to greater productivity, food security, job creation and a better quality of life for all." See "LandCare in South Africa," http://www.elsenburg.com/landcareconference/conf01.html. For a more detailed description of the LandCare program see, "Implementation Framework for the LandCare Programme," National Department of Agriculture, 1999, http://www.nda.agric.za/docs/Landcare/landcare.htm.

[24] "No-till farming encompasses four broad, intertwined management practices:

- Minimal soil disturbance (no plowing and harrowing),
- Maintenance of a permanent vegetative soil cover,
- Direct sowing, and
- Sound crop rotation."

Christian Pieri et al. "No-Till Farming for Sustainable Rural Development," (Agriculture & Rural Development Working Paper, The International Bank for Reconstruction and Development, Washington, DC, 2002): 1, http://info.worldbank.org/etools/docs/voddocs/339/665/NotillFarmingforSustainableDevelopment.pdf.
See also Klaus Ammann, "The Impact of Agriculture Biotechnology on Biodiversity," (A Review, Botantic Garden, University of Bern, 2004): 19-22, http://www.botanischergarten.ch/Biotech-Biodiv/Report-Biodiv-Biotech12.pdf.

[25] "Report on the Survey of Large and Small-Scale Agriculture" (2002: 95, Table 9.3).

Mr. Mndebele holding a Combi-Pack

- There were lower input costs because farmers didn't have to maintain a tractor or plow animal or hire labor to help with weeding.
- It improved soil conditions over the long-term by introducing more organic material into the soil.
- It reduced problems of soil erosion.
- Crop yields were higher and more stable.
- Crops planted this way were better able to withstand the dry season because the left-over organic matter in the soil less-ened evaporation. It also put more potassium and more nitrogen in the soil.[26]

Despite these benefits, smallholder farmers faced a constraint: they had access to seed, fertilizer, and herbicides only in larger units designed for big commercial farmers.[27] This meant that often they needed to get a loan to purchase these goods. Accessing credit could be very difficult for a variety of reasons. Farmers often worked on communal land, rather than on individually-owned, freehold property. As a result, they lacked a common source of collateral. They might be illiterate, and

[26] Interview with Mamati Tembe (former Monsanto smallholder team member, Johannesburg, South Africa), September 26, 2005.

[27] Another constraint resulted from the spread of diplodia ear rot, which destroyed close to one third of South African maize crops. In order to stop the disease, the government mandated that fields should either be burned or tilled before planting. For more on this disease, see http://www.ent.iastate.edu/imagegal/plantpath/corn/diplodia/diplodia_ear_rot.html.

they might not have a credit history, so banks might not lend to them.[28]

As a result of traveling to rural areas and talking extensively with smallholder farmers, employees at Monsanto/South Africa recognized a need and an opportunity. Smallholder farmers needed the best, most affordable seed, fertilizer, and herbicide possible. As an agricultural commodities producer that believes the smallholder market is the market of the future and holds the key to success in Africa, Monsanto saw an opportunity to serve effectively this often-neglected market.[29] It welcomed the Combi-Pack project because it could lead to a better understanding of this market and generate useful market information.[30]

Out of this entrepreneurial alertness grew the idea of packaging small amounts of the needed goods along with pictographic descriptions of the farming process. Monsanto realized that the pictographs would make the pack useful even when a company representative was not physically available to help farmers manage planting—a major issue given that Monsanto has only six representatives helping smallholder farmers in South Africa. Moreover, if the company developed a profitable product for the South African market, it might be able to capitalize on the much larger smallholder market in other African nations.[31]

Monsanto/South Africa's employees recognized that there was good potential for working with the smallholder farmers after the introduction of insect-resistant Bollgard Cotton seed. This product was profitable for the company and profitable for small farmers. Because of the success they had planting Bollgard, farmers expanded operations and stepped towards more commercial production of cotton.[32] The success of this project, combined

[28] For a discussion of some of the difficulties South Africans face using commercial credit, see Karol Boudreaux, *The Effects of Property Titling in Langa Township, South Africa*, Mercatus Policy Series, Policy Comment No. 4, (Arlington, VA: Mercatus Center at George Mason University, 2006): 24-37, http://www.enterprise-africa.org/Publications/pubID.2464/pub_detail.asp.

[29] Interview with Andrew Bennett (Monsanto executive, Fourways Office, Johannesburg, South Africa), March 14, 2006.

[30] Ibid. Monsanto's efforts in this area are notable because they run counter to expectations such as the following: "It is widely accepted that private profit motivated agricultural technology companies are not strongly attracted to the development of technologies appropriate to, or inclusive of, smaller farmers because they do not represent a major market, especially in non-Green Revolution poor countries." Jonathan Kydd, "Agriculture and Rural Livelihoods: Is Globalisation Opening or Blocking Paths Out of Rural Poverty?" (AGREN Network Paper No. 12, ODI, London, 2002): 7, http://www.sarpn.org.za/wssd/agriculture/kydd/Agric_Livelihoods.pdf.

[31] For example, the company recognized that success in selling bio-tech cotton seed in South Africa might lead to sales in other African cotton-growing nations. See Marnus Gouse, Carl Pray, and David Schimmelpfennig, "The Distribution of Benefits of Bt Cotton Adoption in South Africa," *AgBioForum*, Vol. 7, No. 4 (2004): 189.

[32] Ibid.

Stem borer damage.
YieldGard maize resists such damage.

with the development of YieldGard maize seed, contributed to the creation of the Combi-Pack.

Combi-Packs meet farmers' needs on at least three fronts.

- Food Security: Black smallholder farmers often live on marginal land as a result of apartheid-era policies. Growing sufficient amounts of maize (a key staple of the diet) can be difficult due to poor soil conditions.[33] Combi-Packs, combined with no-till farming, allow farmers to grow more maize, which helps to improve food security.

- Affordability: It is difficult for smallholders to get loans, but farmers do not need to take out a loan to buy a Combi-Pack. The price for a Combi-Pack with conventional seed is R232 (approximately $35), with Roundup Ready seed R343 (approximately $52), and with YieldGard Seed, R328 (approximately $50). Further, once they have experience with the product, they can see how it works, and then they realize they can count on improved future yields—allowing them to plan for the future.

- A complete package: Smallholder farmers consume much of what they plant. They are searching for good quality maize seed at an affordable price, but they also need fertilizers and herbicides. The Combi-Packs supply that, offering different varieties of maize

[33] Machethe states: "Although the country [South Africa] is self-sufficient in food production, about 14 million people are said to be vulnerable to food insecurity and 43 percent of households suffer from food poverty." Machethe (2004): 1.

> seed for smallholders—a conventional hybrid and two kinds of transgenic hybrids—together with the necessary amounts of fertilizer and herbicide. Having seed, fertilizer, and herbicide together in one package is convenient and potentially time saving for farmers who can get what they need in one place from one package.

On the Combi-Pack webpage, Monsanto Area Director for Sub-Saharan Africa, Kobus Lindeque, says, "We have found in the past that many of the smaller farmers only focused on some of the inputs. Either they buy proper hybrid seed and then save on fertilizer and herbicides or the other way round. We believe that this Combi Pack can keep these farmers on their land in the future."[34] A former member of the Monsanto smallholder team, Ms. Mamati Tembe, told us that the Combi-Pack was developed to "empower" communities. "It just had to be done. There was a need. It was difficult, but it had to be done."[35] There is no doubt that the benefits that Combi-Packs used with no-till farming afford have empowered successful smallholder farmers, as compared with other seeds and tillage technology. However, Monsanto also hopes to make a profit from this product so that smallholder farmers and Monsanto both benefit from this innovative product.

Monsanto's experience with the Combi-Pack suggests that this product is best viewed as a transition good. Smallholders use Combis to plant small areas. Once they see the results they can generate by using the Combi-Pack, they plant larger plots with other seed or with larger quantity packages in the hope that they can sell the excess maize. This shift from subsistence to more extensive farming allows smallholders to climb the ladder of economic empowerment. At the same time, to the extent that farmers make this move, Monsanto develops clients who will likely use more seed and more of other inputs. With an institutional environment that allows for stable contracting, relative tenure security for smallholders, and security for the company, this beneficial trade takes place, and Combis fill their niche: providing an essential step between subsistence farming and sustainable, small-scale commercial farming.

The future of Combi-Packs may be brightest in other developing nations, where agriculture is a larger share of the economic life of the country than it is in South Africa.[36] In these countries,

[34] See "Products: Combi Packs," Monsanto, http://www.monsanto.co.za/en/layout/products/combi/default.asp.

[35] Interview with Mamati Tembe (former Monsanto smallholder team member, Johannesburg, South Africa), September 26, 2005.

[36] "The crisis in African agriculture: A more effective role for EC aid?" (Practical Action/Pelum, Rugby, Warwickshire, UK /Lusaka, Zambia, 2005): 6, http://www.sarpn.org.za/documents/d0001765/index.php.

subsistence farmers might find a path towards self-sufficiency and empowerment through this product, which gives them the chance to raise enough to feed themselves and their families.

The kinds of products offered in the Combi-Pack provide the means to increase crop yields, promote greater food security in Africa, and reverse the tragic trends of the past several decades. To date, Combis have also been sold in Nigeria and Kenya—just the beginning of what could be, given a relatively stable institutional environment that provides security and protects contract and property rights, a move towards greater food security and improved income opportunities across the African continent. It also represents an entrepreneurial BOP strategy on the part of a major multinational corporation.

Nearly 80% of the population in sub-Saharan Africa live in rural areas, and 70% of this rural population are dependent on food production through farming and livestock keeping for most of their livelihood. Small-scale farming provides most of the food produced in Africa, as well as employment for 60% of working people. Agriculture constitutes the backbone of most African economies and is the largest contributor to GNI, the biggest source of foreign exchange, and the main generator of savings and tax revenues. However, agricultural productivity is dropping in sub-Saharan Africa. For example, per capita agricultural production fell by about 5% over the last 20 years while increasing by 40% in other developing countries.[37]

D. Maize production and poverty alleviation

Raising the output of small and marginal farmers is a necessary condition for eradicating rural poverty in Africa. It also has a larger multiplier effect in the rural economy than increasing productivity in commercial farming.[38]

Agriculture contributes to poverty alleviation at rural, urban and national levels in three [*sic*] ways: (a) reducing food prices; (b) employment creation; (c) increasing real wages; and (d) improving farm income . . . "Agricultural growth has a strong and positive impact on poverty often significantly greater than that of other economic sectors."[39]

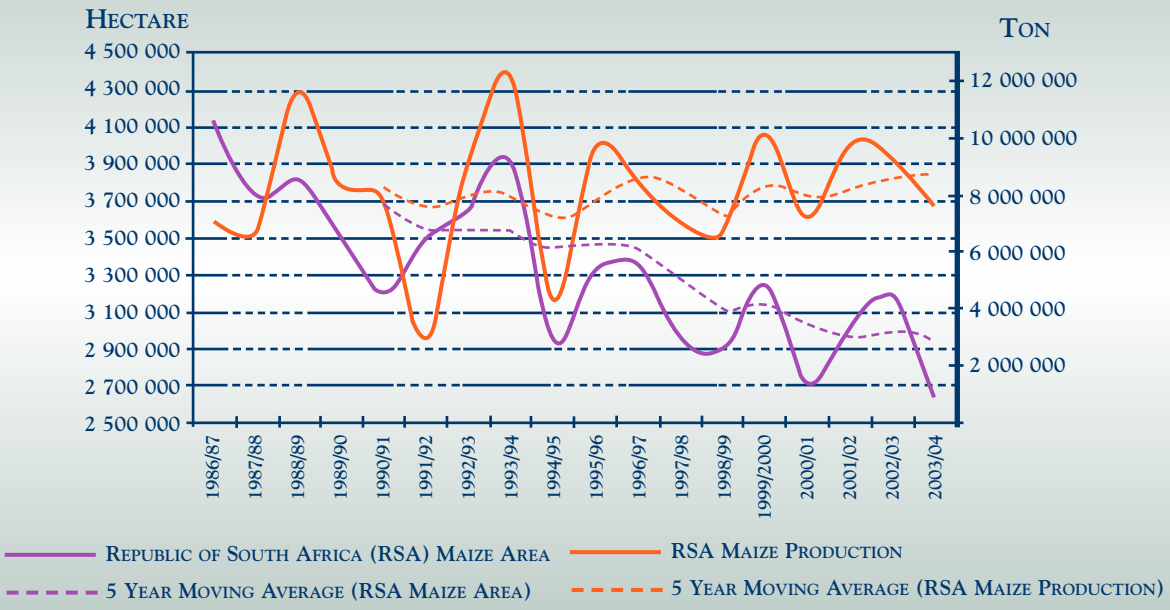
[37] Ibid.

[38] Ibid., 27.

[39] Machethe (2004: 3), citing Food and Agriculture Organization, *Socio-Economic Analysis and Policy Implications of the Roles of Agriculture in Developing Countries, Summary Report* (Rome, 2004).

Figure 1

Maize Area and Production in South Africa



Source: South African Agriculture 10 years after Democracy, citing Abstract, 2004[40]

Maize is South Africa's most important grain crop. Yellow maize provides food for livestock while white maize is the staple food of the majority of South Africans. Although the total number of hectares planted with maize has dropped over the past several years, approximately one-quarter of the arable land in South Africa is planted with the crop.

Despite the declining number of hectares being planted, production is rising. Maize continues to play an important role for smallholders, both in terms of subsistence and in terms of generating cash income. For South African smallholder farmers, farming income, as opposed to government pensions, wages, or remittances, provides the largest portion of their average monthly income.[41] And for farmers in former homelands, who are predominantly smallholders, income from the sale of maize for grain or consumption accounts for 67.5 percent of their farming

[40] Nick Vink, "South African Agriculture 10 years after Democracy," *AFMA Matrix*, December 2004: 17, http://www.nda.agric.za/docs/Cropsestimates/AFMA%2010%20Years.pdf.

[41] Data from a survey of smallholder farmers in Limpopo Province, South Africa indicates that farming income contributed 27.7% of their monthly income, compared to 23.6% for remittances, 23.1% for wages, and 16.5% for pensions. See Machethe (2004: 4, Table 2).

income.[42] Increasing farming income may, therefore, have important benefits for poverty alleviation. Monsanto's Combi-Pack helps to increase farm incomes by raising crop yields.

Monsanto works with smallholder maize farmers across South Africa. We were able to visit with three groups of farmers who have used the Combi-Pack along with no-till planting. These groups were located in Belgrade in Kwa-Zulu Natal; in Hlabisa, also in Kwa-Zulu Natal; and in Mlondozi in Mpumaplanga.

D1. The Mlondozi Farmers Association

Mlondozi is located in what used to be called a homeland area. This means that it is an area to which the apartheid government relocated black South Africans in order to free up more desirable land for use by white South Africans. The area has a hardscrabble look: it is dry and very rocky. The hills in the area have a few scrub trees and bushes, but little else. The unemployment rate can reach upwards of 70 percent among Mlondozi's 80,000 inhabitants.[43] Approximately 50,000 people living here are subsistence farmers and their families. For the young, jobs are limited, and most will end up in the informal sector.

Monsanto has worked in this area for several years, primarily through the Mlondozi LandCare project, which teaches farmers how to use no-till conservation farming in combination with Monsanto products, including the Combi-Pack, to improve soil conditions and increase crop yields.[44] Monsanto says that the goal of this project is "to introduce modern conservation agriculture technologies to a rural small-scale farming community to ensure sustainable and profitable crop production."[45]

Results in Mlondozi have, thus far, been encouraging. The project began in 1999 with 17 farmers. There are now over 300 farmers participating. Maize yields have increased, which means that farmers in Mlondozi, who are overwhelmingly subsistence smallholders, are better able to feed their families and sell any surplus they produce.

[42] "Report on the Survey of Large and Small-Scale Agriculture" (2002: 51, Table 5.6).
[43] See "Helping Maize Farmers in Mlondozi: The Mlondozi Input Project," http://www.technoserve.org/africa/southafrica-other.html#Maize.
[44] The Mlondozi LandCare Project "was initiated in 1999 as a partnership between the Mlondozi Farming Community, Mpumalanga Department of Agriculture, Conservation and Environment, the Agricultural Research Council Institute for Soil, Climate and Water and Monsanto. The major funding was from the Australian government supporting the LandCare programme. There are other specialists from the ARC Plant Protection Research Institute and the Grain Crops Institute, who give very valuable professional advice to help ensure success. The concept is to introduce modern conservation agriculture technologies to a rural small-scale farming community to ensure sustainable and profitable crop production." "Sharing: Mlondozi LandCare Project," Monsanto, http://www.monsanto.co.za/en/layout/our_pledge/sharing/mlondozi.asp.
[45] Ibid.

FIGURE 2

NO-TILL VERSUS CONVENTIONAL FARMING IN MLONDOZI: YIELD AND PROFIT

YIELD (TON/HECTARE)		
YEAR	NO-TILL	CONVENTIONAL
1999	2.94 (+124%)	1.31
2000	4.01 (+19%)	3.36
2001	6.00 (+71%)	3.50
PROFIT (RAND/HECTARE)		
YEAR	NO-TILL	CONVENTIONAL
2000	2,809.00 (+25%)	2,249.00
2001	10,080.00 (+71%)	5,880.00

The profit is the difference between cost of production and income per hectare and is determined at the ruling price of maize.

Source: "Sharing: Mlondozi LandCare Project," Monsanto.

Yields in Mlondozi increased from 1.31 tons per hectare in 1999 to 6 tons per hectare in 2001, and farmers' profit rose 25 percent in 2000 and 71 percent in 2001 (See Figure 2).[46]

In 2003, the Mlondozi LandCare Programme won one of Monsanto's annual "Excellence Awards." Monsanto gives these awards to projects that exemplify the company's pledge to stakeholders to promote sustainable agriculture through improved dialogue, transparency, sharing in benefits, and respect for partners.[47] This award came with a cash prize that was donated to the people of Mlondozi.

In Mlondozi we met with 10 members of the local farmers' cooperative. They told us about their experiences with no-till planting and with Monsanto products, including the Combi-Pack. These Mlondozi farmers had worked with the South African Department of Agriculture and with the support of the Australian government

[46] Ibid.

[47] See "Our Pledge: The Monsanto Pledge," Monsanto, http://www.monsanto.co.za/en/layout/our_pledge/default.asp.

Jeconia Ngema, Chairman of the Sakhuthando Farmers Association

on the small field trials in the late 1990s that demonstrated no-till planting to the community. The project transferred knowledge and technology from specialists to the farmers and local extension agents, who then conducted side-by-side demonstrations of no-till versus traditional agriculture.[48]

The first demonstrations were conducted on 50 meter x 50 meter plots. There were 17 farmers involved. People quickly saw that yields went up on these plots. So in the second year, 178 people used no-till. In the third year, the number of local people adopting no-till was up to 360.

After these initial demonstrations, Monsanto representatives recommended combining no-till with their hybrid seeds. The result was good yields without plowing—which meant reduced costs and labor time. Under the old, conventional plowing system, it took 10 people three days to plant a three hectare plot by hand. Using the association's no-till planter, it now takes one person one and one half hours to plant such a plot.

As Figure 3 demonstrates, the farmers participating in the no-till demonstrations had higher yields than those involved in traditional farming.

[48] Concerning this process, Monsanto literature states: "It is a new learning process and experience, which requires time for confidence to be gained and expertise to be perfected. It is recommended that a group of five to ten farmers, preferably all within walking distance of each other, form a cluster with the extension officer facilitating open discussion, evaluation and farmer visits to each others plots. In the second and third years the group can be expanded as new farmers start to evaluate and adopt the technologies." "Sharing: Mlondozi LandCare Project," Monsanto, http://www.monsanto.co.za/en/layout/our_pledge/sharing/mlondozi.asp.

Mr. Absalom Simelane is one of the Mlondozi farmers who uses no-till with Combi-Packs. Mr. Simelane told us that he used three boxes of Combi to plant his three hectare field and got a yield of 60 bags (or three tons). He is very happy with the Combi. Seeing the success that comes from using the Combi-Pack combined with no-till gives farmers added confidence. They begin to believe that they can do more, plant more, and prosper. And some do just that.

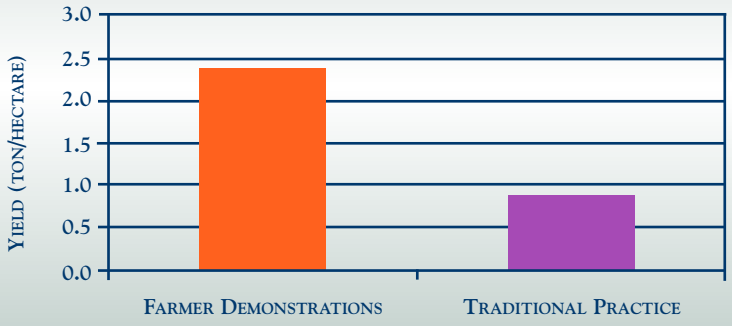
D2. The Hlabisa Farmers Association

In March 2006, we met with 12 members of the Sakhuthando Farmers Association, located in Hlabisa, KwaZulu-Natal province. The association's chairman, Mr. Jeconia Ngema, told us that the members of the association first used Combi-Packs in 2002 and no-till in 2003. As with farmers in Mlondozi and in Belgrade (see below), Monsanto and the agriculture extension office jointly introduced Combi-Packs and no-till in Hlabisa through demonstration plots.

The maize crop has been so successful in this area that many people have now joined the association. Originally there were 11 members of the association. Now there are 30 members, 24 of whom are currently using no-till. We asked the farmers what difference the Combi-Pack and

Figure 3

Maize Yield in Mlondozi: No-Till Demonstrations versus Traditional Practice



Source: Agricultural Research Council—Institute for Soil, Climate and Water[49]

[49] See "Demonstration and Assessment of Sustainable Land Management Practices in the Mlondozi District, Mpumalanga Province," http://www.arc.agric.za/institutes/iscw/main/projects/mlondozi.htm.

George and Queen Thango

no-till have made for them. Mr. Ngema answered that the yield using the Combi-Pack, with its combination of hybrid seed, herbicide, and fertilizer, is much higher relative to the seed and applications they used previously. The yield can be two to three times higher with less work because the stalks produce two or three more ears per stalk.

So far this experiment has translated into an improved quality of life for these farmers and their families.[50] No-till saves these farmers the costs associated with plowing. Because they don't need to spend as much time in the fields, the men look after cattle and the women spend more time on domestic work. The division of labor in Hlabisa now has a better chance of expanding, and these people have increased opportunities to pursue entrepreneurial ideas that could benefit the entire community. According to Mr. Ngema, older farmers who are less able to manage the physical work of plowing and constant weeding have found using the Combi-Pack and no-till especially helpful.

D3. A LADDER TOWARDS INDEPENDENCE

Saving time, money, labor, and soil allow smallholder farmers to capture the real benefit of Combi-Packs: the ability to transition from a marginal, subsistence existence to greater food security and, thereafter, greater economic security. Monsanto sees the Combi-Pack product as a step in the climb from subsistence to commercial farming. We met with some of the farmers who have started climbing this ladder.

[50] Some farmers also plant beans and squash between the rows of maize to diversify their food production. The farmers who do this though cannot use Roundup, which increases their labor costs.

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George and Queen Thango live on the dry, rocky land near Belgrade in KwaZulu-Natal Province. George originally worked as a plumber in Johannesburg, but in 2000 he moved back to the farm and his family. While he was away in the city, Queen lived at the farm, raising a family and growing crops.

By the time George returned to the farm, the no-till approach had been introduced, and some local farmers were using the method. George told us he was intrigued by this and adopted no-till along with Monsanto seeds for his farm. While George and Queen started as Combi-Pack users on a small plot of land, they now use Roundup Ready seed (a biotech product) to plant a larger area.

We visited the Thangos twice: once in September 2005 and again in March 2006. George's 2005 harvest totaled 60 bags of maize (one bag is approximately 70 kg) from one hectare, nearly three times more than the approximately 25 bags this same area yielded in the past. As the Thango family normally consumes only about 12 bags of maize per year, George can sell his surplus crop if the price is good. If it's not, he will wait to make the sale, as he did in 2005 when maize prices were low.

Queen remembers when she depended on her garden as the family's primary source of food and extra income. After spending a long day in the fields, Queen worked in the evenings at her sewing machine to earn extra money. Since George returned and they switched to no-till planting using Monsanto products, Queen has not touched her sewing machine. She now

Charles Matlou, a member of Monsanto's smallholder research team, gave us his impression of why Combi-Packs are useful: "It's not about how much they grow, but about their surplus; it's about how much the farmers save," Charles said. "They save time, money, labor, and they save the soil."[51]

Charles Matlou in a maize field near Belgrade

[51] Interview with Charles Matlou (Monsanto smallholder team member, Belgrade, South Africa), September 28, 2005

Mrs. Mntungwa standing by the family's field

chooses not to sew and instead has some leisure time. They both agreed that no-till is better than conventional planting because it saves time and money. They spend less time in the fields and do not need to hire someone else to plow or weed.

With the income the Thangos earn from the sale of maize and with the additional income that comes from cost savings, they purchase seed, fertilizer, and herbicide and also pay for their children's education.[52]

When asked about difficulties he faces with his farm, George said that he would love to grow more but several factors constrain him, including:

- a lack of machinery for planting and local milling;
- current low prices for maize; and
- a lack of financing.

His small community had purchased a mill in order to grind its corn locally, but the mill machinery broke down and is no longer functional. The closest mill is approximately nine kilometers away. Thus, people have to travel to mill their meal, and traveling adds costs for farmers. Low maize prices, an issue we address below, have a number of causes. Finally, rural credit is limited, and this forces farmers to look to personal savings, family, or informal moneylenders when they need to borrow.

George's goal is to own a mill. If he owned a mill, he could grind his maize to sell to the neighbors,

[52] All three of the Thangos' sons attend school. Their oldest child, who is 21, attends the University of KwaZulu-Natal at Pietermaritzburg and is studying to be a civil engineer. His parents pay for part of his tuition with the money they are able to generate through farming.

increasing his income by adding value to the final product. He could sell what's left over from the milling process for use in animal feed. He also could grind maize for a fee for other small farmers. In thinking of ways to expand his business beyond farming and towards other activities that expand the local division of labor, George is exhibiting the kind of entrepreneurial behavior we would expect to see given the extra time and income he now has. If he is successful, his efforts will benefit not only his family but also the local community.

The Future of Smallholder Farming?

Patience may be the future of smallholder farming in South Africa. She is a young, university-educated single woman, who has decided to farm in part because formal employment in South Africa is limited, but also because she very much wants to work for herself and build a business.

Patience

Patience was orphaned when she was young and raised by her grandmother. After her grandmother died, she and her siblings lived with aunts and uncles. Patience's older sister went to university to study accounting, and Patience was able to follow in her sister's footsteps. Eventually, she finished college with a bachelor's in commerce (BComm). Unfortunately, like many South Africans, she was not able to find formal employment.

About a year out of school and still unemployed, Patience heard about a government program in Free State province that trained young people to do small-scale farming. She signed up for the program with the government's promise that at the end of the year the trainees would receive a small piece of land and a small greenhouse. At the end of the year, the government said it could provide the land, but that if people stayed in the program another year, they would get management training in addition to their earlier agricultural training. At the end of the second year, they would get their small plot of land. Patience stayed with the program and received training, but she never received any land. So she returned to KwaZulu-Natal and was able to arrange to use land there.

She told us she got involved with farming because she never wanted to work for someone who could fire her. She wanted to be her own boss. When we met in September of 2005, she was growing spinach, cabbage, and carrots. She told us that in 2006 she hoped to expand, try Combis, and grow maize as well.

While George and Queen originally farmed only a small plot around their home, they have gained valuable experience, confidence, and more financial security from their experience with the Combi-Pack and no-till farming. This positive learning experience has allowed them to farm a larger parcel.[53] In March 2006, after visiting with the Thangos at their home, we drove to another field they work. The empty half-hectare field we had seen in September was now covered with tall maize stalks, which had sprung from 12.5 kgs of Roundup Ready seed. In May 2006, Queen harvested the maize, a process that takes between three and four days.

Today, George and Queen are no longer subsistence farmers; they consistently grow a surplus of maize. They reinvest the income from these efforts in their farm. They have extensively renovated their home, and they are able to help educate their children. George and Queen also routinely advise neighbors who are interested in emulating their success. As they start up the ladder towards greater economic empowerment, they are helping others to do the same.

D4. And another Step . . .

Mr. Rabie Mntungwa is a tall, thin man with a wonderful smile and an animated character. A father of nine children, he is one of the no-till farmers who no longer uses Combi-Packs. He has "graduated" from the small package and now uses larger packages of Roundup Ready maize seed. We met with him in September 2005 and with his wife in March 2006.

He is also very happy with his experiences planting no-till and using Monsanto seeds. He certainly likes the results he gets in terms of crop yields. In 2005, the five hectares he planted yielded 13 tons of maize, and he reported making three times the money in 2005 that he made in 2004.[54] He also likes that his wife does not have to work as hard as she did in the past.

Rabie is making the transition from smallholder to small-scale commercial farmer. In the 2005 season, he planted five hectares, but in 2006 he planted 13 hectares. He feels comfortable moving to this larger area because he has gained experience and knowledge using no-till along with the Monsanto products.

The benefits of this success are visible. With the income he has earned from his surplus, he has purchased a second-hand tractor, which he uses to plant some of the land he farms. In addition, Rabie not only feeds his family, he also employs others. In the 2005 season he hired eight people to help him in the harvest. He

[53] Under a communal land system, the chief or traditional leader allocates land to members of the community. Unused land may be requested by those community members who believe they can make use of it.
[54] Interview with Rabie Mntungwa (farmer, Belgrade, South Africa), September 28, 2005.

Mr. Mntungwa's increased yields have benefited others, like this worker whom he has had to employ to help with the crop.

imagines he'll need 10 people for the 2006 season.[55] These jobs result from the increased productivity of the land: the higher crop yields that Rabie generates require him to hire workers to gather the crop.

The Mntungwas have, for the past few seasons, solved the problem of food security. In March, when we visited again, Mrs. Mntungwa said, "they [the Combi-Packs] have chased away hunger."[56] The additional income the family earns allows them to do other things. With nine children, eight of whom still live at home, Mr. Mntungwa said he has lots of expenses, especially school fees and clothes, but he can better manage these now. His target for 2006 is to buy a family car and take a holiday.

E. Problems and Constraints

> Smallholder farming, still located mostly in the former homelands, is an impoverished sector, dominated by low-input, labour-intensive production. Low productivity is a major handicap, coupled with tenure insecurity, very small size of land holdings and lack of support services (e.g. extension, finance and marketing). [57]

Official statistics suggest that the agriculture sector in South Africa is quite small at less than 4 percent of GDP. However, these statistics do not capture the extent of subsistence farming and informal farming activity in South Africa. Unlike the U.S., the South African agricultural sector

[55] Ibid.
[56] Interview with Mrs. Mntungwa (farmer, Belgrade, South Africa), March 17, 2006.
[57] OECD (2006: 27).

includes many subsistence farmers. Thus, official statistics underestimate the true size of South Africa's agriculture sector.

Within this sector, subsistence farmers struggle to feed their families. For these smallholders, access to technology can make all the difference between having enough for a family to eat and poverty and hunger. Further, having access to technology that improves crop yields can help some subsistence farmers move from a hand-to-mouth existence towards commercial farming.

This being said, farming is a difficult business, and smallholders in South Africa face a number of constraints as they struggle to support themselves and their families. These barriers include both domestic and international barriers, as well the exogenous factors that all farmers face, such as weather and access to water.

E1. Domestic Barriers and Constraints

The smallholders in KwaZulu-Natal and Mpumalanga face some of the same barriers that small-business owners worldwide face: access to credit, costly inputs, and the development of an effective marketing effort. Other concerns are more specific to the agriculture sector, such as irrigation. We discuss these concerns below.

Access to Inputs. Many smallholders have difficulty purchasing agricultural inputs. In some cases, seeds and other products are packaged in large quantities more appropriate for commercial farmers.[58] In other cases, the inputs are prohibitively expensive or are only available at far-off stores. One recent study notes that while 10 percent of smallholder farmers plant hybrid seeds,[59] such as those found in the Combi-Pack, 90 percent still plant less costly open pollinated varieties (OPV) or saved seeds, both OPV and hybrid.[60] When planted, saved hybrid seeds can revert back to the characteristics of one of their ancestors and often do not yield as well as the original hybrid seeds.

Combi-Packs provide small-sized, relatively inexpensive packages of good quality hybrid seeds, fertilizer, and herbicide and are available at local extension offices or at farmers' cooperatives. This means Combi-Packs are affordable and accessible. Improving access to other hybrid seeds, such as Quality Protein Maize or ClearField weed-tolerant maize, is an important issue being addressed by non-governmental organizations

[58] Sometimes farmers join together to purchase the large-sized inputs and then divide the inputs amongst themselves. Such sharing is certainly one strategy for dealing with the problem of inputs designed for large-scale commercial farmers.

[59] Hybrids result from a cross between parent plants that are genetically unlike.

[60] Marnus Gouse, Carl E. Pray, Johann Kirsten, and David Schimmelpfennig, "A GM subsistence crop in Africa: the case of Bt white maize in South Africa," *International Journal of Biotechnology*, 7, Nos. 1/2 (2005): 92.

(NGOs) operating in sub-Saharan Africa.[61] However, real change will come only when more companies do as Monsanto has done and adopt policies to market to the bottom of the pyramid. In the seed industry, two other companies, Panar and Pioneer, have BOP marketing strategies. Increased competition in this market should lower the cost of seeds, making it easier for small-holders to purchase this technology.

Access to Credit. All small businesses have difficulty accessing credit. South Africa presents particular concerns. More than half of all South African adults do not currently have a bank account, and 41 percent of adult South Africans have never banked.[62] High service fees coupled with lack of geographic access for many people, especially rural residents, make banking unattractive for many.[63] A 2002 survey of large and small-scale agriculture in South Africa found that no farming operations in former homelands obtained credit or repaid loans through commercial banks and only one percent obtained credit or repaid a loan through the parastatal Land Bank.[64]

Most farmers rely on personal savings, loans from friends or family, or loans from informal lenders to purchase inputs and to expand operations. Savings clubs are often used and provide some access to credit, but these resources are limited, so credit remains tight. Yet, there is some evidence from South Africa that farmers who borrow generate higher crop yields than non-borrowers.[65]

The farmers we met live on communal land and may have more difficulty accessing commercial

[61] "Though quality protein maize looks and tastes like the traditional maize varieties, it yields more and shows more disease and pest resistance. It also contains twice as much lysine and tryptophan-the amino acids that are vital for the production of proteins in humans and in animals . . . The crop is seen as a boost to the nutrition of growing children in areas, like many in sub-Saharan Africa, where maize is the staple diet." See "Quality Protein Maize: More Varieties Released," *AgriForum*, Association for Strengthening Agriculture Research in Eastern and Central Africa, Entebe, Uganda (2002), http://www.asareca.org/agriforum/articles20/agf20articles/QPM.htm.
See also "The Development and Promotion of Quality Protein Maize in Sub-Saharan Africa: Progress Report 2003" (International Maize and Wheat Center (CIMMTY), 2003),
http://www.sahims.net/batchfiles_web/2004/05_May/19/Abstract/Development%20and%20promotion%20of%20quility%20protein%20maize.pdf; and "Weed Tolerant Maize Boon to Poorest Farmers," Rockefeller Foundation, October 17, 2005, http://www.rockfound.org/Agriculture/Announcement/80.

[62] See *FinScope 2005: a comprehensive nationwide survey of financial usage in SA* (Marshalltown, South Africa: FinMark Trust, 2005), http://www.finscope.co.za/documents/2005/FinScope05_PR.pdf.

[63] Ibid. However with the introduction of low-fee, easy-to-understand Mzansi accounts, many poorer South Africans are now opening accounts.

[64] "Report on the Survey of Large and Small-Scale Agriculture" (2002: 103, Table 11.1). This table suggests very low levels of credit use overall in former homelands.

[65] OECD (2006: 55).

credit than do freehold farmers because they do not hold title to their land. For example, in Mlondozi, the farmers said that they have approached the South African Land Bank for loans. At first, they applied as a farmers' association; however, they were counseled to apply as individuals. When they did, it took a long time to process the numerous applications, and the farmers did not learn if the loans were approved until November and December—past the beginning of the planting season.[66]

Another model for improving access to credit for smallholder farmers comes from Mali, where financial cooperatives (Caisse Rurale d'Épargne et de Prêt) are helping people in rural areas to save more. Savings, in turn, are used to fund loans for agricultural development. "The CREPs encourage people in rural areas to save their money, which can then be lent out to further agricultural development and improve the welfare of members."[67]

The price of maize. Recent low maize prices in South Africa result from a number of factors. One factor was a large carry-over stock from the 2004/2005 season that had a dampening effect on prices. Even the international markets were unable to absorb South Africa's excess crop supply. The rand has been relatively strong over the past two years, making South African maize more expensive vis-à-vis maize from other countries.[68] Moreover, good rains in maize growing countries produced large supplies of maize internationally, driving down the international prices for maize. These high yields coupled with the subsidies in some countries led to a glut of low-priced maize.

Thus, increased productivity is a double-edged sword. As subsistence farmers improve their productivity, through the use of products such as the Combi-Pack, they grow more maize. On the one hand, increased supplies of maize lessen food insecurity and address the problem of hunger. On the other, everything else being

[66] The Micro-Agricultural Finance Schemes of South Africa (MAFISA) is a new government effort designed to address credit needs for smallholders and other rural residents. MAFISA, which was approved in January 2006, will provide savings, credit, insurance, and payment services for the rural working poor and may operate more effectively for smallholders than does the Land Bank. For more on MAFISA, see http://www.nda.agric.za/docs/MAFISA.pdf. One study suggests that in 2003 less than two percent of the Land Bank's lending was directed towards small-scale farming. See Gerhard Coetzee, "Agricultural Finance in South Africa," in L. Nieuwoudt and J. Groenewald, eds. *The Challenge of Change* (Pietermaritzburg, S.A.: University of Natal Press, 2003).

[67] See "Mali," *Sasakawa Africa Association, Annual Report 2003-2004*, 12, http://www.saa-tokyo.org/english/annualreport/saa_ar03-04.pdf.

[68] A recent weakening of the rand has, however, resulted in surging exports. "S. Africa rand sets 2 1/2 yr low as jitters mount," Reuters South Africa, June 23, 2006, http://za.today.reuters.com/news/newsArticle.aspx?type=businessNews&storyID=2006-06-23T102709Z_01_ALL325416_RTRIDST_0_OZABS-MARKETS-SAFRICA-RAND-20060623.XML.

Queen Thango in her garden, Belgrade, KwaZulu-Natal

equal, increasing supplies of maize should lead to a lower overall price, which will make it more difficult for subsistence farmers to earn a living. Some farmers will not be able to survive growing maize. However, the falling maize prices should provide a powerful incentive for some farmers to shift efforts and grow other crops or enter other businesses. For farmers to be better able to make this transition, the institutional environment in South Africa needs to have greater labor-market and credit-market flexibility.

Climbing the value chain. Mr. Nkosi told us, "We do get maize. In terms of feeding our family, we're fine. But the issue is commercialization."[69] In part, this means that while smallholders in South Africa are able to grow maize, they have difficulty adding value to their product. In order to add value to their maize, farmers need to get their maize to mills. If a farmers' association owns a mill, the farmers themselves can better capture the added value of milling the product for consumers. However, if mills are located at a distance, or if local mills are not operating, it is more difficult to capture this value.[70] In addition, Department of Health regulations specify that milled maize in South Africa must be fortified to include 33 percent of the recommended daily allowance (RDA) of Vitamin A, 25 percent of the RDA of iron, and

[69] Interview with Joseph Nkosi (farmer, Mlondozi, South Africa), September 29, 2005.

[70] The Mlondozi farmers do have a new mill that they can use to grind maize. They can then sell ground maize to the local population. The NGO TechnoServe and the Monsanto Foundation subsidized the cost of installing the mill. The Mlondozi farmers can now add value to their product and capture more of this value.

a multivitamin mixture including riboflavin, folic acid, zinc, and niacin. This fortification process is costly, and the costs may be too onerous for small, local mills.[71]

Getting products to market. Another part of Mr. Nkosi's concerns regarding commercialization has to do with marketing. Farmers can grow maize, but can they identify customers' needs and get their product to market? Often, inadequate transportation hinders marketing. Smallholders typically live in former homeland areas created by the previous governments. Homelands were developed on marginal land in areas where white commercial farmers did not have interests. Under the old governments, there was little emphasis placed on building roads to homelands or providing other infrastructure and support. A recent study finds that 89.6 percent of farmers in former homelands believe a road from farm to market is "not readily available."[72] When roads are available, it can be both difficult (due to the poor condition of the roads) and costly for farmers to hire transport to take maize from farms to mills, markets, and consumers. The lack of infrastructure presents a major challenge.[73] As agricultural pioneer and Nobel Laureate Norman Borlaug notes, "[M]ost agricultural production in Africa is generated along a vast network of footpaths, tracks, and community roads where the most common mode of transport is 'the legs, heads, and backs of women.' Indeed, the largest part of a household's time expenditure is for domestic transport."[74]

Quality of the land. Smallholders typically occupy poor-quality land.[75] In South Africa this is the result of past government policies that moved black South Africans to marginal lands so that higher quality land would be available to

[71] For the latest on regulations relating to the fortification of certain foodstuffs, see *Regulations Relating to the Fortification of Certain Foodstuffs: Amendment*, *South Africa Government Gazette*, September 16, 2005, http://www.info.gov.za/gazette/regulation/2005/28012a.pdf. Regulations have existed since 1979 (Regulation No. R2839, 21 Dec. 1979) on minimum levels of fortification allowable to permit the marketing of a maize meal as "enriched." The initial regulations specified only riboflavin and nicotinamide.

[72] "Report on the Survey of Large and Small-Scale Agriculture" (2002: 30, Table 3.3).

[73] Vink (2004: 23).

[74] Norman E. Borlaug, "President's Report," *Sasakawa Africa Association Annual Report 2003-2004*, 2, http://www.saa-tokyo.org/english/annualreport/saa_ar03-04.pdf.

[75] The *OECD Agricultural Survey of South Africa* notes: "In South Africa, *soil organic matter* has been seriously deteriorated, mainly because of monoculture cereal production, short fallow periods, the absence of effective crop rotation systems and intensive tillage. There is a need to introduce cultivation systems (e.g. minimum tillage, grass cover, legume systems, conservation of crop residues and directed fertilization) that will promote the uptake of reduced forms of nitrogen and cut down on the oxidation of reduced forms of nitrogen." OECD (2006: 48).

Maize fields in Belgrade, KwaZulu-Natal

whites.[76] Nature contributes also: much of South Africa is dry. Estimates suggest that "[o]nly 16 percent of agricultural area is potentially arable, and water resources are scarce in most regions."[77] On dry, marginal land farmers desire, but often lack, irrigation. Lack of irrigation limits production, but developing irrigation systems is quite expensive. The result is that most smallholder farmers depend upon rainfall and so are vulnerable to drought.

However, Paalberg notes:

> One new departure has been a recent competition, among all three of the big GM crop companies—Syngenta, DuPont, and Monsanto—to develop crops with drought-tolerance (DT) traits. Scientists within these companies have now successfully isolated genes conferring significant drought tolerance, and they have transferred these genes using genetic engineering into agricultural crop

[76] An extensive process of land restitution is currently taking place in South Africa. The government is purchasing farms from people owning land that previously belonged to dispossessed communities—those black communities that lost land after 1913. After the purchases, the government returns this land to the communities. This is proving a laborious and time-consuming process. In addition, there is a land distribution program, which involves the government buying commercial farms and settling previously disadvantaged farmers on them. Some studies suggest that black South Africans generally do not want to farm. They would prefer to live in an urban area but receive compensation for their land loss. See Ann Bernstein, Jeff McCarthy, and Simon Dagut, *Land Reform in South Africa: A 21st century perspective*, Research Report No. 14 (Johannesburg, S.A.: The Center for Development and Enterprise, 2005), http://www.cde.org.za/article.php?a_id=36&PHPSESSID=27e6096af30e236ee3fa86fa8d55fc89.

[77] OECD (2006: 14).

> plants such as soybean, rice, and maize, with exciting results in early greenhouse and field trials. If DT traits such as these can eventually be transferred to tropical varieties of maize, wheat, rice, sorghum, or millet, they could offer poor African farmers something far more valuable than the insect resistance or herbicide traits of the first generation of GM crops. [They] would give small farmers in Africa, and also in the drylands of South Asia, a partial safety-net against the cyclical food crises that afflict these regions whenever the rains fail.[78]

Increased access to drought-resistant seed would address this problem, but biotech seed is more expensive than drought-vulnerable open pollination variety seed. Outside South Africa, a minority of African countries have the legal framework to allow the use of such seed. As of 2004, Monsanto sold seeds in only nine of the 53 African countries. Field trials for transgenic crops *are* taking place in a hand-full of African nations, but many countries lack the bio-safety regulations and resources necessary to monitor such trials. Monsanto is working in partnership with the Sasakawa Africa Association, universities, extension agencies, and other research organizations to improve access to seeds, fertilizers, and conservation tillage practices for farmers in Ghana, Nigeria, Ethiopia, Tanzania, and Malawi.[79] This kind of partnership between non-profit and for-profit organizations may help spread the use of improved agricultural technologies. However, in order to promote more innovative BOP solutions to these problems, countries will need to create legislative and regulatory frameworks that:

- protect intellectual property rights in proprietary technology;
- provide clear rules regarding bio-safety requirement; and
- provide an environment that promotes dependable contracting, effective marketing, and easier distribution to BOP consumers.

Such improvements to the institutional environment should allow companies such as Monsanto to expand operations throughout Africa. Without real improvements in these areas—without institutional stability and improved security—companies will be reluctant to enter BOP markets.

To a certain extent, use of no-till technology, which improves soil quality by returning organic nutrients to the soil, should help address the poor

[78] Robert Paarlberg, "Are genetically modified (GM) crops a commercial risk for Africa?" *International Journal of Technology and Globalization*, 2, Nos. 1/2 (2006): 91. See also the Environmental Stress Tolerance Research website, http://web.uct.ac.za/depts/plantstress/, for more information on drought-resistant seed technologies.

[79] Robert Horsch, "Agricultural Technologies: locally relevant around the world" (presentation, Monsanto Company, September 17, 2004), http://democracy-africa.org/africando2004/speeches/HorschPresent.pdf.

soil problem. In addition, improved access to fertilizers can alleviate the problem of poor soil quality. Combi addresses this need by including a fertilizer in the package. As Norman Borlaug recently said, "In marginal lands—where at least half of Africa's 200 million hungry people live and farm—the nature of the agroclimatic stresses and remoteness from commercial markets call for lower-cost, lower-risk technologies. Yield dependability is especially important. Greater use of improved varieties and livestock breeds can be extremely beneficial. Water resource development and management should receive a major priority."[80] Combi-Packs are one such lower-cost technology that provides increased yield dependability. To this extent, Combis may help address some of the problems associated with agricultural productivity on marginal land.

Land Tenure. In South Africa, all of the farmers with whom we spoke live on communal land. These farmers do not own property individually. Rather, the community of which they are a part owns the property. The traditional leader of the community, normally a chief, allocates land based on the needs within his community. Farmers who live on communal land may at times face difficulties accessing credit because their land is not available to use as collateral for a loan.

However, if farmers demonstrate increasing crop yields from the use of new technologies, such as Combi-Pack and no-till farming, we anticipate a gradual, evolutionary movement away from communal property towards greater individualization of tenure. The reason for such a move is that as the value of land rises (due to the possibility of producing more on the land), individuals will look for ways to capture more of the rising value. Creating individual rights in land allows people to capture more of such value themselves. The current Communal Land Rights Act does allow for this kind of evolutionary movement. The Act provides for legal title to communal land, which is currently held in various forms by the government, to be transferred to communities as new legal entities. The land-use rights in each community are to be identified and registered in special Community Registers to be maintained by the government's Deeds Registry office. Community members will determine the rules relating to community property sales in their community. They may decide to retain the existing communal land management system, to have all their properties converted to freehold title, or to have a combination of the two systems. Given this flexible system, areas where farming becomes more profitable or areas where the demand for land increases for any reason should move toward a freehold system.

The saved seed trade-off. Farmers have a choice of which type of seed to plant. Subsistence farmers

[80] Borlaug, "President's Report," p. 2.

can choose inexpensive open pollinated varieties of seed, or they can choose to spend money and purchase a more expensive hybrid seed. Open pollinated varieties have lower yields, but the seed that is harvested can be saved and planted next season—reducing costs for farmers. Farmers who choose to purchase Combi-Packs do so because they desire a higher yield from their efforts. However, farmers who purchase the Combi with its hybrid seed cannot save the seed from one season to the next and expect the high yields they experienced the season before. This means that using Combi, or any hybrid seed, necessitates a trade-off between higher yields and on-going expenditures for seed inputs. For some farmers this trade off is acceptable; for others, it is not. This very difficult decision is best left to individual farmers as they will have the clearest sense of how the trade-offs involved will affect them. And, while some critics suggest that, given Monsanto's prominence in the seed industry, the company could eventually dominate the business to the point where the fertility of seed worldwide is threatened, this seems unlikely. The company is not a monopolist. It faces continuous competition from other seed producers, including Sygenta and DuPont. Monsanto has only 3 percent of the worldwide market; 75 percent of seed used worldwide is saved seed.[81]

E2. International Barriers and Constraints

Agricultural subsidies in the developed world. South African smallholders face a highly competitive agricultural market in their own country. The sector was largely deregulated in the 1990s, and government support levels for most agricultural products (with the notable exception of sugar) are quite low. The OECD recently calculated the Producer Support Estimate (PSE) for South Africa for the 10-year period 1994–2003 and found that government support for the agricultural sector "equaled on average five percent of gross farm receipts . . . the PSE in South Africa is roughly at the level of such non-OECD economies as Brazil, China and Russia . . . [and] well below that in the United States and far below that in the European Union."[82]

Maize receives above-average levels of protection at a PSE rate of 7.6 percent.[83] Tariffs on imported maize are used only occasionally. Presently, there is a tariff of 22.91 rand/ton, or approximately $3.50/ton on maize.[84]

Other countries, most notably the United States, provide substantial subsidies to their maize farmers. Maize is the U.S.'s top crop export, and 60 percent

[81] Interview with Wally Green (Monsanto, Fourways Office, Johannesburg, South Africa), March 14, 2006.
[82] OECD (2006: 20).
[83] Ibid., 21.
[84] The U.S. dollar figure is calculated at an exchange rate of 6.5461 rand/dollar. For information on South Africa's maize tariff, see http://www.sagis.org.za.

Mrs. Nkosinathi in her son's maize field in KwaZulu-Natal. Will we trade with Mrs. Nkosinathi's son?

of the worldwide maize exports come from the U.S.[85] For the 10-year period 1995 to 2004, U.S. taxpayers provided over $40 billion for subsidies to corn/maize farmers—more than twice the amount spent to subsidize wheat farmers and 70 times the subsidies to tobacco farmers.[86] Because they do not bear the full costs of this production, farmers have the incentive to grow large amounts of maize.

These subsidies drive down the international price of maize, which concerns farmers in South Africa. South African studies have noted: "Competing with maize and wheat imported from the United States or the European Union will be extremely difficult for South African farmers given the high subsidies and indirect transfers that farmers continue to enjoy."[87] Not surprisingly,

[85] See Nora Brooks and Ernest Carter, *Outlook for U.S. Agricultural Trade*, United States Department of Agriculture, Economic Research Service (Washington, DC, 2005): Table 2, http://usda.mannlib.cornell.edu/reports/erssor/trade/aes-bb/2005/aes48.pdf; see also Liz Stuart, *Truth or Consequences* (Oxford, UK: Oxfam, 2005), http://www.oxfam.ca/news/MakeTradeFair/AgCamp/bp81_truth_or_consequences_amended%20final_no_emb30.11.05.pdf.

[86] The U.S. maize subsidy is $141.72 per metric ton. See "Corn Subsidies in United States," Environmental Working Group's Farm Subsidy Database, http://www.ewg.org/farm/progdetail.php?fips=00000&progcode=corn. See also Robert Bryce, "Corn dog," *Slate*, July 19, 2005, http://www.slate.com/id/2122961/. Note, however, U.S. yellow corn is not approved for import into South Africa. However, yellow corn is used in South Africa primarily for animal feed. White maize is the basic staple food of South Africans. See "South Africa," *2004 National Trade Estimate Report* (Washington, DC: Office of the U.S. Trade Representative, 2004): 429, http://ustr.gov/assets/Document_Library/Reports_Publications/2004/2004_National_Trade_Estimate/2004_NTE_Report/asset_upload_file388_4796.pdf.

[87] Charles Mather and Asghar Adelzadeh, *Macroeconomic strategies, agriculture and rural poverty in post-apartheid South Africa*, (Johannesburg, S.A.: National Institute for Economic Policy, 1998), http://www.info.gov.za/otherdocs/1998/poverty/macroecon.pdf.

South African maize farmers have lobbied for, and won, some tariff protection on imported maize—largely in response to the fact that subsidized U.S. producers are driving down the price of maize. Although these tariffs benefit both large-scale and small-scale maize farmers, the benefits come at the expense of South African consumers, who must pay more for maize.

Legislative and Regulatory Issues within Africa. The South African government passed the Genetically Modified Organisms Act of 1997, which:

- allows farmers to use genetically modified materials approved by a biosafety committee (to date, insect-resistant cotton and maize, and herbicide-tolerant cotton, maize, and soybeans) and

- addresses concerns over environmental protection.

In addition, in 2001 the country developed a biotechnology strategy that focuses on this technology as a source for jobs, innovation, food security, and environmental sustainability.[88] This legislative and regulatory framework has eased the way for South African farmers to use genetically modified maize seed. For example:

> GM maize increased from 14,6% of total maize planted in 2005 to 29,4% in 2006. Of this 72% was maize with insect resistance, with herbicide tolerant maize making up the remainder. Actual hectares planted increased by 11% to 455 287ha despite the total maize area decreasing by 45%. White GM maize increased dramatically from 8,6% in 2005 to 28,8% in 2006, while the yellow GM maize area planted grew from 24% to 30,5 %.[89]

Although other African countries are working to create the legislative and regulatory environment needed for their farmers to access seeds that are genetically modified and that produce higher yields with reduced use of pesticides and fertilizers, many still need to create a clear legislative and regulatory framework for such products.[90] Zimbabwe, for example, has a bio-safety act and is conducting field trials with insect-resistant maize. Burkina Faso is conducting field trials with bio-tech cotton. Uganda recently approved

[88] See Iqbal Parker et al. *A National Biotechnology Strategy for South Africa*, a report prepared at the request of the Department of Science and Technology (Pretoria, S.A.: Department of Science and Technology, 2001), http://www.pub.ac.za/resources/docs/biotechstrategy_2002.pdf.

[89] Julia Kupka, "GM Maize Doubles Market Share," *Farmer's Weekly*, May 5, 2006, http://www.africabio.com/cgi-bin/viewnews.cgi?newsid1147330314,90794. Note: South African usage calls for a comma, rather than a decimal point, in decimals and spaces, rather than commas, in numbers over three digits.

[90] For a helpful summary of the current state of African regulatory regimes and attitudes toward GM crops, see Greg Bodulovic, "Is the European attitude to GM products suffocating African development?" *Functional Plant Biology*, 32 (2005): 1071, http://www.publish.csiro.au/nid/103/issue/955.htm.

field trials for transgenic bananas, and Cameroon, Egypt, and Senegal all have some bio-tech regulations in place. However, many African nations have not created bio-tech regulations, including bio-safety assessment mechanisms, and many African countries may need to strengthen intellectual property-rights protections before firms such as Monsanto, which develop valuable intellectual property such as proprietary seed varieties, feel comfortable operating within their borders.

European Resistance to importing biotech products. Until 2004, the European Union (EU) maintained a moratorium against genetically modified foods. The World Trade Organization (WTO) recently found this moratorium to be illegal and a violation of WTO rules.[91] Before this, the moratorium was eased somewhat in 2004 when the EU authorized some genetically modified products for import so long as they were properly labeled and complied with tracing requirements. The EU's past policy has had an important negative impact on African nations, which depend heavily on revenues from exported agricultural products. "Exports of agricultural commodities to the European Union account for significant revenue for southern African nations. In many African nations, agriculture is the second most important source of revenue, after mining." South Africa, for example, sends 47 percent of its agricultural exports to the EU.[92]

Rather than risk losing a major export market—the EU—African countries have been slow to adopt bio-tech legislation and regulation. This means that improved seed varieties are not available to farmers in these countries. One critic argues that the EU's resistance to importing food from countries that allow genetically modified crops "is another example of the third world needlessly suffering at the expense of the first."[93]

> The freedom of choice of farmers in developing countries is being severely challenged by the agricultural policy of the European Union (EU). Developing countries might well be reluctant to approve GM crop varieties because of fears of jeopardizing their current and future export markets. They may also not be able to provide the necessary infrastructure to enable compliance with EU requirements for traceability and labeling.[94]

[91] See "EU 'broke trade rules' on GM food," *BBC News Online*, May 11, 2006, http://news.bbc.co.uk/2/hi/business/4761121.stm.
[92] OECD (2006: 16).
[93] Bodulovic (2005: 1072-73).
[94] See *The use of genetically modified crops in developing countries, a follow-up Discussion Paper* (London: Nuffield Council on Bioethics, 2003): xvii, http://www.nuffieldbioethics.org/fileLibrary/pdf/gm_crops_summary.pdf.

Smallholder George Thango standing by a maize field he planted with Combi-Packs

Recent actions by the EU to allow some genetically modified foods into the Union might present African nations with an opportunity to move forward and create or strengthen legislative and regulatory requirements regarding bio-technology and bio-safety. These actions may make it easier for companies like Monsanto to market products like the Combi-Pack to smallholders in other African nations.

F. Policy Implications

> The small-scale farmers in Africa and in other regions, who benefited little from past innovations, need . . . a "Doubly Green Revolution": a scientific revolution that helps farming families over a broad range of agro-ecosystems achieve sustainable advances in productivity and profitability per unit of land, labor, and capital, while restoring the long-term productivity of their farms.[95]

F1. Broad Based Institutional Reforms

Policy efforts directed towards smallholder farmers should first and foremost seek to improve the institutional environment in which these farmers operate. Consumers, entrepreneurs, and businesses will best be able to co-create solutions to poverty when they trade with security in relatively stable environments that protect contracting and property rights. It is essential to implement broad-based reforms addressing the issue of inadequate "transactions infrastructure," a problem that exists in many developing countries and that has been

[95] Gary Toenniessen, "Opportunities for and Challenges to Plant Biotechnology Adoption in Developing Countries" (presentation, NABC 15: Biotechnology: Science and Society at a Crossroad, Seattle, WA, June 2003): 250, http://nabc.cals.cornell.edu/pubs/nabc_15/chapters/Toennissen.pdf.

raised by some scholars as an impediment to smallholder development.[96] Necessary institutional changes within South Africa include:

- protecting the security of land tenure for smallholders by fully implementing the Communal Land Act;
- allowing for greater freedom of entry in the banking sector to promote rural credit opportunities; and
- amending labor laws to allow for greater flexibility in labor markets to increase employment opportunities so that subsistence farming is not the only livelihood open to rural residents.

Land tenure issues should be resolved by allowing for a gradual evolution towards freehold. South Africa should implement the provisions of the Communal Land Rights Act as soon as possible in order to provide members of rural communities with greater security of tenure. The government should encourage community members to record the various usage rights to all properties within their communities so that the official recording process can be carried out as expeditiously as possible. Once usages are registered, community members themselves can make decisions regarding sales and the desirability of shifting from communal to freehold title.

Banking laws should be amended to allow for increased freedom of entry and to permit higher interest-rate charges to compensate for high-risk lending. For example, current bank licensing laws limit the establishment of small rural banks because the cost of obtaining a license for such banks is a steep 250 million rand (close to $4 million US). Usury laws create disincentives for formal lenders to enter high-risk markets. The result is that farmers unduly rely on personal savings, borrow from family, and resort to *Mashonisas*—informal lenders.[97] If South Africa amended the regulatory environment to reduce the licensing fee for small banks and eliminated usury laws, allowing lenders to charge higher rates, increased competition would expand the variety of services offered to consumers. The relatively new Mzansi accounts are one attempt to address the demand for a lower-cost banking product for South Africans. These accounts serve an important function of bringing the "unbanked" into the commercial

[96] Kydd (2002: 2).

[97] Several years ago South African Usury Laws were slightly relaxed and allowed lenders to charge higher interest rates on loans not exceeding R10,000. Currently, the upper range for legal interest rates is 23 percent for commercial banks. Registered microlenders can charge a higher rate. The result was an explosion of microlending. However, microlending soon faced serious criticism because lenders would directly deduct payments out of borrowers' savings accounts, which created problems for some borrowers. The government has passed a "National Credit Act" that requires lenders to verify borrowers' abilities to repay a loan and requires banks not to engage in "reckless lending."

banking environment, and they build on the culture of savings that exists in South Africa in *stokvels* and other savings clubs. However, given the small amount of cash income that poor farmers earn, commercial borrowing is risky. Larger and more reliable crop yields could, in part, reduce the risk smallholders face when borrowing from banks.

Labor laws in South Africa should be amended to allow for greater flexibility in labor markets. Regulations relating to termination and dismissal procedures, the requirements to pay a minimum wage, unemployment insurance, and workmen's compensation insurance all make it more difficult for entrepreneurs to create legitimate, formal businesses. These costs fall disproportionately on small business and are a key reason for the growth of the informal sector in South Africa. For example, while South Africa ranks 28th out of 155 countries overall in the World Bank's 2006 "Doing Business" survey, it ranks 66th in the category "Employing Workers."[98] If the government allowed for greater labor market flexibility, more formal employment would be created, offering alternatives to some of the people who currently have no alternative but to engage in subsistence farming.

F2. Specific Government Reforms

While broad-based institutional reforms are a necessary prerequisite for improving conditions for South Africa's smallholders, more specific reforms will also benefit this segment of the society. To the extent that the South African Department of Agriculture and Department of the Environment have conflicting agendas, these conflicts should be resolved by allowing the Department of Agriculture's experts to take the lead in matters relating to agricultural bio-safety. The inter-departmental committee on bio-safety should work to streamline the approval process for conventional and transgenic seeds so that farmers have access to new products in a more timely fashion. The South African government created a policy that states that 80 percent of the efforts of these two departments should be directed towards supporting smallholders and the small-farming sector. To date, however, these agencies have not created programs that implement this policy directive.[99]

F3. International Reforms

Agricultural subsidies in the developed world should be removed. These subsidies drive down the prices of commodities and make it more difficult for developing world producers to compete with products subsidized by developed-world legislatures. Developed world agricultural subsidies place a significant burden on the smallholder farmers of the developing world and should be removed to promote fairer and freer trade.

[98] See World Bank Group, "Doing Business: Economy Rankings," World Bank, http://www.doingbusiness.org/EconomyRankings/ (accessed July 26, 2006).
[99] OECD (2006: 57).

Elsewhere in Africa, nations must first increase tenure security to provide incentives for smallholders to develop and invest in agricultural land and second decide whether or not they wish to allow hybrid seeds into their countries. In order introduce hybrid seeds, other African nations must create the legislative and regulatory framework to address biosafety concerns. The work South Africa has already done on this front may provide a useful paradigm for other African nations. Some nations, such as Kenya, Zimbabwe, Cameroon, and Burkina Faso, are moving forward with biotech initiatives. This bodes well for the smallholder farmers in these countries. Recent analysis of side-by-side experiments with smallholders in South Africa suggests that the planting of transgenic corn seed has a "large yield advantage" over conventional hybrid seed.[100] Most farmers used less pesticide with the transgenic maize, and the farmers rated the corn as having less pest damage.

> The stakes in this issue for Sub-Saharan Africa are thus high, with GM food technology potentially offering welfare gains that could alleviate poverty directly and perhaps substantially in those countries willing and able to adopt the new technology. African countries need to assess whether they share the food safety and environmental concerns of Europeans regarding GMOs. If not, their citizens in general, and their poor in particular, have much to gain from adopting GM crop varieties and especially second-generation ones.[101]

CONCLUSION

> When the poor at the BOP are treated as consumers, they can reap the benefits of respect, choice, and self-esteem and have an opportunity to climb out of the poverty trap. As small and micro-enterprises, many of them informal, become partners to MNCs [multinational corporations], entrepreneurs at the BOP develop real access to global markets and capital and effective transaction governance. MNCs gain access to large new markets, developing innovative practices that can increase profitability in both BOP and mature markets.[102]

The study of Monsanto's efforts to market to BOP subsistence farmers with its

[100] Ibid., 91.
[101] Kym Anderson and Lee Ann Jackson, "Implications of Genetically Modified Food Technology Policies for Sub-Saharan Africa" (World Bank Policy Research Working Paper 3411, World Bank, Washington, DC , 2004): 21.
[102] Prahalad (2005: 99)

innovative Combi-Pack holds three valuable lessons.

- Markets are pervasive. Even with less-than-perfect institutional arrangements, people and businesses, including large corporations, seek ways to trade to the benefit of all involved.

- Innovative products, such as the Combi-Pack, that allow farmers to save time and money create opportunities for increased entrepreneurship, which benefit all members of the community.

- South Africa should amend land tenure, banking, and labor policies to improve the institutional environment within which smallholders operate. The developed world should eliminate agricultural subsidies in order to create freer agricultural trade.

Today, subsistence farming is the lot of millions of Africans. Mired in poverty, these farmers and their families *are* Prahalad's BOP consumers. They have very limited cash income. As a result, corporations, believing they have little to offer to the poor, have traditionally overlooked them. However, given an institutional environment that allows consumers and businesses to trade with some security and stability, even large corporations will enter this market and provide the goods and services these consumers desire. The more secure and stable the environment, the more trade will take place, benefiting both consumers and businesses. However, this study suggests that even in a less-than-ideal institutional environment, markets are relatively robust and resilient; people and businesses find ways to voluntary trade and co-create solutions to poverty.

Our experience suggests that despite their very limited incomes, these farmers want and need to purchase some goods. Working closely with the smallholder farmers of South Africa, Monsanto realized that the farmers might be willing to purchase seed, fertilizer, and herbicide in a scaled-down size. By providing what smallholders desired—good seed and good supporting products in the right quantities and at the right price—Monsanto is marketing to the bottom of the pyramid, not as an act of corporate philanthropy, but instead in the hopes of making a profit and growing and servicing a market. Whether the company succeeds in reaching the millions of subsistence farmers who live in Africa will depend upon the institutional environments in other nations.

The farmers we met in Mpumalanga and KwaZulu-Natal provinces in South Africa who are choosing to purchase Combis are pleased with their results. They grow more maize, are better able to feed their families, and can at times move away from subsistence farming towards small-scale commercial farming. Monsanto is not giving away seeds of hope; it is selling seeds of hope and creating a

Charles Matlou, Eustace Davie, George Thango, and Queen Thango leaving a field planted with seeds of hope in Belgrade, KwaZulu-Natal

mutually beneficial commercial relationship in the process.

Evidence to date suggests that the benefits of combining Combi-Packs with no-till agriculture are significant, and this provides a message of hope for a better future for smallholders. The productivity of these farmers rises. They experience higher crop yields with less work. Higher yields lead to improved food security and, for some, additional cash income from the sale of surplus maize. Farmers spend less time in the fields weeding and plowing. This saves time and money for smallholders; it allows farmers and their families to pursue other entrepreneurial activities; and it lessens the physical burdens on women—who do most of this back-breaking work. Taken together, these changes translate into improvements in smallholders' standard of living and poverty alleviation.

Smallholders do, however, face barriers and constraints that make it difficult to expand. For many, access to affordable banking services remains a problem. Many communities cannot add value locally because mills are unavailable or the finished product requires expensive nutritional add-ins. The poor quality of much smallholder land is a persistent problem, albeit one that the use of no-till farming and the use of different seeds can partially address. In addition, land tenure issues in communal areas are not settled, and South Africa's rigid labor market continues to limit off-farm employment opportunities. These domestic constraints make it more difficult for smallholders to grow and become small-scale commercial farmers.

On top of these problems, international issues such as agricultural subsidies in developed nations create additional burdens. Subsidies to maize producers in the U.S. tend to drive the worldwide

price of maize down, making it hard for small South African maize growers to compete. These subsidies, coupled with EU resistance to importing agricultural products from nations that allow their citizens to use transgenic technology, impose a double burden on smallholders. Both policies should be abandoned in favor of more open and freer markets.

The lesson of the Combi-Pack is a powerful one: contrary to expectations and predictions, large multinational corporations *are* providing desirable goods and services to very poor consumers—not for charitable reasons, but because these poor consumers are part of a huge, untapped market. Serving this market makes good sense for companies like Monsanto. If they meet the challenge of producing for the BOP, they stand to gain. BOP consumers also stand to gain though increased choice and the opportunity to participate in the global economy. This symbiotic relationship has the potential to benefit both producers and consumers. Most importantly, this symbiotic relationship, if it exists within an institutional environment that respects a rule of law, has the potential to empower the poor and help alleviate poverty. Just ask the South African smallholders.

The Ladies of the Sakhuthando Farmers Association
left to right: Mrs. Q.J. Zungu, Mrs. Patrice Sibici, Mrs. V. Zungu, Mrs. Cele

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