Technology and Agricultural Competitiveness: BRAZIL OR ARGENTINA VS. UNITED STATES

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Technology is a key element in agricultural competitiveness. The United States has long been a leader in technology adoption, but growers in Brazil and Argentina also have quickly adopted new technology.

In the past decade, biotechnology, no-till and precision agriculture have been adopted to some degree in all three countries. Genetically modified crops were adopted very rapidly in the U.S. and in Argentina. In the 2003-2004 crop season, nearly all of Argentina's soybeans were transgenic herbicide resistant varieties.

Brazil has only reluctantly permitted transgenic soybeans, but once this occurred, legal adoption was rapid. Brazil had about 18 percent transgenic soybeans in the first year that they were legally allowed.

However, the percentage of crop areas no-till planted in Brazil and Argentina surpassed that of the U.S. in the late 1990s. In the 1998-99 crop season, approximately 20 percent of arable land in Brazil and Argentina was managed with no-till techniques. In that same year, no-till was used on about 10 percent of U.S. arable land. Since that time, no-till adoption has stagnated in the United States but continued to grow in Latin America.

GPS GUIDANCE

Use of global positioning systems (GPS) and other precision farming tools presents a mixed picture. GPS guidance has achieved widespread use in the U.S., Brazil and Argentina. In the U.S., more than 60 percent of ground-based custom applicators use lightbars, which are a form of manual GPS guidance. In the Midwest, more than 70 percent of custom applicators use lightbars, while some 2,000 of them are in use in Argentina, mainly by custom applicators.

Approximately 5 percent of custom applicators in the U.S. now use GPS auto guidance, which entirely takes over steering except for turning on the ends. In some Delta states, adoption is as high as 10 percent of custom applicators. GPS auto guidance has been demonstrated at farm shows in Argentina and Brazil. But, as of May 2004, only 10 GPS auto guidance units had been sold in Brazil, and none in Argentina.

YIELD MONITORING

Combine yield monitors are the most commonly used precision ag tools worldwide, and their numbers can be used as an index of precision ag adoption. There are roughly 1,000 combines equipped with yield monitors in Argentina and only about 100 in Brazil, compared to some 45,000 combines with yield monitors in the U.S.

Relative to crop area, the U.S. has a much higher intensity of yield monitor use. In the U.S. there are about 200 yield monitors per million crop acres, while in Argentina there are about 17 per million crop acres and in Brazil one per million crop acres. Even allowing for the higher average harvest area per combine in Argentina and Brazil, the U.S. still has a higher rate of yield monitor use. Because of the longer harvest season and the higher percentage of harvesting done by custom cutters, combines in Argentina and Brazil often cover two or three times as much area as combines on Corn Belt farms.

However, Argentinean growers seem to be making more use of GPS and yield mapping. In the U.S., about one-third of combines with yield monitors also are equipped with GPS. Without GPS, the location of yield observations cannot be recorded and yield mapping is impossible. In Argentina, about two-thirds of combines with yield monitors have GPS.

The higher percentage of combines with GPS in Argentina may be linked to farm organization. Farm managers who hire custom operators for most fieldwork operate many Argentinean farms. Argentinean farm managers often do not have firsthand experience of their fields

from the tractor seat, so yield maps can provide new information for them and can serve as a check on the quality of custom operator work.

Use of GPS for all uses in Brazil has been constrained by the relatively high cost of differential correction. Argentina has a network of FM Sideband GPS differential correction towers that provide low cost DGPS. Brazilian growers do not have access to FM Sideband differential and must use higher cost satellite correction.

The Mato Grasso research foundation was established by the state's farmers to combat production problems. The Brazilian facility claims to operate the world's largest test plots.

— Photo courtesy of Dean Houghton, **The Furrow**

VARIABLE RATE APPLICATION

Most of the commercial variable rate application (VRA) of fertilizer and ag chemicals is in the U.S. and Canada. More than 40 percent of U.S. ag retailers offer some computer controlled variable rate application. In the Midwest, 54 percent of ag retailers offered variable rate application in the spring of 2004. The most recent USDA data suggests that about 10 percent of corn acres were fertilized using variable rate techniques in 2001.

Latin American growers have been slow to take up variable rate technology. Some variable rate application equipment has been imported. There were 10 fertilizer applicators capable of variable rate fertilizer application in Argentina in 2000, but none of them were regularly used for VRA.

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In Argentina, one of the primary constraints has been the high cost of soil sampling. In the 1990s, the analysis cost was around $70 per sample. Opening of new soil test labs in Pergamino and Buenos Aires has brought down that cost, but it is still around $25 per sample, too high for the kind of intensive sampling practiced in the United States.

Brazilian manufacturers are showing an interest in developing lower cost VRA equipment, but one of the main reasons for slow development of commercial interest in VRA in Brazil is that land in the Cerrados region is still very cheap. Many growers see the payoff from converting another acre of bush or forest to farmland as higher than the return to more intensive management of existing farms.

NEW TECHNOLOGY USERS

Growers and agribusiness in the U.S., Brazil and Argentina are very aware of the role that technology can play in their profitability, but private and national strategy has given them very different positions in the technological race. The U.S. has had a historic lead in agricultural technology, in part because of substantial public investment in ag research. In recent years public funding, especially at the federal level, has shifted to environmental issues that are a priority for the non-ag taxpayers.

Industry has picked up some of the slack in production research, but not all topics lend themselves to private initiatives. Some research would benefit the ag sector overall, but it would be difficult for any one company to make it profitable. Some technologies require a critical mass of users before they become profitable.

Because of the legacy of public production ag research, U.S. commodity groups tend to focus on marketing and value-added issues. In the future, those commodity groups may need to fund more production research to maintain their competitive position.

EMBRAPA, the Brazilian agricultural research organization, is one of the best ag research organizations in any tropical country. The expansion of cropping into the Cerrados is in part due to varieties and production practices developed by the organization. EMBRAPA will continue to be an important resource in the Brazilian effort to be a competitive source of ag products.

INTA, the Argentinean Institute for Agricultural Technology, is only a shadow of its former strength. INTA has been systematically underfunded in recent decades on the assumption that Argentinean growers would compete by importing technology mainly from North America. This strategy was largely successful with no-till and herbicide resistant soybeans, but will importing technology be as successful with information technology, such as VRA, yield mapping and other precision agriculture practices that require local adaptation?

Argentina also has a problem with international intellectual property rules. The long-running dispute with Monsanto about technology fees on glyphosate resistant soybeans has led the company to stop development and sales of new soybean varieties for the Argentine market. Concern about protection of their intellectual property may interfere with future transfer of North American ag technology to Argentina.

WHO'S AHEAD

The United States has the historical lead in agricultural production technology, but that lead is being eroded as U.S. public investment is diverted to environmental issues and the Brazilian government pursues a national goal of agricultural development of their interior regions. In addition to low land and labor costs, Brazil has an effective public research system that contributes to their competitiveness.

Argentinean growers and agribusiness have followed a strategy of importing technology, mainly from North America, instead of maintaining their own research institutions. That has been relatively successful in the past, but it may be less successful in the future if technology becomes more knowledge intensive and site specific. Also, problems with enforcement of international intellectual property rules may make companies reluctant to sell their technology in Argentina. **AM**

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