GREEN TECHNOLOGIES

NO-TILL SYSTEM AND SOLAR ENERGY TECHNOLOGIES IN BRAZIL - 2022

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INPI INSTITUTO NACIONAL DA PROPRIEDADE INDUSTRIAL

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Founded in 1982 the company has completed over 700 projects in Brazil, Latin America and Africa.

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INPI is the Brazilian National Institute of Industrial Property. Founded in 1970, it is the largest IP institute in Latin America and it was considered the 6th most innovative of the world in 2021, according to the World Trademark Review (WTR).

In 2020, the Program INPI for Business was lauched, which involves partnerships with WIPO and companies, as well as innovation centers and universities, with the aim at promoting innovation and social development in Brazil, in addition to contributing to the increase in registration of industrial property assets. Thus, in addition to receiving applications, INPI is playing a more active role in the Brazilian IP system. The INPI for Business was developed to help entrepreneurs to learn the system and the value of IP, establish partnerships through IP and acquire a strategic view of the IP use and protection.

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Index

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ABOUT THIS PROJECT

Through a partnership with the World Intellectual Property Organization (WIPO) and INPI Brazil, Agrosuisse is implementing the 2022 WIPO GREEN Acceleration Project entitled Agriculture and Energy in Brazil.

This catalog describes cutting-edge technologies available for no-till agriculture systems and solar energy.

The information in this catalog is based on data collected from technologies available in the market and needs assessed through questionnaires in the agricultural and energy sectors. In the agricultural sector, producers seek to adopt new technologies to get better results on the no-till system. In the energy sector, small rural producers in Northeast Brazil see solar energy as a solution to drought, desertification, and the current low-quality power supply.

There were in-person and online meetings with different technology providers, held both locally and nationally.

This catalog compiles relevant technologies, suppliers, and bottlenecks related to investments in solar energy systems adoption.

The technologies listed in this catalog may also be relevant for both the agricultural and energy sectors addressed.

The Organizations consulted and interested in the development of this catalog of the No-Till System and Solar Energy systems are:

- **From the agriculture sector:**
  - Korin Agricultura e Meio Ambiente
  - Duverde Eco Soluções
  - Universidade Federal Rural do Rio de Janeiro
  - Universidade Federal de Viçosa
  - Indústria Mecânica Knapick
  - Guarany Industria e Comercio Ltda.

- **From the energy sector:**
  - SOL Luções Energia Solar
  - Eletrolira Energia Solar as local companies
  - HCC Energia Solar as a nationwide company.

NO-TILL SYSTEM IN BRAZIL

History of the NTS in Brazil

Originated in England and the United States, the term no-till has its origins in the term "no till", which in English means the practice of cultivation inserted directly into the land, without the need to turn the soil. No-till System was introduced in Brazil at the end of the 60s, mainly due to the concern of some producers who had problems with erosion in their own crops and began to use the technique in small areas in the form of academic studies (Table 1) (FERNANDES, 2018).

Table 1. Historical evolution of the consolidation of No-till System in Brazil.

Year	
1969	UFRGS imported a seeder from the USA for no-till system through the MEC/USAID agreement.
1970	Through the Experimental Station of the Ministry of Agriculture of Ponta Grossa - IPEAME, with the support of companies such as ICI - Imperial Chemical Industries and Gesellschaft fuer Technische Zusammenarbeit - GTZ, the NTS began to gain popularity to become a reference.
1971	Research with no-tillage system in wheat cultivation began at the Experimentation and Research Center Foundation – FUNDACEP FECOTRIGO.
1971	Studies began at the experimental stations in Londrina and Ponta Grossa of the Southern Agricultural Research and Experimentation Institute of MAPA – Ministry of Agriculture, Livestock and Supply.
1972	Producer Herbert Bartz from Rolândia, Paraná State, became a central character of this revolution in agriculture, when he was the first farmer to import a no-till system seeder.
1972	Passo Fundo Experimental Station, currently Embrapa Trigo, started studies to evaluate wheat/soybean succession in soils under NTS
1973	An experiment conducted in Ponta Grossa - Paraná State, with different soil preparation systems, including cultivation without soil disturbance, became the first record of research on conservationist soil management in Brazil.
1976	At Bartz's encouragement, other producers in Paraná State also started experimenting with no-till, such as Nonô Pereira and Franke Dijkstra.
1979	The Clube da Minhoca was effectively created, an informal organization of fundamental historical importance in the evolution of no-till in the Campos Gerais region of Paraná State and, by extension, in Brazil and other South American countries.
1980 – 1991	At that time, the main principles of no-till were consolidated, covering the minimum soil turning, the permanent maintenance of coverage with straw or live plants and crop rotation, transforming the practice of no-till into a No-Till System (CASÃO JUNIOR; ARAÚJO; LLANILLO, 2012; FERNANDES, 2018). Agricultural research proved the efficiency of no-till in controlling water erosion and reducing soil losses

Adapted from (FERNANDES, 2018); Adapted Agrosuisse, 2022.

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The No-Till System - NTS, in Brazil - 2000 / 2022

The NTS aims to alleviate erosion problems, assist in soil decompaction, reduce disease pressure, reduce spontaneous plant emergence, increase soil biodiversity, balance fertility and reduce expenses with cultural treatments. This practice promotes environmental benefits, by reducing the entry of sediments into rivers that, with them, carry fertilizers and pesticide residues; economic, by allowing production stability, reducing investments in fertilizers and correctives, in addition to reducing costs with soil preparation caused by erosion; and social, with the improvement of the quality of life in the countryside and in the city (UTZIG, 2018).

In grain production, the No-till System (NTS) was improved by the states of Paraná and Rio Grande do Sul and later spread to the rest of Brazil (STRECK, 2012; UTZIG, 2018). In general, the great challenges in the implantation of NTS in grains are the difficulty of mechanizing the soil and the production of quality mulch, with good volume and high C/N ratio of this straw, providing greater protection to the later crop and, consequently, with greater benefits (FEBRAPDP, 2021). Because the NTS remains dependent on the use of highly soluble fertilizers and pesticides, mainly herbicides, for the management of cover crops and control of spontaneous plants, the NTVPS (No-Till Vegetable Planting System) appears in the 1990s, with a proposal to break with this vision of agriculture, having as a basic principle the collective construction of the transition from conventional agriculture to agroecological-based agriculture for food production (FAYAD et al., 2018).

The estimate made by FEBRAPDP (Brazilian Federation of the No-Till Planting System) points out that in the 2017/2018 harvest, the cultivated area of cereals under NTS in Brazil was 33.06 million hectares (FEBRAPDP, 2021). And this area can be even larger, if we consider areas that use the NTS for the cultivation of vegetables, sugar cane and others. However, challenges still need to be mitigated for an efficient conversion, such as the requirement for agricultural planning, technification of farmers, soil decompaction, difficulty in correcting pH and chemical fertility in depth, reduced productivity in the first 5 years and increased use of herbicides (UTZIG, 2018). Therefore, the objective of this work is to present the main challenges and technologies adopted for the correct management of NTS in Brazil.

Scarlet eggplant and cabbage under no-till system cultivated in Seropédica/RJ

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NO-TILL SYSTEM AND BENEFITS TO THE ENVIRONMENT

One of the alternatives created by the Federal Government with the aim of disseminating knowledge and technologies involving the NTP was the adoption of the Low Carbon Agriculture Plan (ABC Plan), which is committed to carrying out actions to reduce and avoid greenhouse gas emissions. (GHGs).

The Program, which has as one of its objectives the expansion of the NTS by 8 million hectares, seeks solutions to its main obstacle, which is the training of the main actors: the financial sector, rural extension workers and producers. In this sense, the plan also includes funding for research and, mainly, the need to monitor activities, both from a financial point of view and from the point of view of efficiency in carbon capture (ANDRADE et al., 2018).

The survey of technological demands related to the no-till system is presented below and considers the technical and scientific bases of the work carried out, in addition to representing the main needs of producers. The set of technologies for the no-till system effectively contributes to the preservation of the environment through sustainable practices and the conservation of natural resources.

The cultures rotation, no soil turnover, cover crops (single or mixed), straw management, quantity and quality of straw, intercropping, and permanent soil cover are used by grain producers, however vegetable and perennial crop producers are adhering to the technologies of the no-till system and adopting the cited techniques.

CATALOG PRESENTATION

The catalog presents the results of surveys on the technological needs of producers and the technologies that can meet these needs, both in the agriculture sector and in the energy sector.

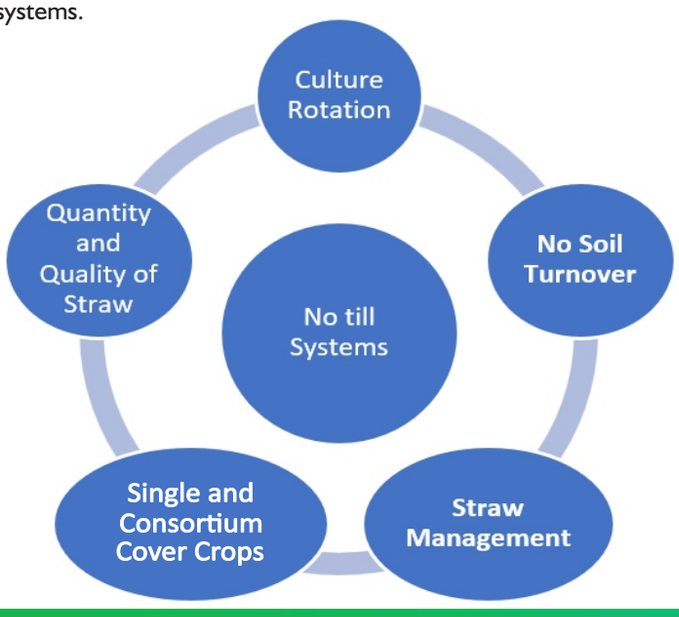
The technological needs raised represent the main challenges for producers and rural communities. The catalog highlights these needs and presents technological solutions to meet the demand of producers and rural communities.

TECHNOLOGY PROVIDERS – NO TILL SYSTEMS

Technology Needs

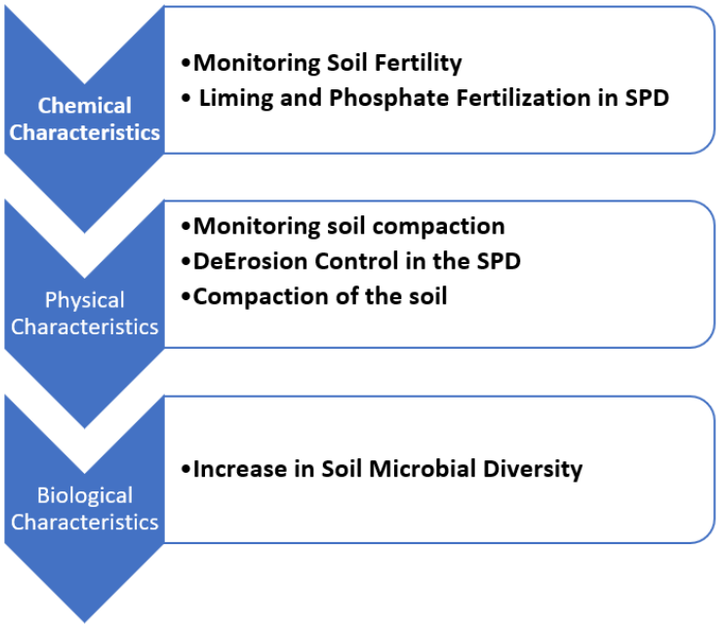
The survey of technological demands related to the no-till system is presented below and considers the technical and scientific bases of the work carried out, in addition to representing the main needs of producers.

The technologies are based on the following practices: the culture rotation, no soil turnover, straw management, quantity and quality of straw, single and consortium with soil cover plants. The machinery implements and agricultural equipment suitable for the no-till-systems.



Technology Providers

The advancement of information technology in the agricultural sector allows technologies to be implemented from the diagnosis of soil structure and its characteristics. The survey of technical and scientific works indicates the need to recover the chemical, physical and biological structures of the soil to adopt the practices of the no-tillage system.



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DuVerde Eco soluções

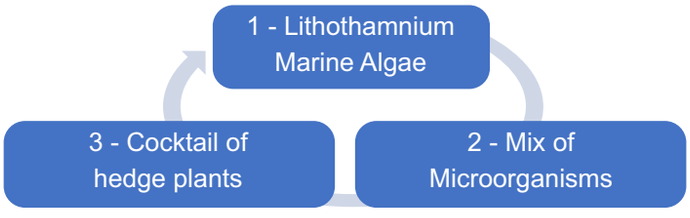
TSAA - Socio-AGRO-Environmental Technologies

Agriculture ORGANIC FERTILIZATION / Fertility and soil cover

The technology to improve soil fertility and cover in no-till systems is based on the composition of natural inputs that promote direct results in the chemical, physical and biological structure of the soil.

The technology consists of the application of Lithothamnium algae and, subsequently, spraying the microbial solution, in the planting furrow, of some species and strains and seeds of green fertilizers (cocktail). After the growth of this cocktail of cover crops, the material is mowed and incorporated into the soil, after which the desired commercial crop is implanted, this practice promotes good results in the no-till system.

Technology Description



1 - Diagnosis of the cultivation area to know the microorganisms in the soil, where it will be cultivated and start the treatment of bioactivation and bioremediation of the soil, aiming at the final balance of the agro ecosystem and its soil biota.

2 - Addition of Lithothamnium marine calcareous algae, together with a MIXTURE - BLEND - of a mix of microorganisms;

3 - Cultivation of a cocktail of cover crops for each type of existing soil pathogen, promoting an increase in chemical fertility and an increase in the biological activity of the soil.

1 - Seaweed

Lithothamnium algae acts as a soil conditioner, providing readily assimilable calcium and various minerals to cover plants and crops in succession.

2 - Mix Microorganisms

The application of different strains of microorganisms, such as *Trichoderma harzianum, T. asperellum, Azospirillum, bacillus subtilis, bacillus methyotrophicus, Fertipremiun Korin* and other biological products, promotes what is called a "Flood" of microorganisms, thus occupying the "locus" and exerting antagonism to pathogens, in addition to increasing the absorption of nutrients, by the physical conditioning of a living soil, of low density, facilitating the penetration of roots.

DuVerde eco soluções

«Taking care of your green area with sustainability"

3 - Cocktail of hedge plants

The cover crop cocktail promotes greater soil exploration, due to the different depths and shapes/types of the root system, and the straw formed combines the supply of nutrients, with a long time of permanence on the soil surface and in the profile, via roots. The practices result in increased productivity for the successor crop in the No-Till System.

TECHNOLOGY ADVANTAGES AND RESULTS

1 - Lithothamnium algae act by stimulating the biological activity of the soil, enhancing the absorption of nutrients. It acts as a conditioner providing Calcium and Magnesium and over 70 mineral and organic elements, minerals and essential amino acids and bioavailable sugars for the development of microorganisms that will compose the new balanced soil biota for cover crops and cultures in succession, which are directly impacted positively with this management.

2 - The application of different strains of microorganisms (mix of microorganisms) promotes what is called biota bioactivation and suppression/inactivation/elimination of soil pathogens, thus occupying the biological "locus" and exerting antagonism to pathogens.

Other benefits:

- Increases the absorption and bioavailability of nutrients, through the physical conditioning of a living soil,
- Increase the cycling of mineral elements, facilitating the penetration of roots and stimulating new roots and absorbent hairs;
- Increasing the uptake of nutrients and water by the rootlets of cultivated plants.

The method brings vigor to cultivated plants and stimulates their secondary metabolites, such as osmosis control, opening and closing of stomata, natural plant defense, bark firmness, increased brix, more organic exudates and more biodegradation of mineral elements, resulting in greater rooting and vigor of the root system, resulting in better harvests.

3 - The cocktail of cover crops promotes greater soil exploration, due to the different root depths, their respective exudates and shapes/types of the root system, and the formed straw that decomposes, with the help of the greater activity of the soil biota, promotes the supply of nutrients, allied to the long permanence time of organic matter on the soil surface, and in the profile, via roots, favoring the development of the root system of the main crops.

https://wipogreen.wipo.int/wipogreen-database/articles/138888

COLLABORATION TYPE For sale
DEVELOPED IN Brazil
PREFERRED REGION Brazil
READINESS LEVEL (TRL) Early commercial demonstration / adoption / dissemination

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Korin Agricultura e Meio Ambiente

Use of microorganisms to increase soil fertility

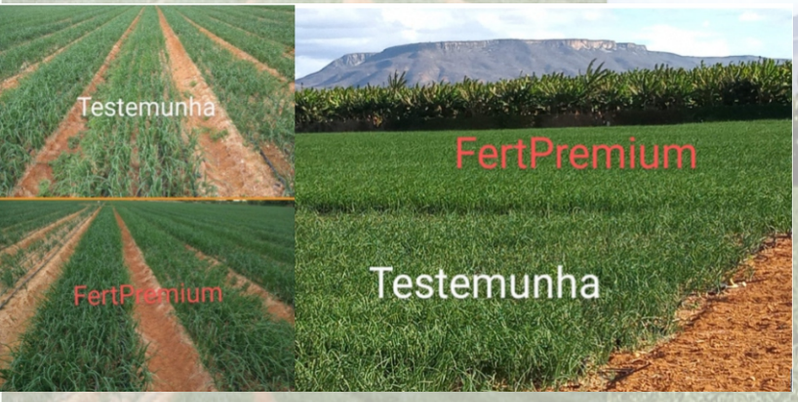
No-Till System - NTS

Technology Description

Commercial product - FERTIBOKASHI
Biological product whose main function is to "vivify the soil"
Developed by Grupo Korin Agropecuária, founded in 1994, by the unification of the Mokiti Okada Natural Agriculture Research Center (CMO) and Korin Agricultura e Meio Ambiente.

The product was generated from the technology of "EM" - Efficient Microorganisms, a technique in which organisms are captured in nature, especially in inhospitable conditions, that is, a prospection of anaerobic species, from hostile environments, selected based on studies of Teruo Higa. The study of this prospect lasted 10 years, from 1984 to 1994, when the EM began to be disseminated with greater amplitude. These functional groups of microorganisms have been selected since then for their rusticity and ability to colonize and quickly occupy the biological "locus".

Currently, the product is in its eight generation of improvement regarding the selection of strains of, mainly, bacteria, fungi and yeasts, in addition to other functional groups of microorganisms that are antagonistic to pathogens and promoters of mineral absorption by the roots.



FERTIBOKASHI contains dormant microorganisms that, when activated, increase the performance of the characteristics of organic matter as a shelter and substrate for microorganisms for life and physico-chemical-biological structuring of the soil.

Technology Results

- Improvements in soil quality resulting from the use of technology.
- Increase in aggregation, porosity, friability, glues and organic gels, increase in bacterial C and N, lower density and greater absorption of nutrients by increasing the contact surface of the roots by association with mycelial hyphae.
- The set of factors provides the greatest ease of three-dimensional expansion of the root system, multiplying the volume of rootlets and the absorption surface, especially and mainly due to the optimal conditions for the association of mycorrhizas with the roots.
- The application of the product with the correct management of C supply, via straw, "softens and prepares" the straw for the microlife of the soil, that is, making it a medium for culture, growth and survival of microorganisms and the best indicator is the vigor of plants.
- Increase in productivity, greater development of shoots and root systems, less soil compaction and increase in water retention capacity and cation exchange (CTC).

Environmental Benefits

The environmental benefits of using FERTIBOKASHI in crops:

- Reduction in the use of pesticides;
- Reduction or elimination of soluble mineral fertilizers;
- Preservation of water resources;
- Reduction of carbon emissions and less greenhouse gases.

General information

- 99% of customers are conventional producers;
- 90% of customers are from NTS.
- Present in 0.5% of the cultivated area in Brazil.

https://wipogreen.wipo.int/wipogreen-database/articles/146116

COLLABORATION TYPE For sale
DEVELOPED IN Brazil
PREFERRED REGION Brazil
READINESS LEVEL (TRL) Scaling up

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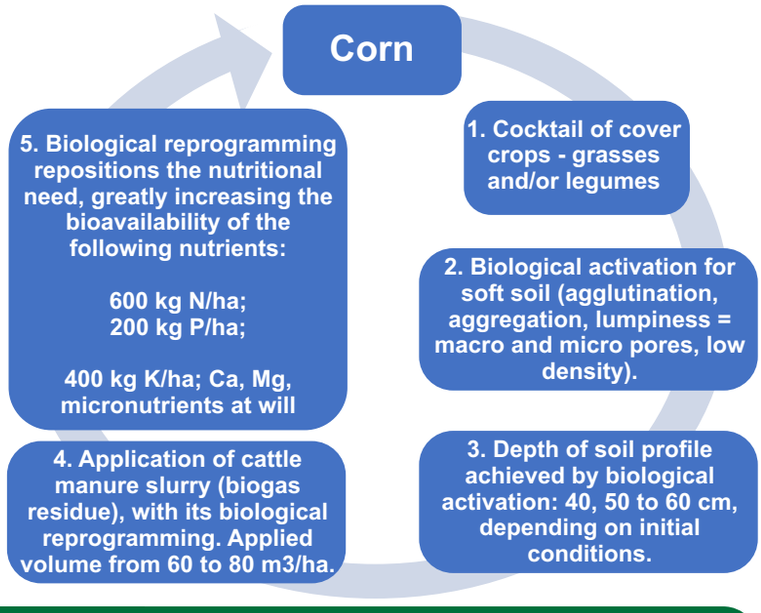
Tomita AgroÖikos

Soil biological programming*

** soil management technology*

Practical example CORN CULTURE

No-till System - NTS



Practical example Carrot, Potato and Garlic crops
No-Till System in Vegetables

1. Soil management for spontaneous suppression and preparation of physical-chemical-biological conditions for SPDH implantation
2. Green manure colonized with leachate biologically reprogrammed by irrigation
3. Mowed three times during the 18 months of permanence of the grass in the area, which is implanted in the spring and summer
4. Turnover, in dry winter, of B. ruziziensis – preferably, but it can also be piatã, massai, MG4, mombasa)
   - B. Ruziziensis serves the purpose best
5. Planting millet in winter, with irrigation
   - Millet mowing with reaper
6. Revolving subsurface with adapted implement, almost a subsoiler, but actually a “shaker” swallow wing.
   - The implement is also used for carrot and beet harvesting.
7. Planting carrots in double rows 12-17 cm, with a high-precision seeder (Sputnik, German).
   - Productivity 4000 - 4500 tons / hectare (ha)
8. This management is done for both organic and conventional plantations.

Potato production

Aerobic Biological Reprogramming in potato field residues (Solanum tuberosum) in the order of 200 tons, which return to crops soon after this treatment, including in seed potato fields.

Potato areas reach up to 1.00 hectares, in the Triângulo Mineiro, State of Minas Geraisin organic system

Productivity
15.400 kilos in organic system;
22.000 kilos in conventional system
Cost from 6.600 to 8.800 kilos / hectare (ha)

Technology Advantages

The advantages of the Technology are of different natures, but the reduction in production costs stands out, due to the lower use of soluble fertilizers and pesticides and the greater independence in the supply of inputs, such as the use of remineralizers or rock powders in total or partial use of soluble mineral fertilizers, whose raw material is predominantly imported.
Another advantage is the “On Farm” production and multiplication of biological soil conditioning products and phytopathogen antagonists, thus providing greater independence and security in the supply and acquisition of these inputs, most of them replacing pesticides.

Environmental Benefits

The environmental benefits of Biological Reprogramming are directly linked to the advantages of the technology:
- Reduction in the use of pesticides;
- Reduction or elimination of soluble mineral fertilizers;
- Preservation of water resources;
- Reduction of carbon emissions and less greenhouse gases.

Pesticides

The technology promotes the reduction or elimination in the use of pesticides, in addition to increasing the safety and health of farmers and consumers. The use of technology can eliminate environmental contamination mainly in water resources. The result of the technology can be evidenced by the greater health of plants due to the principles of the Trophobiosis Theory that promotes plant health.

Soluble mineral fertilizers

The reduction or elimination of soluble mineral chemical fertilizers, considering both crops classified as sustainable and certified organic, improves the energy balance, reduces carbon emissions (C Footprint) and, equally, lowers the emission of GHGs (gas greenhouse effect), as the industrial production of these fertilizers is highly energy and fossil fuel consuming.
Another highly relevant environmental benefit in reducing and/or eliminating the use of chemical fertilizers is the preservation of aquifers, since the intensive use of these highly soluble fertilizers causes the leaching of salts into water bodies and groundwater reservoirs and deep waters, causing imbalances such as eutrophication and increased levels of nitrates in water.

https://wipogreen.wipo.int/wipogreen-database/articles/146428
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Guarany Ind. e Com. Ltda.

tradição e inovação

Knapsack Sprayer Balance W developed for Women

Summary

A unique knapsack sprayer developed for women with a complete new design for better ergonomics that minimizes horizontal pressure on the spine and vertical pressure on the neck. Higher volume pump with hydraulic stirring system. New valve (S7 model) with progressive filtration system for better and safer. Anatomical and adjustable lever. Decorative and adjustable straps.

Description

At the forefront of its purpose, Guarany developed the first manual backpack sprayer designed for the woman farmer. Based on studies on the anatomy of the female body, better defining the points of contact of the body with the geometry of the equipment's tank, in order to increase comfort and provide the best ergonomics during use.

Tank capacity.....16L (4,2 gal)
Net weight .....4.3 kg (9.3 lbs)
Pump model .....Piston type
Max. flow .....600 ml/min (0,15 gal/min)
Material of the pressure chambre .....Engineering plastic
Max. working pressure**.....5 bar (72,5 psi)
* Tank with 6 liters of water. ** Approximated: value may vary according to product and application conditions

Technology Assessment

- Information collected from FAO (Food and Agriculture Organization),
- Product developed based on a study conducted by the Ergonomics and Safety at Work Laboratory of Feagri - Unicamp, one of the most renowned agricultural universities in Latin America, highly specialized in ergonomics applied to field tasks.
- Product designed by the renowned agency Chelles & Hayashi, specialized in created solutions for different realities.

Summary of benefits

First manual backpack sprayer designed for the female farmer. Based on studies based on the anatomy of the female body.

1 - New design: for better ergonomy
2 - New lever: anatomical and adjustable for operator comfort
3 - New S7 Discharge valve: with security latch and progressive filtration system.
4 - Quick release belt system: better practicality and comfort for the operator.
5 - Larger support base: ensures correct distribution of weight and stability of supply.
6 - Pump: higher volume pump with hydraulic stirring system
7 - Straps: decorative and adjustable straps
8 - Abdominal belt: it provides more stability to the operator

https://wipogreen.wipo.int/wipogreen-database/articles/145587

COLLABORATION TYPE For sale
DEVELOPED IN Brazil
PREFERRED REGION Brazil
READINESS LEVEL (TRL) Technology optimization / prototype validated in operational environment

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Guarany Ind. e Com. Ltda.

tradição e inovação

Knapsack Granulate Applicator

Summary

Katu comes from the Tupian language and refers to everything that is positive and makes life better. The tank of the Katu line products are manufactured with green bioplastic produced from sugar cane. A renewal innovative alternative to fossil fuel derived plastics. This manual knapsack sprayer is light and compact, it was specially developed to provide greater comfort to the operator and economy of products, offering more costeffective.

Description

High technology in spraying, it allows operators to apply more chemical products effectively and economically.

Suitable for gardening, orchards, vegetable gardens, greenhouses, hotels, industries, public places and indoor disinfection.

Tank capacity ..... 10L (2,7 gal)
Net weight .....3,2Kg (7,0 Lb)
Pump model .....Piston type
Max. Working pressure ....(45 psi)
Max workflow ..... 600ml/min (0,15 gal/min)
Possible to use a wide range of accessories for all types of applications
Type/Model in g/stroke a/b ..... Gravity driven Knapsack Granule Applicator
Empty weight ..... 4,8 kg
Weight full (with NPK 20-5-20 fertilizer)a ..... 19,45 kg
Chemical product tank – liquid (capacity).....16 L
Dose bands (minimum – maximum) in g/stroke a/b.....(9,0 - 285,0) Potassium Chloride | (8,0 - 215,0) Urea | (10,0 - 250,0) NPK
Linear application (min- max) in KG/min a/b ... (4,2 e 12,2) Potassium Chloride | (4,7 e 11,7) | Urea (3,6 e 10,6) NPK
Machine Dimensions.....357 x 425 x 610 mm

*(a) Average values – may vary as a function of the product, its density, moisture and dimensions of granules

(b) Values obtained from dry granules and discharge set positioned at 30 degrees to the soil.

https://wipogreen.wipo.int/wipogreen-database/articles/145543

Summary of benefits

- Soil preservation - reduces contamination with precise doses
- Fertilizer savings - control in the amount applied
- Operator´s comfort - ergonomics and padded straps
- Dosed or continuous application - Ideal for every type of crop
- Operator - No operator contact with product

Application

It can be used in horticulture in the most diverse agricultural crops, flowers and vegetables, fruits (banana, citrus etc.), beans, corn and coffee; in forest crops (eucalyptus, pine etc.); and also in lawns and gardens. It always guarantees a precise dosage and ease of product distribution, for the correct fertilization of crops and pest control, through the application of granulated insecticides and ant baits.

1 - Discharge tube made of resistant plastic: avoiding damage to equipment during use.

2 - Tank filler with strainer: for breaking up granules that have become compacted prior to filling.

3 - "Joystick" command: all functions are within the operator's easy reach using a "joystick" that combines operating comfort and speed in applying or changing function.

4 - Padded straps with two adjustment positions: offering greater comfort for the user.

5 - Tank base (chassis): made entirely of; plastic; much lighter and more resistant

6 - Spreader Accessory: a component that ensures great savings through better distribution of fertilizers and insecticides falling on the ground. Includes a discharge tube of 12 cm, ensuring height and proper angle for the application.

COLLABORATION TYPE For sale
DEVELOPED IN Brazil
PREFERRED REGION Brazil
READINESS LEVEL (TRL) Technology optimization / prototype validated in operational environment

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Indústria Mecânica Knapik Ltda Epp

KNAPIK®

Manual spray trolley with 20 liter tank

Implement for small family farms.

Conducted manually, through a sprayer bar with 8 nozzles, sized to operate in areas of up to 15 hectares. It has a yield of spraying 4 to 5 hectares per day, with 100 liters per ha. Intended for family farming, it eliminates the need for a tractor and, at the same time, takes the weight off the operator of carrying the sprayer on his back and pumping it. It does not compact the soil, keeping the land suitable for the no-till system.

Equipment for soil management without promoting soil compaction, allows management in no-tillage systems with protection of the existing plant cover. The use of this equipment does not promote environmental impacts, manual use and suitable for the application of biofertilizers, natural solutions and liquid fertilizers.

Manual seeder with rotor and cable

Implement for small family farms.

For planting small vegetable seeds.
With planting depth adjustment, reservoir with transparent acrylic cover, to enable operator visualization.

This manual seeder has a handle with lateral displacement, which facilitates walking between beds and planting in different rows; a trailing chain closes the planting furrow.

Manual seeder with wheel

Implement for small family farms.

For two types of planting: small vegetable seeds and grain seeds (beans, soybeans, corn and others).

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https://wipogreen.wipo.int/wipogreen-database/articles/145770

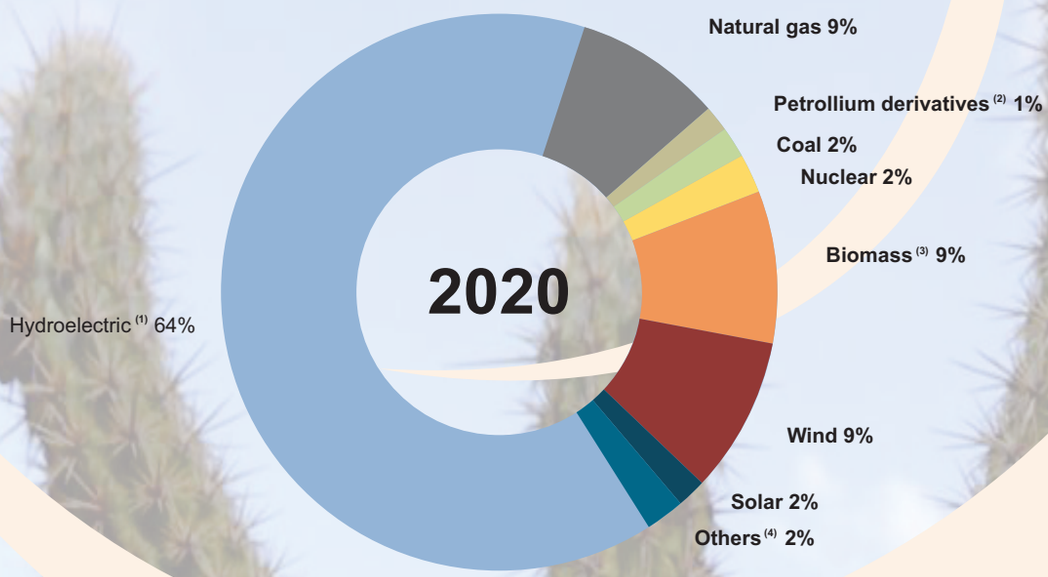
COLLABORATION TYPE For sale
DEVELOPED IN Brazil
PREFERRED REGION Brazil
READINESS LEVEL (TRL) Technology optimization / prototype validated in operational environment

SOLAR ENERGY IN BRAZIL

The green technologies available to generate renewable energy represent an advantage in Brazil compared to other countries. Brazil is a large country, rich in natural resources, and it can generate renewable energy through different sources such as biomass, wind, solar, hydro, and others.

The Brazilian energy matrix is dominated by hydropower despite its decrease in prominence over the last decade. In recent years, government programs - like the Energy Auctions - have helped to diversify the energy matrix by encouraging production from other clean sources. By the end of 2020, Brazil's solar energy sector had 344,608 micro and mini photovoltaic systems installed, which, together with the big solar plants, totaled more than 7 GW of operational capacity.

Brazil Electricity Generation by source (%) -



Source: 2021 Statistical Yearbook of Electricity – 2020 Baseline year – Empresa de Pesquisa Energética/The Energy Research Company (www.epe.gov.br)

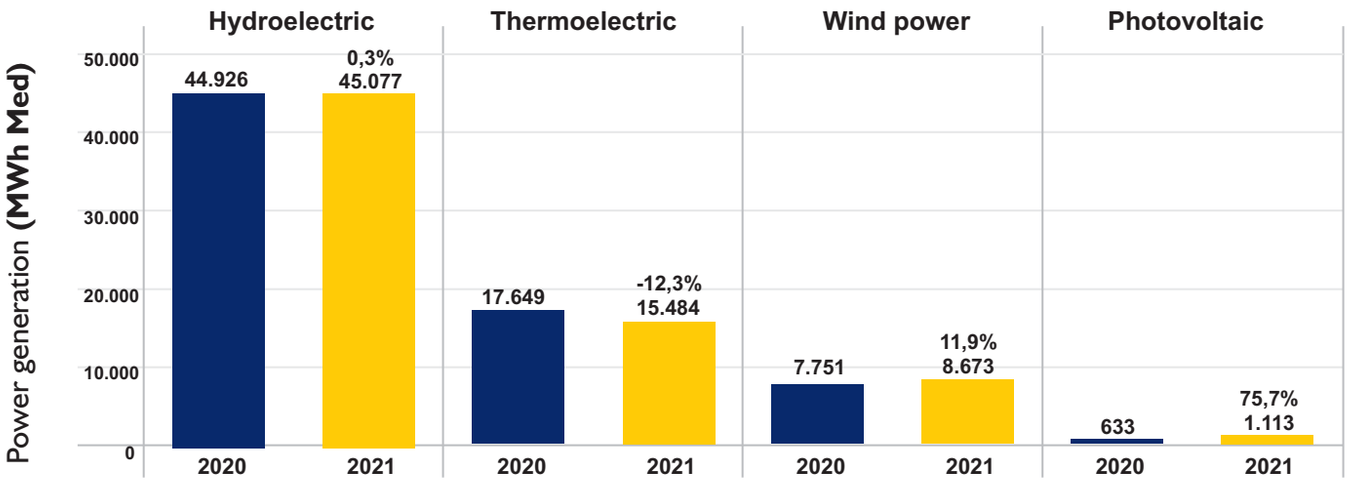
Grades:

I) Includes autoproduction of energy
II) Petroleum derivatives: diesel oil and fuel oil
III) Biomass: firewood, sugarcane bagasse and lye
IV) Other: recoveries, coke oven gas and other secondary

Photo: Ygor Baracuhy

Concerning the electricity generated in 2020, there was production of 621 TWh, corresponding to a drop of 0.8% between 2019 and 2020. Most sources showed a decrease in the period, except for oil products (+9.1%), biomass (+6.7%), wind (+1.9%) and solar (+61.1%), which caused an increase in the participation of all these sources in the national electricity generation mix. In a comparison between the years 2020 and 2021, solar energy generation grew by 72.6%.

Electric power generation by source



Source: CCEE (Câmara de Comercialização de Energia Elétrica – Electric Energy Commercialization Chamber).

In the Northeast Region, the centralized solar source represents 5.5% of the regional installed capacity for electricity generation. A detailed analysis of the solar source in Brazil indicates that centralized generation corresponds to 27% and distributed generation to 63% of the country's installed photovoltaic generation capacity. Considering centralized and distributed generation, the Northeast leads with approximately 38% of the capacity installed in Brazil, resulting from the preponderance of centralized projects in the Region. The high solar potential of the Northeast region has been materialized in winning projects in public auctions for the purchase and sale of electricity.

SOLAR ENERGY AND GHG EMISSIONS

Brazil's accession to the Paris Agreement and a greater awareness of environmental discussions have made renewable energy a permanent agenda in the country – especially when looking for cleaner energy sources that can contribute to achieving the emission reduction target adopted by Brazil. Solar energy represents a clean energy source that does not pollute the air, water, or land, does not emit greenhouse gases or produce noise, and presents consolidated and increasingly innovative green/clean technology, in addition to being accessible both in the installation aspect and economically.

In the Northeast of Brazil, accelerated desertification makes solar energy a source of great importance, with especially alarming rates presented in the region of the Caatinga biome. Desertification has been intensified specifically due to water scarcity, which, in turn, has become a historical factor that explains the low development of the region.

Caatinga Biome - Cabaceiras/ Paraiba State - Brazil rural área (source: Jaqueline Poole)

NEEDS AND SOLUTIONS

The needs were identified in two small towns - São João do Cariri and Cabaceiras - both located in Paraiba State, Brazil. The first area visited was the rural area of São João do Cariri, where it was possible to gather small rural owners and producers at the headquarters of Hidroçu Cooperative. This Cooperative brings together many of the local producers united by the challenge of having water for the production of fruits, vegetables and small animals (goats, chickens, pigs). Then few other rural properties were visited.

Fazenda Mares - São João do Cariri/Paraiba State rural area: an old windmill used to pump water

Cooperative Hidroçu - São João do Cariri/Paraiba State – Hydroponics: pumping and desalination needs

Two different needs were identified in the rural area of Cabaceiras in Paraiba State. The first is on the Serra do Monte Community that produces corn, beans, and vegetables. This community needs solar energy for water pumping (used for corn, beans, and vegetable produces) and electrical supply for a small health center and rural school.

The second need is related to a farm planned to become a Research Laboratory for the study and combat of desertification. In this case, solar energy is a needed demand to make the project viable and sustainable. The shared features of these two needs include pumping due to drought and lack of water, desalination and supply of electrical energy due to poor quality supply of energy on the grid.

Fazenda Marimbondo - Nursery of native plants - Cabaceiras/Paraiba State

Fazenda Marimbondo - Biome Caatinga - Corn Harvest

Serra do Monte Community - Cabaceiras/Paraiba State - Winter corn harvest

Regarding technology providers, some were identified locally and nationally, and presented innovative technologies capable of solving the needs – some of which are as listed below.

Technological needs x Possible solutions

Water scarcity **Salty water in many areas** **On-grid energy**	→	**Pumping** **Desalination system** **solar energy (PV) supply**

Solar Energy System on-grid in Pernambuco/Brazil (Source: SOL Luções Energia Solar)

Solar Water Pump – Paraíba/Brazil (Source: SOL Luções Energia Solar)

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SOL Luções Energia Solar

The company works with photovoltaic solar energy on-grid and off-grid, solar heating, and solar pumping and desalination water systems. They deploy small solar systems using from one or two solar panels to several panels to generate power on-grid and off-grid. Among the simplest solutions, a small solar water pumping can be offered, with a capacity of approximately 300 liters/hour that can use stationary batteries to maintain a stable flow throughout the day. The solar water pumping system is a clean and sustainable technology that provides water pumping for human and animal consumption, animal consumption, and irrigation. This technology presents good efficiency in the northeast region of Brazil, where there are high levels of solar irradiation and water in the subsoil (artesian well). Solar pumping makes it possible to extract water from the subsoil or another source of water, without any electricity costs from the local utility company.

COLLABORATION TYPE For sale
DEVELOPED IN Brazil
PREFERRED REGION Brazil, South America
READINESS LEVEL (TRL) Scaling up

SOLluções Energia Solar

ADVANTAGES

- It is clean and technologically sustainable
- It does not emit GHG
- It is a renewable energy source
- Installation can be done on roofs, facades, on the ground, and in water
- Low cost and maintenance

SERVICES OFFERED by SOL Luções Energia Solar

- Design/build solutions according to the customer need
- Process design and detailed engineering
- Innovative design
- Technical support and training

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Image: Solar system for pumping (source: SOL Luções Energia Solar)

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SOL Luções Energia Solar

SOL Luções Energia Solar is a local company based in Campina Grande/PB, Brazil, and provides solar energy power systems for customers in residential, commercial, industrial, and rural sectors.

They offer innovative solutions to their customers according to the desired use, on-grid or off-grid. Most of their on-grid projects are for residencies, schools, hospitals, bakeries, among others. On the other hand, most of the off-grid projects are designed for rural areas, in places where the customers have weak energy delivered by the utility company, or even where there is no electricity grid.

COLLABORATION TYPE For sale
DEVELOPED IN Brazil
PREFERRED REGION Brazil, South America
READINESS LEVEL (TRL) Scaling up

ADVANTAGES

- It does not emit GHG
- It is a renewable energy source
- Installation can be done on roofs, facades, on the ground, and in water
- Low cost of maintenance
- Deployed in remote areas off-grid

SERVICES OFFERED by SOL Luções Energia Solar

- Photovoltaic energy powerplant
- Solar heating for residential and industrial use.
- Mobile solar energy systems
- Solar grain drying

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Solar panels installed in a roof/residential use (source: SOL Luções Energia Solar)

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HCC Energia Solar

HCC Energia Solar is a brazilian company that provides innovative solar energy systems for customers in the entire country according to their needs. They support their customers in financing, thereby making it easy to acquire a solar energy system. Furthermore, they have solid experience on the installation of solar systems in residential, commercial, industrial, and rural properties.

The solar energy systems offered by HCC Energia Solar are made according to the customer's needs, from the small to the big powerplant, and from the design until the final installation. They support their customers in financing,

COLLABORATION TYPE: For sale, service contract
DEVELOPED IN: Brazil
PREFERRED REGION: Brazil
READINESS (TRL): Scalling up

ADVANTAGES

- It is clean and technologically sustainable
- It does not emit GHG
- It is a renewable energy source
- Installation can be done on roofs, facades, on the ground, and in water
- Low cost of maintenance
- Deployed in remote areas off-grid

SERVICES OFFERED by HCC Energia Solar

- Design/build solutions according to the customer need
- Innovative design
- Technical expertise
- Financing solutions

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Solar Energy System designed and installed by HCC Energia Solar in Floresta/Pernambuco State- Brazil

Solar Energy System designed and installed by HCC Energia Solar – Supermarket chain - São Gabriel/Rio Grande do Sul State - Brazil

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Eletrolira Energia Solar

Eletrolira is a local company based in Campina Grande - Paraíba - Brazil, which provides solar energy systems for local customers with an innovative solution according to their needs.

Eletrolira offers innovative solutions to the customers according to their desired use; for cases of solar pumping, the company deploys solutions such as programmable irrigation systems at certain times of the day, thus ensuring the efficient use of water. The company has solid experience installing solar systems in residential use, the service sector, education, among others.

COLLABORATION TYPE: For sale
DEVELOPED IN: Brazil
PREFERRED REGION: Brazil, Paraíba
READINESS (TRL): Scalling up

ELETROLIRA
MATERIAL ELÉTRICO E AUTOMAÇÃO INDUSTRIAL

ADVANTAGES

- It is clean and technologically sustainable
- It does not emit GHG
- It is a renewable energy source
- Installation can be done on roofs, facades, on the ground, and in water
- Low cost of maintenance
- Deployed in remote areas off-grid
- It represents a saving if installed on the grid

SERVICES OFFERED by Eletrolira Energia Solar

- Design/build solutions according to the customer need
- Install a programmable system (time usage)
- Innovative design
- Technical support

https://wipogreen.wipo.int/wipogreen-database/articles/138915

Solar system installed in a small business (store) in Campina Grande/Paraiba State Brazil by Eletrolira Energia Solar.

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AGROSUISSE
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