

Direct seeding: Encompassing Principles of Conservation Agriculture

Sustainable Agriculture Milestones in the Americas

Relevant experiences in the region to address climate change and care for the environment and natural resources



The compelling results of agriculture in the Americas in support of environmental conservation

The introduction of direct seeding in different countries around the world has yielded a wide range of benefits, contributing to environmental conservation and transforming agriculture in a positive manner. The profound and rapid revolution it has triggered in the Americas, particularly in Southern Cone countries, is especially noteworthy. Direct seeding is based on the principles of conservation agriculture: using no tillage, retaining crop residue mulch, and adopting complex rotations including cover cropping.

In Argentina, Brazil, Paraguay and Uruguay, which comprise one of the leading grain-producing regions in the world and, as such, play a key role in guaranteeing global food security, farmers turned to direct seeding en masse. They realized that modifying their work practices under this technique would yield significant results in terms of farming sustainability and natural resource preservation. As a result, food production in these countries is not only more environmentally friendly, but also more profitable.

Direct seeding has enabled the Southern Cone region of the Americas to reduce soil erosion by more than 90%, improve water use efficiency, lower the consumption of fossil fuels and reduce

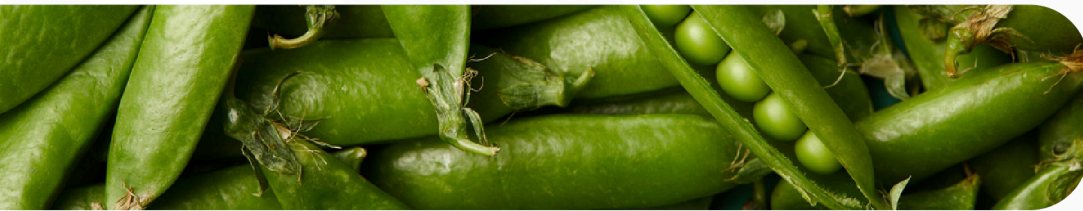
greenhouse gas (GHG) emissions, which contribute to climate change. These concrete achievements have strengthened the region's standing as a global benchmark for sustainable agricultural production.

According to data from the Rosario Stock Exchange, a private entity that is a benchmark for agricultural monitoring, direct seeding has been carried out in more than 90% of Argentina's farming area for several years now.

In Brazil, where the system was first applied in the southern state of Paraná more than 50 years ago, direct seeding has grown exponentially in recent years. According to private-sector estimates, the technique is now applied on 35 million hectares – a significant portion of the total area dedicated to grain production. The application of direct seeding in Uruguay is also significant.

In Paraguay, which shares a border with the Brazilian state of Paraná, the expansion of direct seeding was facilitated by the two countries' geographical proximity and ecological similarities.





Direct seeding



Preservation of natural resources

Direct seeding essentially involves planting a crop without prior soil tillage, a technique that has been used in agriculture for thousands of years. It is unique in that it avoids soil removal, thereby improving contact between the soil and the seed.

However, the direct seeding system that is extensively applied in agriculture in the Southern Cone region of the Americas is much more than that. It is complemented by a series of good agricultural practices, including maintaining a permanent soil cover with crop residues.

Additionally, integrated pest management and more effective retention of organic matter contribute to improving soil health from a biological, physical and chemical standpoint. By avoiding disturbing the soil, this system fosters more efficient water capture and storage, which is one of the most important challenges facing global agriculture amid the current environmental and climate crisis.



A new paradigm

Although the first trials of no-till farming were carried out in Great Britain, direct seeding began to be developed in the United States between 1940 and 1950.

In the mid-1970s, the system attracted the attention of agricultural technical specialists in Argentina, who were looking for less invasive and more productive planting techniques. At that time, producers in the pampa region, whose plains and mild climate made it one of the most fertile agricultural areas in the world, were beginning to experience soil erosion issues due to poor water management. Farmers who tilled the land began to notice that the soil would crack when the rain came.

Direct seeding began to emerge as a more sustainable farming option for Argentine farmers, who finally adopted it on a massive scale in the 1990s. The consequences of soil erosion on production had become evident in many parts of the country and rising production costs led many farmers to find ways to utilize fewer inputs. Such was the case in Brazil, where direct seeding experienced a boom in the last decade of the 20th century.

Direct seeding translates into more water for crops. According to data from the National Institute of Agricultural Technology (INTA) of Argentina, a national public organization considered a regional benchmark for research and innovation, direct seeding in Argentina yields up to 100 millimeters of useful water per year, as opposed to conventional tillage. INTA has estimated that the resulting water use efficiency of each crop represents a production increase of 1,700 kilos of corn, 1,400 kilos of sorghum and 800 kilos of wheat per hectare per year.





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No tillage and healthier ecosystems

“Direct seeding prevents farmland erosion and the presence of organisms that cause pests. It also maintains the soil’s ecological balance by protecting disease-counteracting organisms”, explains David Roggero, President of the Argentine Association of Direct Seeding Producers (AAPRESID).

AAPRESID is an organization established in 1989 by a group of innovative producers who were not afraid to make a change and sought to develop an agriculture sector that could optimize the use of natural resources through greater knowledge, research and the introduction of modern technologies.

The organization, which has widespread presence in Argentina and a subsidiary office in Brazil, has become a benchmark institution for sustainable and advanced agriculture in the region and the world.

To address the global challenge of striking a balance between production and sustainability, Southern Cone farmers are relying on this methodology which, in addition to avoiding tillage, provides for crop rotation, balanced nutrition, optimal and efficient application of different phytosanitary products and other types of inputs, as well as integrated management of weeds, insects and diseases.

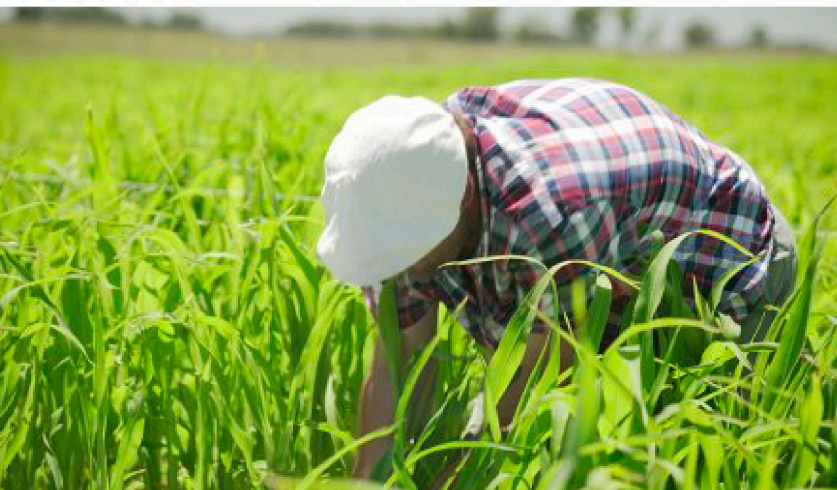
The system is therefore beneficial in preserving soil, agriculture's most important resource and the mainstay of global food security.

“The sustainability of direct seeding is dependent on the comprehensive application of all of its concepts. If we fail to return nutrients to the soil or rotate crops, we are providing all of the microflora and microfauna in the soil with only one type of food. It is crucial to apply various micronutrients”, explains the President of AAPRESID.

Roggero notes that science has demonstrated that crop rotation results in better soil health than monoculture farming. Just like a human being, the soil is a living organism that requires a balanced and diverse diet.

As is done in the Southern Cone, this system can be employed with different crops and on small, medium or large farming areas. At present, direct seeding is used extensively to grow soybean, corn, cotton, wheat, sunflower, sorghum and barley, among other crops.

However, a long road has been traveled to reach the current situation. Although direct seeding has many advantages, South American farmers were initially





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hesitant. Their first concern was how to control weeds. Seeding machines posed another challenge, given that conventional models were made for use on tilled soils, so different machines would be required for non-tilled soils, characterized by abundant agricultural residues – such as those from corn harvesting – and uneven terrains.

The widespread growth of this technique spurred the continuous progress achieved by Southern Cone countries in developing agricultural machinery with the most innovative technology for use in no-till farming. Industry research and advances in countries like Argentina and Brazil has provided these countries with access to the best technology and even enabled them to export agricultural machinery to leading food producing nations.



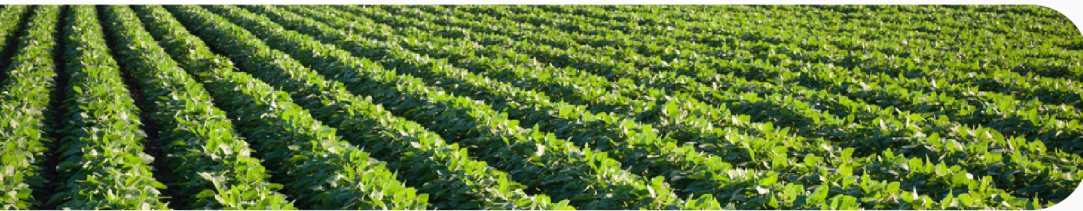
Benefits

With respect to productivity, there are substantial differences between conventional tillage farming and no-till farming. Over the past 20 years, thanks to the implementation of direct seeding, in addition to advances in agricultural machinery and

biotechnology, Argentina, Brazil, Uruguay and Paraguay have experienced considerable growth, enabling their grain production to reach record-breaking figures.

Some of the benefits that have been documented in the Southern Cone include:

- Better use of staff time.
- Fuel savings.
- Optimal use of rainwater (both in harvesting and subsequent phases).
- Higher yields compared to conventional tillage farming.
- Reduction in greenhouse gas emissions.
- Better infiltration of water in soil, reduced evaporation from the surface and improved accumulation and conservation of water in the soil profile.
- Better conditions for carbon sequestration in soil, through the frequent rotation of crops and grasses as well as balanced fertilization.
- Higher yields for cash crops, primarily due to improved water conditions in soil.
- Better adaptation to changing and uncertain climate.
- Saving of time in performing farm operations such as seeding a crop.
- More farm profit.



Direct seeding



Application of direct seeding

Direct seeding can be applied anywhere on the planet, but it is important to bear in mind that soils and climate vary in each territory. Consequently, practices must be adjusted based on the chemical, physical and biological characteristics of the soil, as well as the corresponding climate. Farmers have been tilling the land for 10,000 years, so transitioning to a different system is not easy. It is a gradual process, and progress achieved will depend on the advice, machinery and economic resources with which farmers are provided.

“The use of phytosanitary products is lower from day one, because the crop residues left on the soil help us control what we used to control with tillage”, says Roggero.

Direct seeding works for small, medium and large-scale producers who use manual seeding methods, animal traction or mechanized seeding. It is less costly than tillage farming and results in less degraded soil.

Prior to applying direct seeding, Roggero recommends identifying dense layers in order to adequately manage them, using cover crops to break up hardened layers of the soil profile. No-tillage farming allows for drastically reducing the oxidation of soil organic matter, which, in turn, allows for storing atmospheric carbon in the soil and contributing to climate change mitigation.





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Dissemination of the system

The direct seeding system is spreading across the world, especially in Latin America and the Southern Cone region. Nearly half of the global surface area that has been cultivated with direct seeding is located in Latin America.

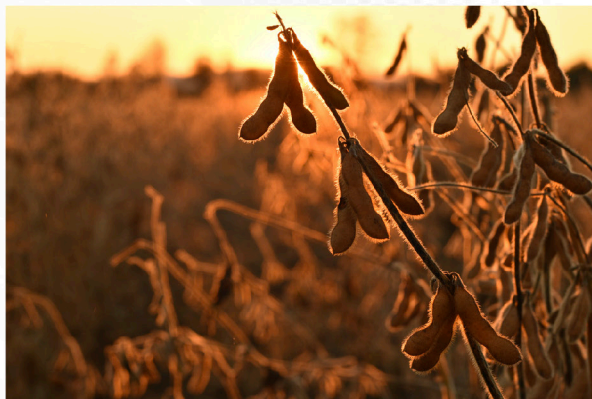
A study by the Cooperative Program for Agrifood and Agroindustrial Technology Development in the Southern Cone (PROCISUR) notes that "there has been a dramatic shift, given that only a few years ago, virtually all agriculture was carried out in the conventional manner, with tillage".

Argentina, Australia, Brazil, Chile, the United States, Uruguay and Paraguay are the countries with the largest no-tillage farming areas in the world. In the case of Central America and the Caribbean, no data is available on the number of hectares cultivated with direct seeding.



According to David Roggero, President of AAPRESID, "the adoption of this system in countries with no experience should be fostered through public policies that integrate institutions, training programs, access to technological knowledge and credit opportunities, as well as the creation of practical tools".

"Each time we till the soil, we are accelerating the decomposition process of organic matter. Part of it stays in the soil, but the other part is lost. That is why we want to establish strategic partnerships to implement direct seeding all over the world, because no-tillage farming is the way forward", concludes the president of AAPRESID.





Direct seeding

"The development of innovation, science and technology in the agriculture sector is the way to make agrifood systems increasingly productive, sustainable and inclusive".

IICA.



"The way to save the planet is to recapture carbon from the atmosphere through living crops".

David Roggero, President of AAPRESID.



"In recent years, direct seeding has revolutionized farming around the world; however, the Southern Cone of Latin America is the region in which this technological change has been implemented with greater speed and intensity, yielding excellent results".

PROCISUR



Direct seeding



General Benefits

- Reduces soil erosion by more than 90%.
 - Reduces water evaporation by 70% and improves water use efficiency.
 - Reduces the use of fossil fuels by more than 60%, significantly reducing greenhouse gas emissions.
 - Facilitates soil carbon sequestration and improves chemical, physical and biological fertility.
 - Fosters greater biodiversity and biological activity.
 - Increases nutrient circulation.
 - Reduces operating costs and working hours, which allows for using extra time to improve planning and production strategies.
 - Drives the accumulation of stubble on soil year after year, contributing to better soil care by increasing the surface layer of organic matter.
 - Improves soil permeability and aeration and reduces soil erosion.
 - Addresses the reduction in the organic matter content of agricultural soils subjected to conventional tillage, by removing as little soil as possible.
 - Allows for accessing waterlogged soils shortly after rainfall in some humid areas.
- In extreme cases in which machines are unable to move in muddy areas, no-tillage farming has allowed for regenerating eroded soils.

Source: AAPRESID, Argentina





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