

In Support of Conservation Agriculture for Smallholder Farmers

BY HOWARD G. BUFFETT

I have been farming for 35 years and currently manage or operate farms in Arizona, Illinois, Nebraska and South Africa totaling more than 14,000 acres. Farming seems to be the only profession where others think they know how to farm better than farmers. I would never presume to tell a banker how to collateralize a loan or a scientist how to develop a peer-review study, yet I have observed everyone from bankers, politicians, bureaucrats and academics tell farmers how they should farm. Their advice is usually derived from books, small research plots, extrapolations or philosophical revelations about what will work and what will fail for farmers. As a result, billions of development dollars have been misguided.

Every year I face new challenges on my farms, every year I must adjust and adapt and every year I learn enough to write a new chapter in a book. I learn it from experience, frustration and failures. However, one thing that has provided consistent success on our farms and for millions of farmers, both large and small, across the world is conservation-based agricultural production techniques.

FARMING IS RESEARCH

Since I operate a private foundation focused on addressing hunger and achieving food security through agricultural development, I also farm to learn about what works and what doesn't work in different contexts. We partner with Southern Illinois University, Penn State, Purdue, Texas A&M and other organizations to achieve meaningful results. Our foundation research farms use oxen with no-till planters and roller crimpers. We also use 400 horsepower tractors with 60 foot planters. We farm two acre fields and 320 acre fields. Our research plots are adapted in size to reflect real field conditions. The first time I learned the importance of this was in Mozambique—the research station was consistently producing six tons of maize per hectare yet the average in the country was less than one ton per hectare; the research success was not transferring to farmers.

Farming is a challenging business—farms are susceptible to all types of weather, are at the mercy of volatile markets and subject to a myriad of crop pests and diseases. There is one common denominator that commercial farmers require to be competitive and what every small farmer in developing countries must have to feed their families; it is healthy soil. And how you farm determines the health of all soil.

SOIL IS LIFE

The human body requires air, water, food and sunlight. Plants require the same. Most people think of agriculture as growing food, but it is actually a complex biological process and it is often site-specific. I have farms 15 miles apart in Central Illinois that require different techniques even between these fields. Why? Because of different soil types, topography, drainage, soil organic matter, Ph, and cation exchange levels. Scientists study these soil characteristics, but farmers, who have access to the information, know them in each of their fields.

The idea behind agricultural science is obvious: to provide answers about soil and resource preservation while increasing our productivity. But these answers do not always transfer from one part of the world to another, or from one field to the next.

One principle that does transfer and hold true is that productivity is directly related to soil health. Our farms with four percent organic matter will consistently outyield our farms with two percent organic matter—there are rare exceptions, but not many. No-till increases organic matter and carbon levels, which improves soil structure; it enhances water percolation and retention capacities; and it sequesters CO₂-reducing GHG levels in the atmosphere. It also provides numerous other benefits, all of which support healthy soil.

Therefore, some basic principles, such as the use of conservation agriculture, hold true. How those principles are understood and how we achieve better results by applying this knowledge in different contexts requires an understanding of soil quality, climate, pests, disease, and labor, as well as access to animals, mechanization, chemicals, fertilizer, seeds, infrastructure, markets, and the economic status and culture of the general population.

Viewing it this way no longer makes farming look so simple.

1 Horowitz, John, Robert Ebel, and Kohei Ueda. United States. Department of Agriculture. 2010. "No-Till" Farming Is a Growing Practice. Web. <http://www.ers.usda.gov/publications/EIB70/EIB70_reportsummary.pdf>.

BUSINESS AS USUAL MINDSET

To bring tens of millions of small-scale farmers out of poverty, and for commercial farmers to meet future global demands for food production, requires us to improve our farming methods. Forty years ago, many laughed at U.S. farmers who were pioneering conservation-based practices such as no-till and strip-till. Today it is practiced on 35 percent¹ of all U.S. crop acres and is a central component of Brazil's success in achieving world-class status in agriculture. So why are some trapped in the same place U.S. farmers were 40 years ago? Mindset.

Resistance to change is a killer for any innovation. Examine some of the greatest innovators, from Borlaug to Jobs, and you will see they have faced great opposition and hurdles in their efforts to change people's acceptance of new ideas. Gandhi articulated this phenomenon perfectly: "First they ignore you, then they laugh at you, then they fight you, then you win."

Conservation agriculture has been ignored, laughed at and fought against; but now it is winning. It is winning across the globe. Yet there are still a few fighting, arguing why it cannot work or isn't applicable instead of looking for appropriate applications of the basic principles.

Big problems are not solved without looking beyond our current thinking—just ask any scientist or crop breeder, they will tell you they can achieve something better than what we have. They prove it over and over.

Do you use the same computer you used ten years ago? Do you rely on the same phone you had five years ago? Of course not. Knowledge and technology have provided new solutions—farming is no different.

SEPARATING MYTH FROM REALITY

The fact is, some of the challenges facing the adoption of conservation agriculture for smallholder farmers are symptoms of other problems. These problems need to be addressed with or without conservation agriculture. Africa suffers from some of the most weathered and abused soils in the world. There are areas in Central America where soils have been beaten and wasted away by hurricanes. These soils cannot be restored by simply applying synthetic fertilizer, nor will they ever reach their potential from improved seeds without the proper support systems. We—and others—have invested millions of dollars in our own research to find solutions to these and other problems.

Let me address ten common myths of conservation agriculture when applied to smallholder farmers.

My response is based on our experience, over many years, across multitudes of soils, weather, equipment and observations. In future editions, we will provide information from others who have also critically examined this issue.

Myth #1: Minimum or no-till cultivation practices require more labor, do not sequester enough carbon, and in some cases can be harmful to soil structure.

On our farms, no-till uses less labor and decreases weed pressure—this is true for our large operations and small operations. (On our commercial farm it also significantly reduces equipment costs and fuel use.) Some argue that no-till doesn't sequester as much carbon as originally estimated—that is like saying a child failed his exams by receiving a B instead of an A—not everything is defined by perfection. Tillage promotes accelerated volatilization that releases CO₂. Therefore, the less soil is tilled, the less carbon is released into the atmosphere—that is good for the soil and the environment. Tillage is what harms soil structure; carbon builds soil structure.

Myth #2: Retention of high levels of crop residue for ground cover mulch is not realistic for smallholder farmers because they are not able to produce sufficient biomass or must use biomass to feed higher value livestock.

It is true that the residue of some crops is used for feed, but this is not always a result of best practices. The bottom third of the stalks of crops such as sorghum or millet can have negative nutritional value for animals, but offer good organic material for soil. However, without the proper training, these old habits will not change. There has also been little research in Africa to determine the value of simply leaving the root balls in place and planting between the old rows.



In South Africa, two oxen pull a roller crimper. I first learned of this process years ago in Mozambique when I visited two farmers who had constructed a homemade crimper from an old oil barrel.

In some cases it will be a challenge to overcome the issue of competition for residue, in other places it is not an issue at all. Therefore it is like everything else in life, you do it where it works and you make adaptations where necessary. In terms of increased biomass, as yields increase, biomass will increase—no one should be advocating for accepting current yield levels.

Myth #3: Smallholder farmers in the developing world cannot access or afford the herbicides they need to combat weeds without significant additional labor.

Our experience with our African development projects, on our Africa farm, our research in Ghana and on our farms in the United States is that no-till reduces labor, weeds, equipment costs and fuel. As our no-till commercial fields mature, we often use less herbicide. This year is a case in point: the only fields where we applied herbicide twice was where we tilled the ground to replant corn—the no-till did not require additional herbicide application.

We have also experienced limited weed pressure in our small oxen-powered fields using cover crops without herbicide.

There is huge potential to use cover crops to balance the use of herbicides. It would be difficult to broadly scale cover crops in Africa today, but who is advocating that Africa's—or anyone else's—resources remain where they are today?

Conservation agriculture faces the same challenges all agricultural improvements face where there has been a lack of investment and research over many years. Continuing to advocate approaches that are beyond the financial capacity of poor farmers, rely on fossil fuel hydrocarbon price volatility or that continue to degrade soil is irresponsible. We need to invest in affordable, context-appropriate long-term solutions.

Myth #4: In much of the developing world, there is limited availability of seeds and too high a need for subsistence food crops to justify investment in productive cover crop plant varieties.

Arguing that cover crops will not work because the seeds are not available is like planning our future as if today's constraints are permanent. Our foundation is investing in developing improved seeds and seed access in various ways across Africa so farmers have new options.

We also need to look at the use of edible cover crops such as cowpeas to support poor farmers—this approach could yield multiple benefits. If we take the attitude that we cannot solve the seed access issue, farmers would never make progress.

Smallholder farmers need solutions, not people who will keep them poor. They need access to all kinds of improved seeds from cover crops to open pollinated varieties to hybrids.



We deliberately left a section of land without cover crops to determine weed pressure.

Inset: The area crimped by the oxen/crimper combination is examined for weeds—within the square pictured, zero weeds were located.

Myth #5: Small farm plot areas, limited dietary demand and long time horizons to realize benefits limit adoption of crop rotation and intercropping practices.

The idea that small farm plots cannot realize the benefits of crop rotation and intercropping practices due to long time horizons is misguided; millions of smallholder farmers currently use these practices! It also implies that the process is affected by the size of the field. Do hybrid seeds yield less per acre on two acres than on fifty acres? Of course not!

Hundreds of years ago, the Milpas of Guatemala, the Aztecs of Mexico and the Iroquois of North America survived by using symbiotic relationships between crops and by using rotations, an important aspect of conservation agriculture. Penn State recently published a paper² on the importance of these approaches. The benefit of farming practices are not determined by size but by activity, and conservation agriculture has many faces as these native production systems demonstrate.

There is hope for smallholder farmers but they need context-specific research, alternatives to rebuild soil and reliable extension services. If U.S. farmers had decided that farming would never improve, we would be a very poor and hungry nation. If farmers are provided the opportunity and support, they will be successful. This is not a challenge unique to conservation agriculture.

Myth #6: Benefits are highly sensitive to a wide variety of local environmental, climatic and socioeconomic conditions, making adoption of conservation agriculture a more complex and riskier approach.

Conservation agriculture actually provides a risk management strategy that most other farming approaches cannot because it provides resiliency for farmers, relies less on external inputs, conserves soil and water, and reduces costs and labor. In addition, for smallholder farmers to rely on a system that depends exclusively on herbicides has its own risks, including carry over impact affecting crop diversity in subsequent years and off-site movement affecting the environment—both can be addressed by training.

Herbicides are important, but their use requires training for proper handling and application—and that already assumes herbicides are available and affordable, which is not the case for many smallholder farmers.

Myth #7: The time and training required for adoption of conservation agriculture is impractical for solving the immediate and future need.

If the farmers I met in Fufuo, Ghana, or Estelí, Nicaragua accepted the attitude that new ideas are too impractical to implement, their children would starve. They have improved their lives because of conservation agriculture, improved seeds and training. When you begin with limited resources, of course the challenges are great. However, try telling the smallholder farmers in Brazil that it is impractical to use conservation agriculture, or tell the thousands of farmers benefiting from the World Food Programme's Purchase for Progress pilot effort in Central America that no-till practices take too much time to adopt, they will have one answer: "it has worked for me and for my family."

My most encouraging experiences have been with small-scale farmers when I have returned to visit and they are excited to show me the success of their changes. Sometimes they have changed their seed spacing or seeds per hole. Oftentimes they have switched to no-till or minimum till—and their yields have improved. Conservation agriculture is already a solution for millions of farmers.

Myth #8: Synthetic fertilizers will solve productivity problems for smallholder farmers, therefore there is no need for conservation agriculture.

Synthetic fertilizer will often contribute to increases in crop yields. However, this can be a stop-gap measure without the support systems to address water quality, soil fertility, desertification and long-term productivity gains. Cover crops and other conservation-based practices complement and supplement synthetic fertilizers. Cover crops stabilize nitrogen in the soil, scavenge nutrients for crop use, add organic matter, build soil structure, address compaction issues and affect permeability. In poor soil, and in extreme cases, "dead soil," the soil will not respond to synthetic fertilizers and biological activity must be reestablished. Cover crops also provide resiliency to distribution or financing interruptions to synthetic fertilizer systems. To imply a country and their farmers will never achieve the capacity or sophistication to have these same choices and opportunities is like advocating for agricultural colonialism.

2 Postma, Johannes A. and Jonathan P. Lynch. United States. Pennsylvania State University. 2012. *Complementarity in root architecture for nutrient uptake in ancient maize/bean and maize/bean/squash polycultures*. Web. <<http://aob.oxfordjournals.org/>>

Myth #9: In cases where smallholders begin to adopt conservation agriculture, as soon as external funding and technical support is discontinued, many farmers revert to previous conventional farming methods.

This myth has some truth to it—smallholder farmers do often adopt various agricultural practices until external funding and technical support are discontinued (the NGO model). In fact, this is why we no longer fund these standard development projects. What this demonstrates is a failure in process and resources, in capacity-building and long-term commitment, not a failure in the farming method. Conservation agriculture did not fail these farmers: we failed these farmers, governments failed these farmers, NGOs failed these farmers, donors failed these farmers. The fact that these farmers originally adopted conservation agriculture with the proper training and support only proves that the system is viable. It is why we advocate for a commitment to the system, not just the farming method. There is a long list of agricultural projects that never used conservation agriculture as part of their approach and expended huge sums of money only to see failed outcomes.

Myth #10: The challenge of changing the ‘mindset’ of millions of poor farmers requires an enormous effort to redefine the culture of agriculture.

I refuse to accept the premise that because it is difficult we should not do it. Is overcoming poor governance less difficult than conservation agriculture? Is eliminating malaria less difficult than conservation agriculture? Is preserving the world’s natural resources less difficult than conservation agriculture? When did we start making decisions based on the degree of difficulty instead of what is the best solution for the goals we want to achieve?

TREATING DIRT LIKE SOIL

The future for many farmers will depend on the long-term viability of soil. Conservation agriculture is a diverse and proven method to deliver results. Farming is a biological process—the principles of conservation agriculture are consistent with nature’s methods.

I have farmed in many conditions with many soil types. I have farmed everything from beach sand, silt loams, to heavy clays. I have watched my crops destroyed by cut worm and been forced to replant hundreds of acres. I have seen soybeans cut to shreds and shattered by hail just before harvest and I have hauled 10,000 bushels of corn from a bin, spoiled by aflatoxin—a costly lesson I will never forget.

I have deep ripped in South Africa while avoiding aardvarks and I have seen deer devastate my corn in Illinois.

There is nothing about farming that is normal or consistent. There is no average year and what works one year may not work well the next.

There is one reason our foundation will continue to advocate on behalf of conservation agriculture in every format we can: we want to see millions of farm families succeed. And we want to see this achievement driven by good science and practical applications. We know that farming can be compatible with preserving our natural resources, but we must be innovative and think long-term. We must serve the millions of farmers who need our support with bold ideas that will bring about change—not with philosophies or models that are outdated and have for decades failed to change the lives of millions of smallholder farmers living in extreme poverty. It’s time for a new mindset, new thinking and responsible risk-taking to bring about productive change.



Best practices benefit large farm operations and small operations. Cover crops and other techniques which improve soil health, build soil structure, break up pest cycles, reduce soil erosion, improve water quality, sequester carbon and reduce synthetic inputs are not limited to field sizes or farmer profiles.

THE HOWARD G.
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About the Howard G. Buffett Foundation

Established in 1999, the Howard G. Buffett Foundation’s primary mission is to improve the standard of living and quality of life for the world’s most impoverished and marginalized populations. The Foundation’s focus is on international programs that operate in challenging environments, including conflict and post-conflict countries. The Foundation has supported more than 100 agricultural projects in over 40 countries and more than 35 nutrition projects in over 20 countries. The Foundation believes achieving global food security requires all countries—including the United States—to adapt its agricultural practices and policies to meet long-term agricultural needs and successfully address hunger and malnutrition. For more information visit:
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GHANA IS A BEACON

Africa's farmers have largely missed out on the conservation agriculture trend that's swept many of the world's breadbaskets. But what's happening in Ghana shows that these techniques can deliver big benefits to smallholder farmers on that continent as well.

In February 2007, I traveled on a deeply-rutted red-dirt road to Fufuo, a village in Ghana's Ashanti region, with agronomist Kofi Boa. He was teaching smallholder farmers how to get more food from their plots by moving away from their traditional slash-and-burn practices. In Ghana, as in much of Africa, farmers have traditionally found room for growing crops by using a cutlass to chop down the brush and trees on a hectare or so of tribal land. Then they burn the residue to expose the ground for planting seeds. What is left over from the harvest usually gets torched as well. After two or three years of producing crops, the soil is so depleted of nutrients that sputtering harvests force farmers to hack out another plot from the bush. In some parts of Ghana, farmers must leave their depleted plots fallow for up to ten years so that the soil recuperates.

This system scars the land and consumes so much labor that farmers often don't have time to cultivate enough land to lift their families out of poverty. Making matters worse, the appetite of Africa's growing population is forcing farmers to give the land less time to recover before planting their crops again. It is little wonder that Sub-Saharan Africa's corn yield per hectare is now just one-third of the world average compared to about two-thirds of the world rate in 1960.

In Fufuo, however, the farmers told me that their corn yields have climbed since they began adopting conservation practices. Other than poking holes in the ground to plant seeds, they have stopped breaking the soil and have stopped viewing plant residue as trash. In Fufuo, farmers can buy the weed-killer glyphosate, which they spray from backpacks onto their plots in order to knock down weeds before the planting season. That gives their corn plants time to grow big enough leaves to rob any weeds of sunlight. Unchained from the hoe, the farmers now have time to produce other crops and raise chickens.

Among other things, the extra money they are making is paying school fees for their children.

A study released in 2002 found that in normal growing seasons no-till farmers in Ghana reported 45% higher corn yields than farmers who had never tried the method. The yield advantage grew to 48% in a dry year.¹ Similar yield advantages on no-till with mulch plots in Ghana have been reported by Boa-Amponsem et al (1998), Aflakpui et al (2006) and Kombiok et al (1995). The higher corn yields in the no-till fields were attributed to a significant reduction in weeds, lower erosion and enriched soil moisture.

The 2002 study also found that smallholder farmers in the Ghana survey who adopted the no-till method reduced the labor involved with field preparation and planting by 22%. The time spent removing weeds from their plots declined by 51% to an average of 4.3 man-days per hectare from 8.8 man-days per hectare.

Our foundation provided \$1.6 million for a four-year CARE project to introduce conservation agriculture practices such as zero-tillage and cover crops to thousands of farmers in northern Ghana, where growers have complained of shrinking crop yields and many farming families struggle with food shortages four to five months of the year. By the time the project ended in June 2011, according to CARE, the corn farmers who had adopted conservation agriculture practices were seeing yields averaging 140% more than the 2008 baseline.

My experience in Ghana tells me that it's time to stop the sniping in the scientific community over conservation agriculture.

What we need to do is put more resources into figuring where it would work best in Africa, and how to tweak these practices for the growing conditions that vary widely across that continent.

At our foundation's research farm in South Africa, for instance, studies are underway on the ability of cover crops to suppress weeds, bank water and improve soil microbiology. We held a conservation agriculture workshop at the farm earlier this year for managers of African seed companies and we're testing equipment such as a no-till planter that can be pulled by oxen or a small tractor.

I think Ghana is on to something big.