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INSTITUTE OF CURRENT WORLD AFFAIRS

The more you learn the less you know: re-thinking how to farm

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Harare, Zimbabwe
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Dear Peter:

The showers of Zimbabwe's rainy season have begun.

It's my favorite time of year in Africa, one that brings a marvelous sense of renewal. Yesterday, a drizzle in the night continued the sporadic showers that began last week. Today, I've been watching another storm develop over Harare. Now the sun is a faint silvery luster on the horizon as thunder rumbles in approach. In the last few minutes, it grew colder and a wet wind began to blow, agitating passersby in the street. A woman walking on the road outside our house starts to run for cover and the children playing in the street stop kicking a punctured ruin of a soccer ball to stare after her. Then they, too, trot along looking for shelter with yelps of laughter. The rain is coming!

People run for good reason. Unlike most rain I've seen in the United States, thunderclouds here can dump a large amount of water in a short time, and with little warning. The raindrops pound so hard that dirt splashes onto the house from the barren soil outside my window. When the ground dries, the compacted surface will form a crust impermeable to subsequent rainstorms.

Though violent, these first downpours of a new rainy season bring a feeling of relief, as springtime signals rebirth. Seasons here in the southern hemisphere are the reverse of those in North America, so Zimbabwe had a cool and dry winter from April until September. October brought scorching heat that dried up wells and dropped reservoirs already dangerously low. The spring rains that began last November ended prematurely in February, when they should have been heaviest. The country received only 20 to 30 percent of its normal precipitation. Drought destroyed crops and claimed lives among devastated rural people. Today, however, the needed water falls steadily from the sky. Planting time has come.

Experienced farmers say an 80-pound sack of harvested maize,

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what Americans call corn, is lost per acre for every day sowing is delayed after sufficient moisture falls. Many peasant farmers, however, currently lack draft power because their oxen died during the drought and the cattle that survived are too weak from hunger to pull a plow. An emergency re-evaluation of the basic techniques of growing food in southern Africa is under way because of this lack of draft power and also because most farmers lack the money to purchase needed fertilizers and seeds.

Zimbabwe President Robert Mugabe, on a national tour to assess the effects of the drought and to drum up support for his ruling ZANU (PF) party, promised peasant farmers free seed, fertilizer and tilling by tractors to help them recover from the disastrous agricultural year. The World Bank gave Zimbabwe US$100 million in grants and loans for the hand-outs. A total of 800,000 small-scale farmers are supposed to receive supplies for at least two hectares (about five acres) of land. Mugabe's announcement drew cheers: The most desperate farmers already ate their stores of seed grain to avoid starvation and have no money to buy more.

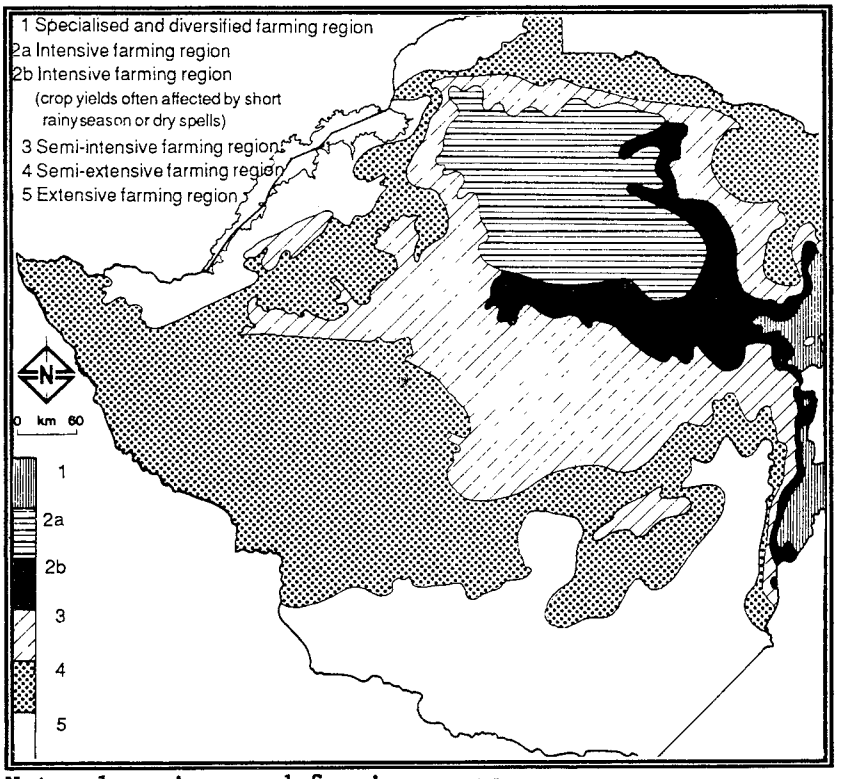
But like many political promises worldwide, the reality has fallen far short of the pledge. The seeds and chemicals should have been delivered by mid-October, but this week authorities are still frantically sending out trucks with the needed supplies before rain makes rural dirt roads impassable. Hundreds of people thronging to distribution points receive seeds and fertilizer sufficient to plant only one acre. Meanwhile, Zimbabwe's soaring inflation rate has more than doubled last year's price of a 50-kilogram bag of seed for maize and hiked the cost of a similar amount of fertilizer by 143 percent.

The chief agricultural liaison for the Department of Agricultural, Technical and Extension Services (Agritex), which administers the program, confirmed the shortfall. "If money comes before January, maybe we can give a second acre of inputs to people, although it may be too late by then," said Sam Kahwa, the chief liaison. "The World Bank gave Zimbabwe the money, so I don't know where the rest of it is or why it's delayed."

Even the seeds already handed out are frequently the wrong type needed for a particular region. Zimbabwe has five zones of agricultural potential, classified I through V according to temperature, rainfall and soil fertility. When the white settlers came to Zimbabwe, they pushed the Africans out of regions I and II, where the climate is temperate and the high rainfall very reliable. Almost all peasants still live in communal areas in regions III, IV and V. There is only enough rain in region IV for people to plant a high-yielding type of maize that takes a short time to grow, but they are being sent long-season varieties because of seed shortages. In the hot lower veld of region V in the south, farmers should receive seeds for drought-resistant crops like sorghum and millet, formerly staple cereals here and

used as bird seed in the United States. Instead, short-season maize is being shipped to the lower veld by the tons. Authorities know it won't grow well there, even with exceptional rains. And both short and long-season maize needs a lot of fertilizer, which impoverished, rural Zimbabweans clearly can't afford this year.

"For technical reasons, some areas shouldn't get maize seed, but politicians are involved," Kahwa said. "There's pressure by local members of parliament to give people there the staple crop. They want to be seen representing the area. Everyone has to seem to receive something from the government, since elections are in 1995. That's why we are sending contradictory messages."



Natural regions and farming areas
Source: "TABEX Encyclopedia Zimbabwe," Quest Publishing, 1987.

Even if they had the right kind of seeds, the fields aren't ready. Next year's harvests in the rural areas, where more than 70 percent of the population lives, could be perilously small because the free-tillage program has accomplished little. "As far as tillage units are concerned, people should write them off," a development worker said during a visit to one province to assess the progress made in free plowing and distributing seed packs. He found little. "Our concern should be on ensuring that maize is planted to a sufficient hectarage so that there are not going to be food deficits at household and national levels," he said.

Government tractors have only tilled 24,710 acres of the four million acres needed by Zimbabweans who have no draft power to cultivate their land. Experts had estimated up to 8,000 tractors would be needed to meet Mugabe's promises, but there are only 200 to 300 distributed throughout the eight provinces. The number varies according to how frank officials are about how many

actually work. As the rain falls across Zimbabwe, many tractors sit dead in the fields or parked at government district offices:

* In Mudzi district of Mashonaland West, the four tractors allocated by the government are broken down and remain idle for lack of new wheels, carburetors and distributors. As a result, most fields in the district's communal lands will not be ready in time for planting, according to the district administrator. In another district of that province, five of the six new tractors are not equipped with ploughs and only three are working on any given day, Zimbabwe Farmers' Union President Gary Magadzire said.

* In Chihota communal lands in Masvingo Province, where some 140,000 cattle died in the drought, the chairman of Rudhaka District Council boasted all three of his government tractors are working. But instead of free tillage, the council charges US$5.60 to plow about one and a half acres. Free plowing would start only after a future organizational meeting, he said. An estimated 180,000 farmers still await their free tilling in that province.

* Speaking over drinks in the official government bar for the Rushinga District in Mashonaland East, the administrator said his four tractors already plowed about 300 acres for farmers who lost their oxen. Asked the goal, he stared into the distance and took several swigs of beer before replying, "86,500 acres."

* In Matabeleland North, the provincial administrator said he has 25 tractors and more than 815 acres of free plowing done. But there are 73,315 acres still to plow and only 13 of the tractors are operational. His explanation: The government's Central Mechanical Equipment Department is slow collecting tractors in need of repair and even slower in repairing them.

* In Tsakare resettlement scheme in Mashonaland Central Province, no fields are plowed because all four tractors are out of commission. A ZANU (PF) provincial party official told farmers in marginal areas to use traditional hand hoes "like peasants do in Malawi, instead of waiting for the promised tillage units by the government, because time is not on your side."

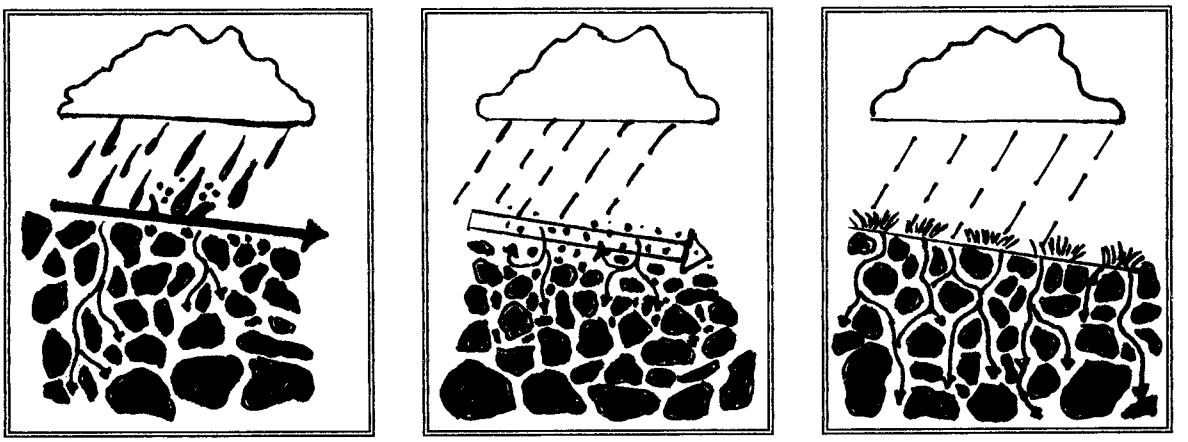
Government officials and Agritex extension officers now repeatedly urge farmers not to panic if they have yet to receive their allocation of free seed, fertilizer or tillage. But they are also telling people to get whatever supplies they can and plant by hand, rather than to sit and wait for government help.

That's the most fundamental change this year: the use of hand hoes "like peasants do in Malawi" because of the lack of tractors or oxen. "Zero tillage" is the handy euphemism to soften the government's admission that most farmers will be on their own this year. Yet a growing number of white, commercial farmers have already adopted variants of zero tillage in previous years to

reduce soil erosion, improve soil fertility and quadruple yields. It's a cruel paradox: A century ago European settlers introduced the ox-drawn plow to Zimbabwean peasants, while the settlers' descendants now recognize sustainable farming must be based on principles formerly practiced in traditional African farming.

"The plow is the prime culprit of soil degradation," said Brian Oldreive, a white commercial farmer who crusades among both black and white farmers for zero-tillage practices. "Plowing inverts the soil, drying it out, killing soil bacteria and destroying root anchorage. Our soil structure in Zimbabwe has deteriorated until the soil just seals with a hard rain into an amorphous cement that doesn't breathe. The water just runs off."

Oldreive is the manager of Hinton Estate, an 18,000-acre farm in the fertile Mazowe Valley of northern Zimbabwe. When he took control 10 years ago, the farm was almost bankrupt. "We did conventional farming with fine-tilth plowing in straight lines, planting wheat and soybeans," Oldreive said. "The soil had no structure at all, it was just pulverized into powder. That first year I was here we lost a lot of money and the bank said we had one last chance. I remember standing in a field after a hard rain, with brown water running past my legs, thinking 'I don't have a chance.' Then I swore to myself that whatever it takes, I wanted to fight this. My growth medium was just flowing away."



(1) The impact of raindrops dislodges soil particles, seals the soil surface and causes runoff. (2) Runoff carries off soil particles. (3) Stubble protects soil while decomposed roots bind soil together and channel water downward.
Source: "Conservation Tillage," Commercial Grain Producers' Association, 1989.

A question took root in Oldreive's mind: "How did the Americans deal with the Oklahoma dust bowl?" He did research and learned of a system developed in the United States that leaves mulch on a field's surface. This mulch cushions the impact of rain, increases the infiltration of water and keeps soil moist and cool. He planted a five-acre block of cotton amid the stubble

of the previous year's wheat crop and found it worked great. Within four years, the plows began to rust at Hinton Estate while Oldreive developed alternative equipment and techniques to minimize soil disruption. Every year thereafter, the farm turned a profit. Today, it is Zimbabwe's second largest wheat producer.

The mechanics of zero tillage are simple. Instead of using an angled plow to turn the earth, Oldreive's tractors use a straight-edged ripper tine to slit open the soil, leaving the roots of the old crop intact. Each season, his tractors drive the same tracks, reducing compaction by ripping the same row again and again. The soil in this narrow crop zone becomes softer and easier to penetrate. Fertilizers continually applied to this same strip build up soil fertility and the thick cover of crop residue causes plants to feed at a shallow root level and absorb more of the fertilizers applied. On plowed fields, a white froth of fertilizer appears as water washes it away. In the zero-till field, however, water and fertilizer remain on the land. Fewer weeds grow when their seeds aren't turned under soil by a plow.

An average rainfall of 63 mm (2.5 inches) on a 4-percent slope, which is typical in Zimbabwe, produced these results:		
Type of cultivation	**water runoff**	**soil loss from land**
Deep Plowing	90 percent	11.5 tons/acre
Zero Tillage	10 percent	0.4 ton/acre

Source: "Conservation Tillage," Commercial Grain Producers' Association, 1989.

Some fields at Hinton are no longer ripped open. Instead, Oldreive invented a "badza wheel" (**badza** means hoe in the Shona language) that is pulled by a tractor and scoops out a series of shallow depressions. On these fields, he employs hundreds of workers to hand sow seeds and sprinkle a dressing of fertilizer to the side. As he gradually improves the technique, Oldreive finds his modern farm is a reconstruction of life a century ago with families planting and weeding the fields with hand hoes.

Out of the 4,300 white commercial farmers in Zimbabwe, about 2,500 produce crops that could be grown under zero tillage. (Tobacco growing necessitates plowed land, so plows must be used.) Of those who could adopt this conservation strategy, only 300 -- or 15 percent -- are practicing some form of reduced or zero tillage. The older farmers are resistant to change because they grew up perfecting the ancient art of plowing long and straight furrows in the soil. They're suspicious of the attempt to turn the accepted rules on their head after years of being told by extension agents to plow deeper for better results.

An example of how hard it is to change Zimbabwe's deeply ingrained plowing ethic can be found in the Natural Resources

Board conservation contest. The board, dominated by older white commercial farmers, awards prizes to communal farmers practicing sustainable land-use systems. Winners get a cash sum and an ox-drawn "Master Farmer" plow made by Bulawayo Steel Products, a big manufacturer of conventional tillage implements. Get the message?

Farmers in the communal areas are just as suspicious. For decades they looked across from the land where colonialism consigned them and watched commercial farmers running tractors and harvesters. As role models, the European farmers with their large-machine technology were equated with success and progress. Few communal farmers believe harvests can be enlarged without such modern technology. And the commercial farmers using zero tillage spray expensive herbicides like gylphosate (trade named "Round-Up") or paraquat (trade named "Gramoxone") to eliminate weeds and prevent last year's crop from re-seeding. Their envious neighbors usually have no access to such expensive chemicals, so fields must be arduously cleared of weeds by hoe before planting.

"It takes heart to do the weeding, but with determination and confidence you don't need herbicides to make it work," Oldreive said. "I figure you can triple communal farmers' harvests with zero tillage. We've proved at Hinton we can quadruple output and for sure we can double it, if you work."

Oldreive becomes passionate when he talks about hidden issues in development that go beyond technology. He raises embarrassing questions about dilemmas in Shona culture, like excessive drinking and sexism: topics that can infuriate black Zimbabweans and make culturally sensitive white foreigners squirm. He's a white Zimbabwean, so it could be easy to write off his convictions as racist views historically held by most bigoted white settlers here. And Oldreive's perspective as a born-again Christian makes one wince when he talks of spirituality because it can sound so judgmental. Yet when he finally focuses on the specific example of tending a maize field, the man has an uncomfortable accuracy in his observations.

"Why is weed control so bad?" he asked. "Because communal farmers let it go until they grow five inches tall. If you hoe small weeds everyday, doing four hours a day, you can do four acres in four days. We're dealing with gray areas here, things like discipline and culture. In Shona culture, hoeing is not man's work. The wife does it, so the strongest member of the team is not included in a critical job. Four days a week he's blind drunk because he has no hope, no purpose. You say, 'Don't mess around with culture,' but it's a matter of survival."

Religious compassion prompted Oldreive to begin an informal extension program six years ago, and he is now helping several primary and secondary schools in the Chiweshe communal lands near Hinton Estate to grow crops using zero tillage. Each year, these

demonstration plots of two or three acres have convinced many surrounding farmers to test plant a small section of their fields in the same way. Children are teaching parents what they learn.

"Zero tillage has come to stay," said Muronga Zvombo, headmaster of Mukodzongi Primary School, where zero tillage has produced greater yields since adopted in 1988. "A lot of people aren't worried about the future. They just plow and when the heavy rains come, the top soil is washed away. Well, some rich farmers can use the soil all up, but what about poor people like ourselves? Where do we go when our heritage is destroyed?"

Muronga Zvombo (left) and Ian Jam check on the amount of mulch left on the surface of a field.

Zvombo noted one obstacle to zero tillage this year. Fields lack last year's thick mulch cover of maize stalks because hungry cows broke down the fence when grazing disappeared. "How can you argue about that when everyone is fighting to survive?" he asked.

The biggest obstacle to zero tillage, however, lies not in deficiency of mulch or lack of disciplined weeding but in the institutional opposition by the state Agritex extension workers. Oldreive and his prime extension worker, Ian Jam, found farmers more confused than ever when they re-visited Chiweshe communal lands. The Agritex officers had followed up Oldreive's visits with their own, telling people that deep plowing would conserve more moisture than zero tillage. A battle has begun.

"There's quite a lot of controversial statements made about zero tillage," Agritex's Kahwa said. "For example, they claim it improves water infiltration into the soil. That's doubtful. We're saying if you plow, you improve aeration and water percolation. Given that lack of tillage is an emergency, we might talk about zero tillage right now, but we're not giving emphasis to it."

Jacobus de Jong, assistant director of Agritex's technical division, is less contradictory in his opinion about zero tillage. He believes in a **triage** of soil types just as some doctors evaluate "survivors" and "goners" at a catastrophic disaster to prioritize scarce medical resources. Some soils are

fertile enough to be helped and some are far too poor to save. "People think they can improve the soil in communal areas with organic material, hoping no-till techniques can help," de Jong said. "But inherently bad soil will remain so. Good soil remains good, while class IV soil will never physically improve. Zero tillage works well on heavy soils, not on light sandy ones (in communal areas). Temperatures are so high that organic material breaks down too quickly to do any good."

To an outsider reading this, de Jong's comments can raise serious doubts about zero tillage that only more research like crop trials and published tangible results can answer. Yet in Zimbabwe, Agritex is known to be loathe to admit policy errors, and hostile to challenges to its authority. The institution has a record of eventual reversals after persisting in disastrous mistakes. Obstructing others' efforts to teach zero tillage could be yet another.

Looking to the future of agriculture: zero tillage.

The drought revealed one Agritex policy that exacerbated the effects of poor rains. In the same way the lack of oxen and operational tractors has led to a re-evaluation of plowing, the drought made Zimbabweans realize the government's push of drought-intolerant varieties of maize helped create disastrous harvests. Now, Agritex and the government are once again touting the importance of sorghum and millet.

These small-grain crops were the dominant cereals grown in southern Africa about 100 years ago, but maize displaced them during the colonial era and afterward. Zimbabwe is now dependent on a single crop that originated from the Americas, a different continent with different pests and disease. Many southern Africans view the drought-tolerant sorghum and millet as old-fashioned crops and unpalatable to modern tastes, especially those in the urban areas. Farmers say their children complain if they have to eat sorghum paste because they've never done so before. The government doesn't like it much either. Only two years ago, the state Grain Marketing Board threw away thousands of tons of sorghum because authorities failed to find markets or storage facilities for the bumper crop.

An important factor in the crop switch -- and in taste -- is government policy itself. Rodger Mpande, a Zimbabwean agronomist, says Agritex presses farmers to plant high-yielding varieties of maize even in semi-arid regions IV and V, which are inappropriate for such crops. "Farmer's preference shifted from small grains because of extension workers, who told them sorghum was a poor person's food," he said. Credit is not available for traditional varieties of maize or the drought-resistant sorghum or millet. And extension support for these crops is almost nil, he said.

Mpande knows Agritex policies well because he worked there for years as an extension agent and researcher. He resigned after writing a searing critique of a government program to provide tractors in the communal areas. Mpande had calculated that marginal farmers in the Zambezi Valley actually lost money by hiring state tractors to plow. In 1989, for example, plowing charges were US$5.66 per acre and harvests earned US$6.23 per acre. The 57-cent profit, however, fell far short of the costs of planting. And Mpande found tractor operations cost US$1.64 more per acre than the government charged, so it lost money as well. (As a result of inflation, running the tractors now costs the state US$25.00 per acre.) After his fight with officials, Mpande joined the Zimbabwe Environmental Research Organization, a group promoting research from an indigenous perspective on development.

Mpande is still calculating farming costs and continues to find gaps between what the government promotes and what is economically rational for farmers. "There's no longer a pure subsistence farming because people need money, so if there's no incentive for them to grow small grains they try to grow maize to gain even a small amount of cash," he said. "It's one thing for government to say there's a problem, but if there's no demand created then farmers won't change." If government-controlled prices for drought-resistant crops go up, the stigma would be removed from "non-valuable crops," he said. Yet the state-fixed price for maize jumped to US$180 per ton this year while the price for millet and sorghum still lags far behind at US$70 a ton. Consumer demand is so far skewed to tastes acquired from Europe that wheat is the king of all crops, fetching US$240 each ton. It's also the hardest to grow in Zimbabwe or anywhere in Africa. Wheat imports cost Zimbabwe some US$12 million a year.

Mpande said the government has its own reasons for discouraging farmers from sowing crops that might have survived the drought. "You can't export sorghum or millet, so there's no push to grow them because the government can't earn money from it," he said. "All along, the government was only interested in (earning money from its) maize contracts with the United Nation's World Food Programme to supply food to the Mozambican refugees."

The very reasons why sorghum and millet are advantageous to small farmers are the same reasons why fertilizer companies and

seed companies ignore them. Sorghum and millet, aside from their drought tolerance, are also open-pollinated crops -- meaning they are not hybrids and they grow well without expensive fertilizers. A hybrid is a one-shot seed. Any special characteristics the seed possesses are lost to the next generation, so a farmer must buy new hybrid seeds each year. On the other hand, one can save seed grain from an open-pollinated crop to plant next season. Seed corporations can't make much profit on seeds that are recycled, therefore high-yielding hybrids make practical business sense.

The influence of fertilizer companies is more insidious. Representatives of Zimbabwe's two fertilizer suppliers, Windmill and Zimbabwe Fertiliser Company, sit on Agritex committees or make detailed recommendations to influence extension agents' advice. The Agritex agents organize small-scale farmers into groups to get loans for seeds and fertilizers from the state agricultural bank. These state officers then deal directly with Windmill or ZFC to get the needed supplies in bulk, and win prizes if one of their groups purchase the most fertilizer.

In the results of a study presented at a Harare seminar in 1990, researchers Polly Chonyera and Sam Page questioned whether communal area farmers are given correct recommendations regarding fertilizers because of corporate influence. Farmers need a maize yield of at least one ton per acre to offset the costs of fertilizer and seed. A survey of Mhondoro communal area, however, showed that of the 38 percent who used all the recommended inputs more than half harvested less than the one ton break-even level. Average yields there ranged from 0.4 to 0.6 tons an acre. Most farmers who surpassed the crucial level reduced the amount of fertilizer Agritex advised and substituted manure, Chonyera and Page said. Few people outside of Harare's technical agricultural community know of these conclusions. Insiders speculate the government stifled publication of the study because its findings directly contradict what Agritex has told farmers for years.

The two researchers conclude there is a common belief in Zimbabwe -- propagated by the fertilizer companies -- that the more fertilizer one uses, the higher the yields and the more progressive and modern the farmer. Those who use less are labeled old-fashioned and inferior. Victor Chirau, a 52-year-old Zimbabwean, is one such man. But he laughs at anyone who would call him out-of-date. After he spent 17 years in Zambia as a taxi driver and later as a taxi company owner, few can fool this man, known as one of the smartest farmers in Chiweshe communal area.

Chirau has been converted by Oldreive into a zero-till believer, and most of his 50 acres are under zero tillage. He uses fertilizer sparingly, preferring cattle manure. "Most people say you are more advanced to use fertilizer," Chirau said. "It means you're a well-off person, not more advanced. Manure keeps the soil stronger. Fertilizer is good for one year. Manure,

you're going to use it for three years, because it will help the soil longer."

Although Chirau admits manure will produce more weeds once spread, he said the rains won't wash it away as they do store-bought fertilizers. Agritex may recommend more fertilizer after testing his soil, but he said he will always prefer manure. After years of applying chemicals to his land, Chirau realized the soil was sour and poor: too much fertilizer, not enough manure. Most agronomists agree fertilizers do build up and make soil too acidic for plants to grow well. The solution? Agritex says to apply lime, although other experts say acidity from fertilizers can be corrected with ... manure.

Victor Chirau (right) holds a plow to compare it with a "ripper" while his brother holds Chirau's baby son.

Chirau plants traditional crops like sorghum alongside his maize, cotton and tobacco. "I want to keep it in reserve for food, since it stores for three to five years. The children won't like it, but in a drought they'll survive."

Although Chirau makes a lot of money from the businesses he owns -- a grain mill, butchery, three general stores -- he prefers to farm. Among the people of Chiweshe, some whisper that his remarkable yields are due to magic instead of zero tillage or manure. The feisty former taxi driver stamps hard on his soil when asked about such accusations. "Poverty and jealousy is the cause of witchery," he said. "A person who isn't a hard worker, that's the person who does witchery. I'm using technology."

One could conclude farmers in Zimbabwe's communal areas are leaping backward in terms of technology: from tractors to ox-drawn plows to hand hoes; from hybrids to traditional seeds; and from chemical fertilizers to manure. This year's agricultural season does harken back to the past. Agricultural development usually means better machines, crop varieties and fertilizers. But ideas like zero tillage and drought-resistant crops are also technology, though lacking in prestige and foreign funding.

As a commercial farmer, Oldreive uses machines to improve fertilizer placement, seed propagation and weed control. Chirau uses age-old tools. Yet the two men are alike because they both use better ideas and management to improve yields. If Chirau continues to profit from his type of technology, it won't be long before he buys a tractor or obtains more land. In the end, it is success and not necessity that is the best incentive of all.

Sincerely,

Casey Peters

Received in Hanover December 8, 1992