

Farming families protagonists in the research and innovation process in agroecology





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The summary of lessons learned was produced by the Lutheran Deaconry Foundation (FLD), through the CAPA Agroecology Program, with the participation of farming families through the Innova Ecovida project. Its aim is to summarize the main lessons learned from the work carried out over four years in the Reference Units (URs) and to serve as a basis for guiding qualitative progress on these issues.

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**NO-TILLAGE VEGETABLE
PRODUCTION SYSTEM (SPDH)**

Technical sheet

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PRESENTATION

The title of this booklet - Farming families as protagonists in the research and innovation process in agroecology - characterizes the central idea of the Innova Ecovida project, which was set up from the mobilization of families and organizations linked to the Ecovida Agroecology Network, to advance in the social construction of knowledge on the themes of bio-inputs, the No-tillage vegetable production system (SPDH) and vegetable seeds and seedlings.

This publication presents the main lessons learned from four years of working with Reference Units (URs). With the aim of adding value to the knowledge generated, it aims to guide the actions and planning of farming families with regard to the different themes researched.

Innova Ecovida is a binational project between Brazil and Uruguay, funded by the European Union (EU) through the Global Alliance of Agricultural Agencies (Agricord), which is responsible for implementing the program "Organizations of farming families leading research and innovation in agroecology for sustainable food systems" (FO-ledR&T). The coordination is carried out by Cresol Agrigencia, Agricord's representative organization in Latin America. In Brazil, the executing organization is the Lutheran Deaconry Foundation (FLD), through the CAPA Agroecology Program, a partner of the Ecovida Agroecology Network, which advises six of its Nuclei. FLD is a civil society organization whose mission is to defend the right to exist with a good life for all diversity, and which works with groups and communities promoting and advising actions in agroecology, culture, solidarity economy, gender and ethnic-racial justice, human rights and land and territory. In Uruguay, the organization responsible for implementing the initiatives is the National Rural Development Commission (NRDC).

The operational management of the project is structured around the organizational process of the Ecovida Agroecology Network, strengthening its participation and connection with the social movement and its representative bodies, which decide on its operation. Thus, the entire work plan was built in an articulated manner, connecting the farming families with the initiatives determined by the global movement of the FO&RI Program. This structure was fundamental to guaranteeing internal workflows, expanding people's capacity to participate, respecting the rhythms of each location and driving effective actions with a greater impact on realities.

The methodological basis adopted is based on the principles of Campesina a Campesino (CaC), which is based on praxis, practice-theory-practice. Based on the context of each location, the practice and concrete reality of the lives of farming families, the foundations for structuring the

action research initiatives. This is coupled with theoretical elements that help to understand the real situation and design initiatives with the capacity to move the objective materiality and produce innovative transformations in the environment in which they are working.

Based on the URs, work and study plans were drawn up, pointing out the main research problems to be tackled collectively. Under the coordination of the nuclei of the Ecovida Agroecology Network, the common limits were prioritized and, from the organizational bodies and the general plenary, its 34 Nuclei were involved, making it possible for 46 women to participate in decision-making. A total of 30 URs were set up with farming families, 10 of which were on SPDH, 10 on bio-inputs and 10 on vegetable seeds and seedlings.

Fifteen thematic meetings, field days and

PRESENTATION

workshops were held to share results and articulate research and innovation work with the entire network, with 1,100 people taking part; four national exchanges between the URs, primarily involving young people, to disseminate and exchange knowledge; and two binational exchanges between Brazil and Uruguay, involving farming families and partner organizations, to exchange experiences and improve agroecological transition methodologies.

Fifteen cooperation agreements were also signed with partner organizations, which are linked to the Ecovida Agroecology Network hubs, to contribute to the action-research process, acting directly in the execution and monitoring of local activities. These organizations were defined on the basis of local family collectives, taking into account their links and commitment to the work initiatives being developed.

In addition, the project relied on the collaboration of teaching, research and extension institutions, which work in a qualitative way, contributing with specific actions based on the demands raised by the local collectives of farming families. In total, 12 institutions are linked and cooperating directly in the development of the research, considering the training movement that is taking place and that articulates the set of nuclei of the Ecovida Agroecology Network.

We would like to thank all the people who have been involved in this journey, helping us to take long steps forward in defending agroecology as a project for society and in the collective construction of agroecological knowledge to face the challenges of food security and mitigating the climate emergency. Agroecology is the way!

PRODUCTION AGROÉCOLOGIQUE DE SEMENCES POTAGÈRES

INTRODUCTION

“seeds are the heritage of peoples at the service of humanity¹”. Seed multiplication is the origin of agriculture, more than 10,000 years ago, and it was women in particular who unraveled the mystery of seed germination.

Seeds are fundamental to peasant autonomy, in a context of increasing control of agriculture by large transnational corporations, especially with hybrid and transgenic seeds, which are highly dependent on industrial inputs and pesticides. In addition, Ministry of Agriculture and Livestock Ordinances No. 52, of 2021, and No. 404, of 2022, established that the seeds used must come from agro-ecological production systems, starting in 2029².

The production of agroecological seeds is carried out by guardians and requires different intentions and care, and can be protected and enhanced by a Casa da Semente.

1 - Motto of La Via Campesina International

2 - In the meantime, there are different interpretations (Seeds and Seedlings Working Group)

SEED GUARDIANS AND GUARDIANS

Some individuals can become guardians of an extraordinary biodiversity, such as farmer César Luís and farmer Maria Aparecida Kerber⁴, who maintain around 1,240 varieties of beans and fava beans and 400 varieties of vegetables, in addition to many others of soybeans, rice, corn, green manures, cassava, and forest species. Guardians can take part in collective processes to create new varieties, as happened with the Canhão Contestado pumpkin, to the development of which farmer Celson José Chagas⁵ contributed; and even in dehybridization processes. Or they can carry out "breeding" processes (adapting commercial varieties to local conditions, a process that takes ideally five years), as is the case with agriculturist Silvete Regina Matujaki Koscrevic⁶.

This is often the work of generations, as in the case of farmer Maria das Dores Correa Garcia (Maria das Alegrias⁷, who preserves varieties that have been in her family for decades, some for 100 years.

Photo: José Maria Tardin



César Kerber with part of his seed collection, 2025

INTENTIONS IN THE PRODUCTION OF AGROECOLOGICAL SEEDS⁸

Photo: Milena Leal y Leandro Bortolon



Maria das Alegrias' family has been producing carrot seeds of the Aurélia variety for 28 years, 2024

The seed production requires hard work and dedication. For most species, it takes longer than the production of vegetables for food, and a production cycle can last from 120 days (radish) to 2 years (onion). As the plants grow larger, the spacing of the planting will also have to be wider, taking up more space.

Seeds for multiplication can come from its own source or be exchanged between guardians (or obtained from other reputable and trustworthy suppliers). Where production work is organized collectively, the collection and exchange of seeds can be enhanced at Seed Fairs and Festivals, at Casa da Sementes, and with Peasant Family Groups, Community Associations and Family Farming Cooperatives

3 - Casa da Semente, Núcleo Maurício B. do Amaral (PR)

4 - Núcleo Maria Rosa Anunciação (PR)

5 - Núcleo Maria Rosa Anunciação (PR)

6 - Núcleo Serramar (SC)

7 - Núcleo Serramar (SC)

8 - These guidelines are fundamentally based on slide material prepared by Johannes Georg Rinklin (Hans), from Casa da Semente, for training activities with farmers from the Ecovida Agroecology Network. More information is available at: <https://www.irdin.org.br/site/produtos/9786588468548/MOREIRA,Vladimir.Guia%20pr%C3%A1tico%20para%20a%20produ%C3%A7%C3%A3o%20de%20sementes%20de%20hortali%C3%A7as.Carmo%20da%20Cachoeira:Irдин,2023>



Maria das Alegrias in her purple lettuce seed production field, 2024

a) Suitable weather conditions

As flowering is influenced by temperature and photoperiod, care must be taken to establish seed production fields at suitable times, observing the climate of the region, to avoid losses.

In some species, high temperatures stimulate flowering (as in lettuce and summer plants in general). Other species require low temperatures to form viable seeds; in Brazil, this can be achieved through artificial vernalization (which is done by storing the carrot root or onion bulb in a fridge or cold room for a set number of days) and subsequent replanting in the field.

Seeds are best when there is low humidity at harvest time, especially for species with dry fruits (such as carrots, lettuce, onions, parsley, peas, okra, radishes, brassicas, etc.). In addition, Silvette and Maria das Alegrias follow the biodynamic calendar for choosing the best planting time.

b) Bases for production planning

Seed production occurs through sexual reproduction and differs among self-pollinating, cross-pollinating, and intermediate species.

In self-pollinating plants, the flowers are hermaphroditic, containing both male and female organs at the same time. Pollination is closed, with self-fertilization occurring. This system is rarely altered by the presence of an insect that can bring pollen from another plant. Examples of self-pollinating plants: lettuce, chicory, endive, tomato, pea, potato, green bean, common bean, fava bean, rice, soybean, and wheat.

In cross-pollinating plants, cross-fertilization (or open fertilization) occurs, with the male and female organs being located in different flowers or even plants, and pollination takes

place by insects, other animals or even the wind. Plants with high allogamy are very susceptible to receiving pollen from other varieties of the same species, including hybrid and transgenic cultivars (as is the case with maize), or even from related species (from the same family). Examples of cross-pollinating plants: brassicas (cabbage, cauliflower, leaf cabbage, broccoli, rocket, radish, mustard and others); cucurbits (pumpkins, mongooses, watermelon, cucumber, melon and others); beet, chard, carrots, parsley, cilantro, spinach, passion fruit and others.

We also find the so-called intermediate plants, which have the reproductive structures typical of self-pollinating plants, but reproduction also occurs with frequent allogamy these

these include okra, eggplant, mint and peppers.

This difference requires some care when producing and collecting seeds:

- In self-pollinating plants, due to self-foundation, the genetic base is more evenly distributed throughout the plants, i.e. the genetic difference between plants of the same variety is low. In this way, you can collect seeds from a smaller number of plants (at least 10, if possible) without damaging the genetic diversity of that variety.
- Cross-pollinating plants, on the other hand, typically have a wide genetic diversity due to open pollination, and in order to preserve them properly, it is necessary to collect seeds

from a single plant a large number of plants (over 100, if possible). Furthermore, as cross-pollinating plants present a high risk of unwanted genetic contamination, it is necessary to provide for spatial isolation (distances of 1000 to 1500 m between crop fields) or isolation in time (with a minimum interval of 30 days between plantings). This must be observed when planting different varieties of the same species (for example, when planting a Charleston watermelon and a Fairfax watermelon) and even when planting related species, such as squash, zucchini, strawberries and mangoes, which cross between each other. The same is true of onions and spring onions and brassicas. Planting peppers near chili peppers should be avoided.

c) Selection of mother plants and varietal improvement

Selection can be positive or negative, so we can be right or wrong depending on the procedures we carry out (we can improve or "worsen" a variety). When the field is managed in such a way as to obtain production for consumption and marketing, and at the same time to select matrices for seed production, the possibility of committing negative selection is high, as plants that could potentially become excellent matrices can be harvested early, leaving the worst ones.

Positive selection is the process in which the guardian can visually monitor the plants throughout their entire vegetative cycle, up to maturity

and select those that display the desirable characteristics typical of the species and the respective variety — in terms of color, growth habit and shape, vigor, and flavor; as well as stage of maturity (early, normal, or late), health status, and productivity, among other traits. You can tie colored ribbons to the plants that are being selected, as farmer Erci and farmer Lorita Sonntag⁹. Maria das Alegrias has been selecting her arugula for years so that it flowers as late as possible, and has achieved leaf production for up to eight months.

Matrices should be healthy plants (avoid stunted plants, those with diseases or those damaged by insects), distributed in different parts of the field.

d) Management

Balanced plant nutrition has a direct influence on seed quality, so we must be capricious in properly preparing and managing the soil ecologically, with the use of rock powders (limestone, ba-salt, natural phosphate), green manures, organic composts, biofertilizers in the soil and in composting microorganisms,

isolated or in communities. Dried fruit species have a longer development cycle compared to food crops, so top dressing is necessary.

Protection against insects and diseases and plant control and management are also essential spontaneous, so as not to contaminate the harvested seeds. Irrigation is important for

filling the seeds in regions with low rainfall, and preference should be given to drip irrigation, which reduces the possibility of disease outbreaks.

Some guardians plant their seed in Agroforestry Systems, such as farmers Israel Guilherme da Silva and José Luiz da Silva and farmer Leila Maria Rita¹⁰. Maria das Alegrias learned from her ancestors not to cover the carrot seeds with soil when sowing them, thus subjecting the variety to a first natural process of pa-selection to obtain more resistant plants.

Many species require specific management, such as tutoring (beans and tomatoes, among others), the use of techniques for flower induction (as in cabbage and iceberg lettuce), de-sprouting (in the solanaceae family) or weeding (as in broccoli).

Harvesting should be done at the point of physiological ripeness, which is easier to identify in fleshy fruit (by the change in color/appearance of the fruit). These need to rest for between 7 and 21 days before the seeds are removed. For dried fruit species, you need to know the recommended point¹¹.

Casa da Semente

The production and marketing of semen individually, in isolation, can be quite difficult, and there is also the possibility of losses due to a lack of suitable storage conditions. Casa da Sementes exist to support the guardians in their work.

The Casa da Semente Assemente, located in Mandirituba (PR), has existed since 2016. As well as being the result of the organizational processes of the agroecological seed guardians of southern Brazil, it also contributes to the qualification of the seed production process and its organization within and outside the Ecovida Agroecology Network. It is part of the effort to set up an Agroecological Seed Network of solidarity exchanges between family farmers. As the technician Hans explains, in this way each farmer doesn't have to produce seeds of every species, but simply circulate the seeds from where they produce best.

The House carries out the work of receiving, identifying, cleaning, measuring humidity and germination tests, as well as storing in controlled temperature and humidity conditions, in a cold room, which ensures the quality of germination and vigor for a long period. Only vegetable seeds with a germination rate of over 70% are made available. Purity is improving all the time again,

Photo: Casa da Semente



Seed cleaning machine. Casa da Semente, 2025

11 - This and more detailed information can be found at: <https://comunidadefigueira.org.br/pt-br/guia-pratico-de-sementes-de-hortalicas>

10 - Maria Rosa Anunciação (PR)

especially with the construction of a ventilation column machine for cleaning and sorting vegetable seeds, an innovation provided by the Innova Ecovida project. This machine separates impurities such as straw, sticks and pebbles, as well as sorting seeds into different sizes. The Casa team has also been working in partnership with Embrapa to develop a process for pelleting seeds, with the aim of making them larger to improve sowing efficiency.

Assemente also provides technical assistance to seed guardians in the planning and continuous improvement of their agroecolo-

gical seed production systems, as well as legal support. In order to legitimize themselves in the collective process of seed production as guardians, farmers need to undergo an initial training course.

It also promotes the great work that the guardians do, as well as offering seeds to interested people who can buy them by visiting its headquarters directly, at Fairs and Seed Festivals where the House is present, at other events or through social networks. The availability of the varieties throughout the year can be found on the As-seed website (<https://www.assemente.org.br/jobs>).

CHALLENGES

There is still a great deal of resistance among the farmers of the Ecovida Agroecology Network to using seeds that are not produced by large companies. With the extension of the deadlines for demanding agroecological seeds, demand has been lower than expected to try to overcome this barrier,

both Casa da Semente and the guardians of Núcleo Serramar have been donating samples for experimentation by farmers, and in most cases the response has been satisfaction with the germination rate, vigor and resistance to disease.

COOPERATION

Seed guardians hold a wealth of knowledge, passed down from generation to generation, which needs to be highlighted through *Camponês a Camponesa / Camponesa a Camponês*-CaC processes, in order to expand the seed production and exchange network.

The Casa da Semente is a concrete reference that encourages and guides better cooperation between the guardians, strengthening their practical ties through organized seed exchanges, and providing opportunities for exchanges through meetings, courses, seminars, fairs and festivals, strengthening CaC relations, in an innovative process created and led by the peasants themselves.

To mediate between the groups and the Casa da Semente, each Nucleus of the Network can

organize a basic structure for cooperative work, with a fridge, computer, moisture meter, scales, etc. It is also recommended that a financial fund be set up, using the Ecovida Agroecology Network's own resources, to cover the cost of producing seeds and seedlings¹².

Cooperatives can also support guardians by setting up agro-ecological seedling nurseries to use their seed production, as Cooperfamília¹³ is doing, thus closing the production loop. Or you could buy machines suitable for harvesting different species (for example, the YH880), like the Cooperativa Mista Origem Camponesa¹⁴.

Finally, the nuclei could structure a large-scale variety testing program for agronomic evaluation and possible local seed reproduction.

12 - Meeting of Seeds and Seedlings of the Ecovida Network, Mandirituba (PR), April 2025.

13 - Núcleo Serramar (SC)

14 - Núcleo Vale do Rio Pardo (RS)



AGROECOLOGICAL PRODUCTION OF VEGETABLE SEEDLINGS

INTRODUCTION

Since the dawn of agriculture, peasants have been producing their own seedlings, using local materials and a lot of creativity. In market gardening, however, many depend on buying seedlings on the market, mainly due to the limited availability of labor. The vast majority of commercial nurseries don't produce organic or agroecological seedlings, and they also deliver conventional seedlings that are of poor quality, too young or past their prime, untraceable and expensive.

Ministry of Agriculture and Livestock (MAPA) Ordinance No. 52 of 2021 established that "vegetable seedlings obtained from seeds may only be produced in organic production systems". The deadline for this requirement has been extended, but as of May 2026, the mandatory percentage of certified seedlings should return, although it is not yet known whether the count will return to 40% or 60%¹. In this way, the production of seedlings is an important and urgent issue for peasant autonomy.

¹ - Seeds and Seedlings WG of the Ecovida Agroecology Network

STEP BY STEP

a) Location and construction of the nursery

The nursery should be set up on flat ground or with a slight slope (1%) and with easy access to water. It should be well exposed to the sun and away from shady trees. However, it is important to consider installing windbreaks in places where it is very windy, as this can cause serious damage to the nursery.

The ceiling height needs to be at least 3 m to dissipate heat. In regions with cold climates, there should also be side tarpaulins. If possible, install anti-aphid screens on the sides to prevent insects and birds. The plastic of the roof needs to be cleaned periodically to allow sunlight through.

Photo : Alimentaria

Photo : José Maria Tardin



Different nursery models: with open sides - Alimentaria seedling nursery, 2024 and with closed sides, Scheer family, 2025

Photo: Elvis H. Camargo



Adequate root and shoot development. Viveiro Alimentaria, 2024

b) Substrate

A good substrate needs to meet the requirements of drainage, aeration, density and minimize the leaching of nutrients during the process, with the plant developing both the aerial part and the roots well.

Currently, there is no certified substrate available on the market for organic production. Some experiments have been carried out with commercial substrates that do not contain contaminants. You need to pay attention to the composition, as most have vermiculite, which is harmful to the development of cauliflower and broccoli, in which case you need to mix it with some other material, such as peat-based soil conditioners (in a ratio of one part peat to two parts substrate), as farmer and technician Gustavo Scheer². Another option is to mix commercial bokashi substrate and basalt powder (preferably in talcum form, as this makes nutrients available more quickly) in a ratio of 6:2:1, moistening everything with 10% biofertiliser, as done by farmers from the Cerro Alegre and Mulheres Camponesas Unidas pelo Trabalho groups³.

In the experience of farmer and biologist Elvis Has-mann de Camargo⁴, a good substrate can be

2 - Núcleo Sul (RS)

3 - Núcleo Planalto Serrano (SC)

4 - Núcleo Peroba Rosa (PR)

produced in the agro-ecosystem itself with the following ingredients:

- 40% compost based on tree branches
- 25% crushed dry ruminant manure
- 25% charred rice straw (which can be replaced with charred pine wood or coconut fiber)
- 5% charcoal powder
- 1% dolomitic limestone
- 2% rock dust or bone meal
- 1% bokashi or castor bean cake
- 1% wood ash (washed)

The first stage consists of composting tree pruning material and Napier grass. The presence of gongolos (also known as snake lice, which are diplopods of various species) allows for the use of materials with a high C:N ratio and good end product quality. The material must be kept moist, but does not need to be turned⁵, taking 45 to 90 days to be ready, and can be inoculated with 1% Efficient Microorganisms (EM) to speed up the process. It is then passed through the forage grinder to be crushed and then sieved. The result is best when using a mixture of 60% compost sieved through a 2.2 mm mesh and 40% through a 3.7 mm mesh.

In a second step, all the ingredients are mixed well in the recommended proportion (for larger quantities, the use of a mixer is recommended). Washed ash is obtained by mixing equal parts of ash and water and letting the mixture decant, then discarding the water. If you don't use bokashi, inoculate with 1% MS. The material then goes through a second com-posting and stabilization period. The finished substrate is stored in bags. Lettuce seedlings, being more sensitive, are a good parameter for testing the final composition of the substrate, as Elvis points out.

The Terra Livre Nursery, run by the Terra Li-vre6 Cooperative, is developing experiments to produce its own substrate on a larger scale, based on compost from pulp industry waste (certified by Ecocert).

There is also an influence of seasonality on the mineralization of organic matter, which means that salinization of the substrate can easily occur in summer, while in winter there is a slower release of nutrients.

Photo: José Maria Tardin



c) Trays

There are various types of trays for seedlings, made of plastic or Styrofoam (expanded polystyrene), and they can be disposable or returnable; there are also those made of biodegradable material. Returnable containers need to be thoroughly disinfected every time they are planted, as they can transmit diseases. This can be done with bleach⁷, MS (both at 10%) or ash and lime⁸, leaving them to dry in the sun (work-tops can be cleaned in the same way).

The number of cells in each tray also varies (the more cells, the smaller the volume of substrate available for each seedling). The trays need to have a maximum of 200 cells (with 11 cm³ of substrate per cell⁹) for faster-cycling plants such as lettuce, beet, parsley, spring onions and leeks, and 128 cells (20 cm³ of substrate per cell) for other species. The 128-cell trays produce more robust seedlings that tolerate with a

Trays of different sizes and materials. Cerro Alegre Groups and Mulheres Camponesas Unidas pelo Trabalho [Peasant Women United for Work], 2025

5 - CORREIA, M. E. F.; ANTUNES, L. F. de S. Gongocomposto: uma alternativa de substrato orgânico na produção de mudas de hortaliças. Technical Communication 149. Seropédica: Embrapa, 2021.

6 - Núcleo Maria Rosa Anunciação (PR)

2 - Núcleo Sul (RS)

8 - Núcleo Peroba Rosa (PR)

9 - Volumes vary according to the manufacturer.

short time frame of a few days to be planted in the field, and also suitable for the No-tillage Vegetable Production System (SPDH). The 64-cell ones (with 40 cm³ per cell) are being tested for solanaceae and brassicas in SPDH¹⁰. For tomato seedlings, planting in tubes (with 55 cm³ of substrate) has shown a very significant positive difference, both for the roots and the aerial part¹¹. This is due to the proportionality between the aerial part and the root system, which should be close to 1:1, as well as favoring the root structure of the species (pivoting or fasciculated)¹²

However, the lower the number of cells, the lower the number of cells the higher the substrate consumption and the more space it takes up in the nursery, impacting on the cost per seedling.

In trays with more cells (over 128-200), the volume of substrate is too small, and the seedlings don't develop a proper root system and are more susceptible to disease attack.

When filling the trays, it is important not to fill them to the brim to make the first watering easier, nor to knock them "to settle", as this promotes compaction of the substrate, as technician Adilson Rech¹³ points out.

Photos: José Maria Tardin

d) Sowing

Agroecological seeds should preferably be used (consult Casa da Semente, Bio-natur and nuclei with seed guardians, such as Serramar).

For larger-scale production, there are manual seed drills, which allow you to easily and quickly sow just one seed in the center of each cell, with the size of the opening adapted to each species. There is also the cradle marker, which allows you to sow at a uniform depth.

The substrate must be moistened before being placed in the trays. The seeded trays should be covered with thick plastic to maintain humidity and temperature (in cold regions, a germination chamber with an air-conditioned temperature of between 24 and 26°C may be necessary) and can be stacked. Observe daily and, at the first sign of emergence (emission of the radicle), remove the plastic and arrange on the benches in the nursery.

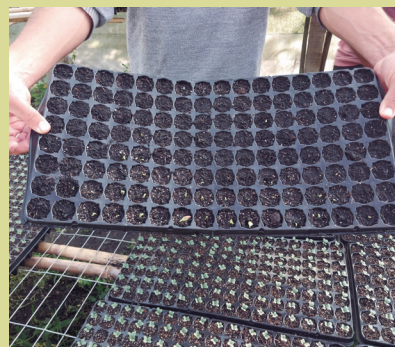


Manual seeder and cradle marker, Scheer family, 2025

Sown and identified trays, covered with plastic, in the germination chamber of the Terra Livre Nursery, Cooperativa Terra Livre, 2025



Tray with the newly emerged seedlings, brought from the germination chamber to the nursery. Scheer family, 2025



e) Seedling nutrition

The substrate does not contain enough nutrients for the seedlings to develop fully, so supplementary top dressing (solid or liquid) is necessary. This is because a substrate that is less concentrated in nutrients favors germination, while one that is more concentrated will hinder it.

Completion also needs to be done due to

leaching from irrigation (N, K, Ca, B, S and Mg are the most leached elements), and according to the needs of each species. Leafy plants are very sensitive to excess nutrients, especially nitrogen, which causes excessive leaf development, competition for light in the trays and consequent stunting (when the seedlings become too tall, thin and fragile). Now brassicas and tomatoes,

10 - Núcleo Planalto Serrano (SC)

11 - Núcleo Planalto Serrano (SC), Núcleo Alto Uruguay (RS) (SPDH)

12 - FAYAD, Jamil. A.; ARL, Valdemar; COMIN, Jucinei.J.; MAFRA, Álvaro L.; MARCHESI, Darlan R. (2019). Vegetable no-tillage production systems: Method of transition to a new mode of production. São Paulo: Expressão Popular, 2019, pp. 244-246.

13 - Núcleo Planalto Serrano (SC).

because they stay in the nursery for longer, need more nutrients during their development.

At the Terra Livre Cooperative nursery, this is done by sprinkling castor bean cake on top of the trays (on average 30g/tray). Elvis, on the other hand, uses a set of biofertilizers¹⁴:

- Ash and lime slurry (provides K; Ca; Mg and micronutrients) at 1 or 2%
- Liquid humus (provides macro and micro-nutrients)
- Aerobic fermentation of vegetable waste, with sugarcane molasses, wood ash, thermophosphate and Efficient Microorganisms (provides N; P; S and micronutrients) at 10%

- Acetic extract of bone or eggshell, from Korean Natural Farming-KNF (provides Ca; Mg; P and micronutrients) at 1 or 2%

- Propolis extract (provides micronutrients¹⁵) at 0.1%

- 10% milk

It is advisable to increase the oxygenation of the fermented biofertilizer by installing an electric aerator in the drum (it can be an aquarium aerator) to prevent denitrification (loss of N in the form of gas). Fermented biofertilizers tend to promote acidification, so it is advisable to use ash and lime mixture (prepared with hydrated virgin lime) afterwards to correct the pH.

f) Irrigation

The trays should be irrigated with very fine droplets, so as not to remove the substrate. Experience has shown that manual watering (hose with appropriate irrigation shower, preferably

metal) is more efficient, as there is an edge effect in the trays: the edges lose more water than the center, requiring a different application of water.



Photo: José Maria Tardin

g) Plant health

Vegetable seedlings can be attacked by mites, aphids (thrips), mealybugs, cowflies, caterpillars and mosquitoes known as fungus gnats (families Mycetophilidae, Keroplatidae and Sárídae), especially in summer, when humidity and temperature conditions are more favorable. Elvis uses 1% hydroalcoholic extracts of plants such as citronella, eucalyptus, rosemary, garlic, cloves, neem, pepper, mustard and lavender, among others. These extracts contain repellent substances such as terpenes, growth inhibitors and anti-nutritional compounds such as tannins, lectins and phytates. The homeopathic Staphysagria CH 6 for spider mites and aphids is also used.

The main diseases that usually occur are mildew, cercosporiosis and damping off (caused by fungi), which, when severe, require the nursery to be emptied and disinfected. It's about preventing the onset of disease, because once you've been affected and have symptoms, it's very difficult to recover the seedlings.

¹⁴ - Some of these and other recipes can be found at: <https://www.gov.br/agricultura/pt-br/assuntos/sustentabilidade/organicos/fichas-agroecologicas>

¹⁵ - PEREIRA, Daniel S. Classificação quanto a cor e composição de micronutrientes da própolis do leste Potiguar. In: Proceedings of the VI Bahia Beekeeping and Meliponi Culture Congress, III Brazilian Propolis and Pollen Seminar, VIII Northeast Propolis Seminar. Sectorial Chamber of Beekeeping and Meliponiculture of the State of Bahia. Ilhéus (BA): Executive Commission of the Cocoa Farming Plan, 2015, pp. 41-43

For this reason, well-balanced nutrition is essential to avoid susceptible plants.

As a preventative measure, Elvis mainly uses homeopathy, preparing nosodes from diseased plants that eventually appear (make the mother tincture and then dynamize it to 06 CH), applying 0.1% weekly. Other homeopathics is used to improve the health of the plants:

- Carbo vegetabilis CH 6 (vigor)
- Arnica montana CH 6 (stress)
- Calcarea carbonica CH 6 (vigor)
- Silicia CH 6 (strength and endurance)

Propolis extract also has an effect on diseases. You must always alternate forms of control to avoid the development of resistance in the insects and microorganisms that cause disease.

h) Growing other species

To make nurseries economically viable, it can be interesting to combine the production of seedlings of other species, such as passion fruit, aromatic and medicinal plants, ornamentals, etc. In this case, you need to take great care with sanitation to avoid the transmission of diseases.

A good substrate for medicinal plants (and others grown in plastic bags) can be made with % carbonized rice husk, ¼ coconut fibre, % forest soil and ¼ earthworm humus, adding a little basalt powder, according to the experience of Diva and Fábio Deitos¹⁷.

Another homemade substrate can be made by mixing 20% carbonized rice husk, 20% coconut fibre, 10% dried and ground cattle manure, 50% forest soil and a handful of basalt powder, according to the experience of Carmem da Rosa Kilian Munarini¹⁸.

Photo: José Maria Tardin



Community nursery that plants seedlings of various species, from vegetables to ornamental, medicinal and native essences, Grupo Vó Elsa¹⁶, 2025

CHALLENGES

As with all branches of agroecological production, seedling production requires observing the ecological conditions of the region, requiring experiments and adaptations to arrive at an appropriate technical route. For example, in cold climate regions, during periods of high cloud cover, which can last for many days, the seedlings will need much more time to develop due to the low solar radiation. In this type of environment, mildew also tends to be difficult to control.

The granting of a longer deadline for compliance with MAPA Ordinance No. 52 resulted in little

interest in the purchase of agroecological seedlings, having a very negative impact on some nurseries that were already producing.

The logistics required to deliver the seedlings is another challenge, as the trays take up a lot of volume and transportation over long distances may not be worthwhile compared to large commercial nurseries.

Finally, the availability of agro-ecological seeds is still insufficient to meet the demand for seedling production, and there is a need to work together on these two fronts.

16 - Núcleo Oeste Catarinense (SC)

17 - Núcleo Oeste Catarinense (SC)

18 - Núcleo Oeste Catarinense (SC)

COOPERATION

Cooperation takes place in multiple ways between families, one of its historical forms being the sharing and exchange of seedlings of all kinds of plants. It is practiced prominently by women farmers in the most varied opportunities in which they find themselves. Each seedling shared in solidarity provides dialogues and exchanges of knowledge from Camponesa a Camponês/de Camponês a Camponesa- CaC and protects and ensures agrobio-diversity. Cooperation is the fertile soil on which the Ecovida Agroecology Network is based:

a) Cooperatives and associations can take on the task of producing the seedlings, as is the case with the Terra Livre Cooperative, paying one or more people especially for this work; and use their structure to acquire inputs, produce agroecological substrate on a large scale and get the seedlings to the cooperative members.

b) The groups can carry out the seedling production process collectively and self-managed, organizing

joint efforts to prepare the soil substrate, filling the trays and sowing, with a family responsible for the daily activities of watering and monitoring the health of the seedlings - as is the case with the Cerro Alegre and Mulheres Unidas pelo Trabalho¹⁹ groups, and Vó Elsa.

c) It is even possible that the purpose of the nursery is not to sell the seedlings, but to be part of a mobilization and coexistence strategy, as is the case with the Vó Elsa Group, made up of peasant women. This group organizes its nursery from the perspective of traditional peasant cooperation and mutual aid, according to the working time capacities of each member (also taking into account the work demands of each family in their agro-ecosystem), with equal access to seedlings, according to the needs of each peasant. This nursery is also integrated with the work of the Pitanga Rosa Association, made up of peasant women who collectively carry out volunteer work in popular health.



Photo: José Maria Tardin

Farmers from the Cerro Alegre and Mulheres Unidas pelo Trabalho groups at a meeting on the organization of the nursery, 2025

19 - Núcleo Planalto Serrano (SC)

PRODUCTION OF BIO-INPUTS BY AGROECOLOGICAL PEASANT AGRICULTURE

INTRODUCTION

The Brazilian legislation considers bio-inputs to be products, processes or technologies originating from living organisms and used in animal and plant production, storage and processing¹. Bio-inputs may seem recent, but their use by peasants goes back a long way.

The use of medicinal and aromatic plants in syrups and other preparations, for example, is lost in human history. Homeopathy began to be applied to plants and animals in the early 1900².

In the 1980s, the use of *Baculovirus anticarsia* to control the soybean caterpillar (*An-ticarsia gemmatilis*), developed from Embrapa research, became widespread in Brazil. *Baállus thuringiensis* (BT), which has been known for over 100 years, has also been widely used in agroecological family farming, but was later appropriated by transnational corporations and even genetically manipulated in the production of transgenic corn.

There have also been various experiments in the production of fermented biofertilizers by peasant farmers from communities of microorganisms, most notably the "Super Magro" - Ecological Center (RS) in the early 1990s, which stimulated creativity and innovation in the production of various local adaptations. Another initiative, developed by the Mokití Okada Foundation, was the technique for capturing and multiplying Efficient Microorganisms from leaf litter.

1 - BRAZIL. Ministry of Agriculture, Livestock and Supply. Decree No. 10.375, of May 26, 2020. Establishes the National BioInsumables Program and the Strategic Council of the National BioInsumables Program. Federal Official Gazette. May 27, 2020, p. 105-106.

2 - ANDRADE, Fernanda M. C. de et CASALI, Vicente W. D. Homeopatia, agroecologia e sustentabilidade. Brazilian Journal of Agroecology, 2011, vol. 6, n. 1, pp. 49-56.

Transnational companies and agribusiness entrepreneurs have an interest in restricting family farming's mastery of these processes, in order to keep it dependent on the market and without autonomy. However, Federal Law No. 15.070 of 2024 guarantees the right to produce and reproduce on one's own agricultural unit (production *On-farm*),

either individually or collectively (by associations and cooperatives), as long as there is no marketing.

At the Ecovida Agroecology Network, with the support of the Innova Ecovida Project, experiments have been carried out with microbial isolates, microbiological communities, homeopathy and plant extracts.

PRODUCTION OF MICROBIAL ISOLATES

The installation of a reproduction unit for microbial isolates ("Biofactory") is done by hiring a specialized company, preferably from peasant agriculture, such as Bioforte³. A masonry room of at least 6m² is needed, plus a room for storing materials, with a fridge. The floor must be washable, with a drain for the water to run off. If possible, we recommend covering the room with isothermal panels (like those used in cold rooms), which can be reused. This will allow for better temperature control. Microorganisms can be multiplied in solid media (more suitable for fungi) or liquid media (for fungi and bacteria), the latter being the most common in peasant units.

Multiplication in liquid media is carried out in bioreactors, which are nothing more than 20 to 200 L drums arranged on a simple bench. Each bioreactor has an aerator, made up of a structure of PVC pipes with micro-holes, and the air is captured from outside the production chamber by an air compressor. After being properly sanitized with specific products, the reactors are filled with a solution of culture medium, which is the food for the microorganisms. Finally, the mother culture is added, as if they were "seeds" of the microorganism to be multiplied. Temperature, pH and foam production must be strictly controlled. To keep the temperature at around 32 °C for bacteria, and between 25 and 26 °C for fungi, you can use an air conditioner that has both cold and hot functions. Farmer and technician Ronaldo Ferro⁴ adapted an air conditioner by splicing the wires of the reading sensor's harness and positioning it on the base of a bioreactor, thus obtaining a more precise temperature reading and consequently greater control.

Photo: José Maria Tardin



Bioreactor with aerator at the bottom.
Mãos na Terra [Hands on Earth] Group⁵, 2025

3 - Planalto Nucleus (RS)

4 - Planalto Nucleus (RS)

5 - Planalto Nucleus (RS)

One problem with small-scale multiplication is the risk of contamination by other unwanted species, which can lead to a loss of efficiency in the final product. To avoid it, you need to take great care with cleanliness, handle the mother culture flasks carefully and always keep them tightly closed, as well as the packaging of the culture medium. As additional protection, Ronaldo installed a UV-C lamp (ultraviolet germicide) inside the breeding chamber, and another inside the air duct, where he also attached an ozone generator, another powerful germicide. In addition, the farmer and technician Flávia Comiran and the farmer and technician Jean Christian Boukouna⁶ fitted taps to the lower part of the bioreactors so that they could remove and fill the multiplies without having to open the top lid. They also plan to subdivide the internal space of the production unit to create a separate area for changing clothes and shoes, further reducing the risk of contamination.

While viruses act on specific species, bacteria have an intermediate specificity. Fungi, on the other hand, are broad-spectrum (and should therefore be applied with care, as they also act on beneficial insects such as bees). Microorganisms can be used^{7 8 9}, for example, in the control of disease-causing fungi (*Trichoderma spp.*), insects and mites (*Metarhizium anisopliae*, *Beauveria bassiana*, *Chromobacterium subtsugae*), bacterial diseases and nematodes (*Bacillus amyloliquefaciens*), for the formation of a protective biofilm (*Bacillus subtilis*), growth promotion (*Bacillus pumilus*), atmospheric nitrogen fixation in grasses (*Azospirillum brasilense*), phosphorus solubilization (*Bacillus megaterium*), prevention of water stress (*Bacillus aryabhattai*), among other uses. As farmer Marcos Mosquer¹⁰ reminds us, you can mix different strains of bacteria in the same application, as well as different species of fungi, but you shouldn't mix fungi with bacteria. *Trichoderma* should be applied separately.

The isolates can be applied to practically any crop, with good results. Noteworthy is the control of *Botrytis cinerea* in strawberry plants through the combined use of *Bacillus subtilis*, *B. amyloliquefaciens*, and *B. pumilus*, applied alternately with *Trichoderma spp.*; as well as the control of the two-spotted spider mite (*Tetranychus urticae*) through the combined use of *Metarhizium anisopliae* and *Beauveria bassiana*. This

results in the production of large, less acidic fruit without "mid-skirt" even in winter¹¹.

A surprising result was obtained by the technician and farmer Ariel Bonadiman¹² with the application of *Beauveria bassiana* for tick control in dairy cattle, during a severe infestation in a picketed area. Three applications were made, according to the tick's life cycle (at 14 days and 21 days after the first application), spraying the cows and the "collective" areas: milking parlor, corridors and rest areas around the drinking troughs. As well as successful tick control, there was also control of the horn fly, the house fly and the pasture leafhopper. It should be noted that, during this same period, infestations of both ticks and leafhoppers were out of control in conventional production systems due to favorable weather conditions.

The cost of setting up a reproduction unit, depending on capacity, is around BRL 20.000,00. For production on a very small scale, of a more didactic nature, such as at the Escola Família Agrícola da Região Sul (Efasul),¹³ a used refrigerator was adapted to serve as a cold room, inside which an 80-liter bioreactor was installed.

Once ready, biologics should be filled into clean, dry containers and used as soon as possible for maximum efficiency. If necessary, they can be stored in a refrigerated environment between 5 and 10 °C and used within 15 days. Shelf life can be extended under more strictly controlled conditions in the most technologically advanced biofactories. Another relatively simple way is to add preservatives, which make it possible to transport it to places further away from the biofactory, increasing families' confidence in its use.

Indications for use vary from 2 L/ha (on grain crops) to 5 L/ha (on fruit trees). For small areas, such as vegetables, you can use 15 ml/L of water in the backpack sprayer. For *Chromobacterium sp.*, double the dosage should be used. The multiplies can also be used to spray the seeds when planting.

As Ronaldo points out, the microbiological isolates are intended to solve specific problems, such as insect attacks and the occurrence of diseases. In order to improve soil quality and the health of the agro-ecosystem in general, the use of microbial communities is recommended, which are also more affordable to produce.

7 - MONNERAT, Rose et alii. Manual for the production and quality control of biological products based on bacteria of the genus *Bacillus* for use in agriculture. Brasília (DF): Embrapa Genetic Resources and Biotechnology, 2020.

8 - IWANICKI, Natasha S.; JUNIOR, Italo D. Panorama dos bioinsumos no Brasil e no mundo. Visão agrícola, 2025, n. 15, pp. 10-14.

9 - ECOLOGICAL CENTER, Econativa, Ecovida Agroecology Network. Biofertilizantes na agroecologia: Uma inovação de origem ancestral. Ipê (RS): out. 2024.

10 - Serra Gaúcha Center (RS)

11 - Serra Gaúcha Center (RS)

12 - Núcleo Alto Vale Rio do Peixe (SC)

13 - Núcleo Sul (RS)

COMMUNITIES OF MICROORGANISMS

Photo: José Maria Tardin



Aerator with washing machine motor, in a water tank, to reproduce communities of microorganisms, on the Marcos Mosquer site, 2025

The reproduction of microbial communities (colonies of microorganisms) does not involve so many risks of contamination, and the unit can be installed in a simpler environment (an old stable or chicken coop, for example).

For the preparation of community fermentates, an aeration system can also be used in the bioreactors (usually 200 L drums), in order to avoid the denitrification (loss of N to the air) that occurs in anaerobic environments. However, aeration is not constant, as in the production of isolates, but is regulated by a timer, with the compressor running for an hour and then switching off for an hour. Farmer Marcos Mosquer¹⁴ adapted a washing machine motor for this purpose.

It can be done with Efficient Microorganisms captured in the leaf litter, with fresh cattle manure as an inoculant or with the microorganisms present in the environment and which naturally establish

themselves in the nutrient mixture, which can contain wheat bran, whey and cane molasses, among others. Macro and micronutrients are usually added, as in supermagro, and there are specific recipes for each crop.

In addition to the traditional system of capturing EM with rice cooked in the forest itself, farmer and technician Flávia Comiran¹⁵ is experimenting with capturing them from forest soil and leaf litter collected in a container and stored in a protected place (inside the shed, for example), so that they can colonize the rice, and has had initial success with this practice.

It is also possible to produce various types of fermented biofertilizers based on microbial communities undergoing anaerobic processes (without aeration), such as the “sopão” (or “creole ferment”¹⁶) produced by farmers supported by the Centro Ecológico¹⁷.

Foto: José Maria Tardin



Efficient microorganisms captured with cooked rice by Flávia Comiran; on the left, left in a bamboo thicket; on the right, with soil and leaf litter collected in a container, 2025

14 - Serra Gaúcha Center (RS)

15 - Núcleo Alto Uruguai (RS)

16 - For recipes for the biofertilizers mentioned in this text, see: <https://centroecologico.org.br/cartilhas-e-manuais/20>

17 - Serra Gaúcha Center (RS)

HOMEOPATHY

In agro-ecosystems, one can resort to the use of homeopathic preparations by analogy with those used in human therapeutics. For example, *Nux vomica* is often used to detoxify non-agroecological seeds and seedlings. Or you can prepare nosodes from the very insects and diseases that are damaging the crops.

A homeopathic compound has been tested for a problem that is very difficult to deal with in agroecology: the leaf-cutting ant (*Atta sp*). Developed by FLD project advisor Valdeilson de Almeida¹⁸, it is prepared by mixing a nosode and two medicines that can be ordered from homeopathic pharmacies, as described below.

- Toasted Ant Nosode 6 CH - the mother tincture being prepared with ants collected from various anthills and toasted in the greenhouse (or in the oven) in aluminum foil;

- Belladonna 30 CH

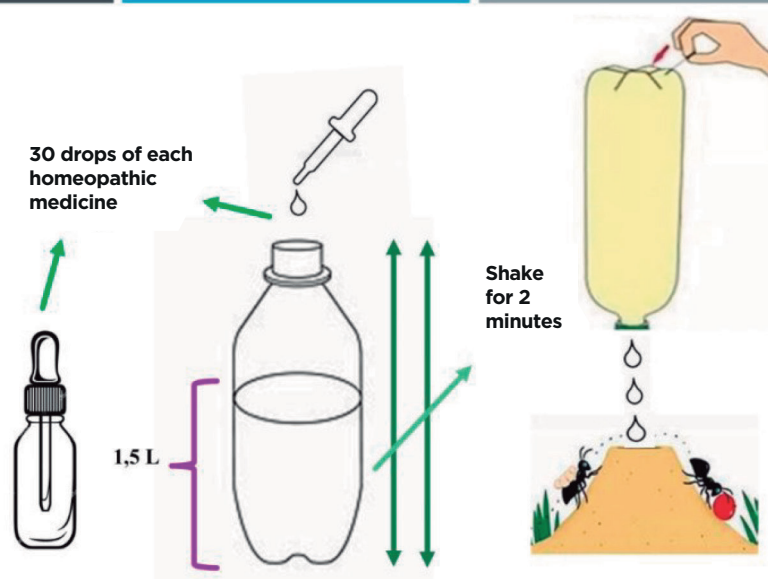
- Apis mellifera 200 CH

Drip 30 drops of each preparation into 1.5 L of water in a 2 L PET bottle, shaking well (vertically) for 2 minutes. Then pierce the top and bottom of the bottle with a needle and hang it over the anthill's main scout. It is important to note that compost reduces aggression and foraging, but does not kill ants and can act as a complement to other forms of ecological management in controlling them.

The FLD, through the CAPA Agroecology Program, has promoted training in homeopathy and has made very complete homeopathic apothecaries available to technical teams, farmers, and even has a dynamizing machine in its office¹⁹.

How to prepare and use homeopathic compost for leaf-cutting ant management

How to use:



Prepared by: Valdeilson Almeida

¹⁸ - Núcleo Oeste (PR)
¹⁹ - Santa Cruz do Sul office (RS)

PLANT EXTRACTS

The medicinal and aromatic plants have long been used to protect crops and post-harvest, to control insects and bacterial and fungal diseases, using various formulations: hydroalcoholic extracts, macerated syrups, dried plant powder, etc. More recently, distillation has also been carried out to obtain essential oils and hydrosols (also called aromatic waters), as occurs, for example, in the groups of the Association of Small Farmers of Western Santa Catarina (APACO)²⁰

APACO's technical team carried out a survey of the potential agricultural use of medicinal plants²¹. Noteworthy are alecrim-de-tabuleiro (*Lippia grata*), which contains compounds with acaricidal, insecticidal, fungicidal, and even herbicidal properties; and *Melaleuca alternifolia*), whose essential oil exhibits

strong fungicidal activity. Other plants with fungicidal properties include: *oregano* (*Origanum vulgare*), lemon eucalyptus (*Eucalyptus citriodora*), citronella (*Cymbopogon nardus*), sage (*Salvia officinalis*), lemongrass (*Cymbopogon citratus*), marjoram (*Origanum majorana*), coriander (*Coriandrum sativum*), ylang-ylang or cananga (*Cananga odorata*), mentrasto or billygoat weed (*Ageratum conyzoides*), turmeric rhizomes (*Curcuma longa*), and Brazilian lemon balm (*Lippia alba*).

Farmers also use Brazilian peppertree (*Schinus terebinthifolius*) and erva-baleeira (*Varroinia curassavica*) as fungicides; rosemary (*Rosmarinus officinalis*), erva-baleeira, and garlic as bactericides; and peppers in general and tansy (*Tanacetum vulgare*) as insecticides.

CHALLENGES

As this is a more recent process in peasant agriculture, the shared production of microbiological isolates presents some challenges. Its multiplication and application require technical knowledge with rigorous training, combined with practical peasant experience, in a learning process that can take time, with the possibility of losses of multiples, which can have a financial impact. The implementation and operation of small units, despite the possibility of adapting to a smaller scale and of the cost of reusing

materials can still be unaffordable for peasant farmers if there aren't appropriate lines of financing and technical assistance programs.

The search for partnerships in universities is important to increasingly qualify the production of bio-inputs in general. For example, there is already an initiative to research the microbiological and metabolic composition of microbial community multiplicates²².

COOPERATION

Supported by the resources of the In-nova Ecovida Project, cooperation has boosted innovation and knowledge generation capacities, energizing the Camponês a Camponesa/Camponesa a Camponês-CaC processes:

a) the reproduction of isolated microorganisms as an unprecedented feat, which required a great deal of study, creativity and inventiveness in planning, various adjustments to facilities and equipment, achieving results of excellence in the basic structural design of a Microorganism Reproduction Unit and the quality of the final products;

b) the collection of communities of microorganisms in local environments and their reproduction, with the potentialization of reproduction systems that were already being practiced and their diversification;

c) the qualification of knowledge and facilities and equipment for the extraction of essential oils and hydrosols, opening up a new field of agro-ecological experimentation;

d) the dynamization of training processes in homeopathy for agriculture and livestock, with the creative development of homeopathic preparations according to local needs.

21 - ABREU, Lucilene; BORSUK, Luis Carlos; MUNARINI, Anderson; DEITOS, Diva Vani. Usos de Plantas Medicinais, Hidrolatos e Óleos Essenciais na Agricultura. Chapecó, 2025 (mimeo)

20 - Núcleo Oeste Catarinense (SC)

22 - Núcleo Luta Camponesa (PR)

NO-TILLAGE VEGETABLE PRODUCTION SYSTEM (SPDH)

WHAT IS IT?

The SPDH is a system developed by researchers from the Agricultural Research and Rural Extension Company of Santa Catarina (Epagri) for planting vegetables and other crops, including grains and fruit trees, even in Agroforestry Systems (in which case it is called SPDH+), on the green phytomass of a previous planting (cover crops, being green manures or spontaneous plants), with soil disturbance restricted to the planting lines. The SPDH has a technical-scientific axis and a political-pedagogical axis and can be configured as a transition system from conventional agriculture to agroecology or contribute to qualifying production in agroecological systems.



SPDH with brassicas, farmer and technician Alex Sandro Souza¹, 2025

1 - Núcleo Maria Rosa Anunciação (PR)

FUNDAMENTAL BASES OF SPDH² IN AGROECOLOGICAL PRODUCTION

Photo: Arquivo FLD



Tomato in SPDH agroforestry system, farmer and technician Roberto Petroski³, 2025

In the scope of the Ecovida Agroecology Network, the work is based on Peasant to Peasant/Peasant to Peasant (CaC) processes, boosting CaC protagonism and strengthening the autonomy of family farming, involving:

- Promoting plant comfort, taking into account the characteristics of each species (in terms of development and aerial and root size), and the possible combinations in consortia and crop succession;
- Plant nutrition at times of greatest demand, with the use of organic compounds, biofertilizers and syrups, and the association of isolated microorganisms or in communities, which provide nutritional elements;
- Encouraging soil health, with an emphasis on producing as much phytomass (green matter) as possible, ideally at least 10 t/ha of dry matter (straw measurement) each year;
- Minimal turning of the soil restricted to the rows or planting pits;
- Rotation of crops and green manures (cultivated and spontaneous), which can evolve into rotation with animals managed in the Voisin Rational Grazing (VRP) system, with the aim of direct planting in the green;
- Mechanical management of green manures using a knife-roller and brushcutter;
- Production and use of adapted agroecological seeds and seedlings.

STEP BY STEP

a) Soil preparation

SPDH begins with an assessment of the soil⁴ in terms of compaction, acidity, organic matter levels, biological diversity and fertility. An analysis is carried out using stratified sampling (from 0 to 10 cm and from 10 to 20 cm deep) to determine the need for lime and fertilizer. This is usually done with poultry litter, with farmers using also other sources

of nitrogen (pelletized compounds, castor bean cake), as well as basalt powder, thermophosphate, potassium silicate and others to replenish minerals.

It is also important to open a trench to see if there is a compacted layer in the soil profile. In this case, subsoiling is recommended. The preparation is then done as normal

2 - Adapted from: FAYAD, Jamil. A.; ARL, Valdemar; COMIN, Jucinei.J.; MAFRA, Álvaro L.; MARCHESI, Darlan R. (2019). Vegetable no-tillage production systems: Method of transition to a new mode of production. São Paulo: Expressão Popular, 2019.

3 - Núcleo Alto Uruguai (RS) 24

4 - COMIN, Jucinei José et al. Guia prático de avaliação participativa da qualidade do solo em sistema de plantio direto de hortaliças (SPDH). 3. ed. Florianópolis : UFSC, 2024

b) Cover crops

Cover crops are the so-called green manures, which can be summer or winter crops. The most used in the URs are:

- summer: millet, mucuna (black, gray), cro-talaria (*juncea*, *ochroka*, *spectabilis*), buckwheat, guandus (common, dwarf), pigeonpea;
- winter: oats (black, white), rye, turnip rape, vetch, field peas.

Mucunas are more difficult to manage. Sudan grass (*Sorghum sudanense*) has not proved to be suitable, as it is very aggressive⁵.

Some experiments are also beginning with chia (*Salvia hispanica*) as a summer plant, which has good control over spontaneous plants and good phytomass production⁶.

Green manures are used in single crops or as a consortium (or "mix") of species. Consortia, if done well, can combine positive characteristics of the various species, such as: faster soil coverage, avoiding competition with spontaneous plants; greater phytomass production; diversified root systems, some capable of helping to decompress the soil; increased biodiversity; nematode control; allelopathic effect on spontaneous plants.

Some care should be taken to avoid mixing species with very different flowering and seed maturation cycles, as the green manure may perennialize through natural reseeding or regrowth. Another issue is that the mixes supplied by the companies are adapted to conventional crops, which are then desiccated with herbicides, as farmer and technician Gabriel Zanotto⁷ points out.

A good strategy is to plant small beds of each species and intercropping to observe and compare their development in the local conditions. Universities can be good partners in establishing these fields of study⁸.

To produce a good amount of phytomass, a planting density 1/3 higher than for seed production is recommended⁹.

Photo: Jocinei G. Lima



Planting brassicas on the matted phytomass of papaya at the milky grain stage, farmer Paulo Brizola and farmer SandraMayer¹⁰, 2024

9 - MONEGAT, Claudino. Plantas de cobertura do solo: características e manejo em pequenas propriedades. Chapecó: Ed. do Autor, 1991
10 - Núcleo Maria Rosa Anunciação (PR)

14 - Núcleo Vale do Rio Pardo (RS)
6 - Serra Gaúcha Center (SC)
7 - Serra Gaúcha Center (SC)
8 - Núcleo Sudoeste (PR)

In the absence of green manure seeds, seeds from crops available in the region can be used for subsequent rolling, such as kidney beans, caupi or string beans (*Vigna unguiculata*) and azuki beans (*Vigna angularis*), used by farmer and technician Aires Niedzielski¹¹; or even common beans, soybeans and corn, planted at a higher density.

Depending on the species present, the mulch can be made up of the spontaneous plants themselves. For example, in regions with a milder climate, such as Lapa (PR), you can use the spontaneous marsh grass or papuan grass (*Urochloa plantaginea*) as a cover plant, allowing it to establish itself in late summer and rolling it to the point of milky grain in the fall, for planting vegetables in the winter. In this experiment, the yield was 8.4 tons/ha of dry mass¹². Farmer Mauro Erdmann¹³ experimented with mowing an area of papuan grass that he had sown, planting cucumbers there directly, with good results.

In this case, because it had already sown and was affected by a frost, the papaya didn't regrow. This spontaneous plant was already well established on the site, but care must be taken to ensure that it doesn't continue to increase the soil's seed bank. The management of papuans is complex and needs to be better studied and experimented with by farmers in small areas.

According to the experience of farmer and technician Elaine Vicente and farmer and technician Fábio Ander-son¹⁴, in order to stimulate the tillering of winter grasses, cattle can be put out to graze lightly and temporarily when the first plant in the pasture flowers¹⁵.

Depending on climate and soil conditions, it may take more than one planting cycle of green manures to establish enough phytomass for no-till farming. It is therefore advisable to divide the planting area into plots that are rotated¹⁶.

c) Lodging/Rolling

Fallowing occurs when the cover crops are in the milky grain (or grain filling) stage. Before then, the plant is still in full vigour, and there may be resurgence (when the plant "gets up" even after being lodged) and regrowth, especially vigorous species such as millet and vetch. On the other hand, if it goes beyond this point, natural reseeding will occur and some species may perennialize or form "tiguera". As already mentioned, you have to be very careful when using mixes.

The specific piece of equipment used for tilling is the knife roller, which comes in various sizes and models. Rollers with helical knives bed in better and compact less¹⁷. The aim is not to cut down the plants, just to crush them, in order to delay the degradation of the straw as much as possible.

As technician Jocinei G. Lima and technician Nataly V. Espitia¹⁸ observed, two passes of the knife-roller, with an interval between them, leaves a more uniform lodging; and for more woody plants, such as *Crotalaria juncea*, it is recommended to pass the roller perpendicular to the planting line.

In the absence of a knife-roller, women and men farmers have used various alternatives for cutting: tree trunks (one or two, tied together), also called stick-rollers, dragged by the tractor; tires lying flat, tied to the tractor's trailer (if the plants are not very woody); use of the scoop (agricultural shovel) on the tractor's hydraulics, almost close to the ground; motor cultivator with iron wheels, among others.



"Wooden roller", made up of two wooden logs tied together. Farmer and technician César Volpato, 2025



Lodging with an iron-wheeled tiller, farmer and technician Alex S. Souza, 2024

11 - Núcleo Planalto Norte (SC)
12 - Núcleo Maria Rosa Anunciação (PR)
13 - Núcleo Sudoeste (PR)
14 - Núcleo Planalto Serrano (SC)
15 - Use based on VINCENZI, Mário L. Reflexões sobre o uso das pastagens cultivadas de inverno em Santa Catarina. Florianópolis: UFSC-CCA, 1994; and PINHEIRO MACHADO, Luiz C. Pastoreio Racional Voisin: Tencologia Agroecológica para o 3º milênio. São Paulo: Expressão Popular, 2010
16 - Serra Gaúcha Center (RS)
17 - Núcleo Maria Rosa Anunciação (PR)
18 - Núcleo Maria Rosa Anunciação (PR)



Another option is to build a knife-roller out of repurposed materials.

Building a knife-roller for a tractor-tiller

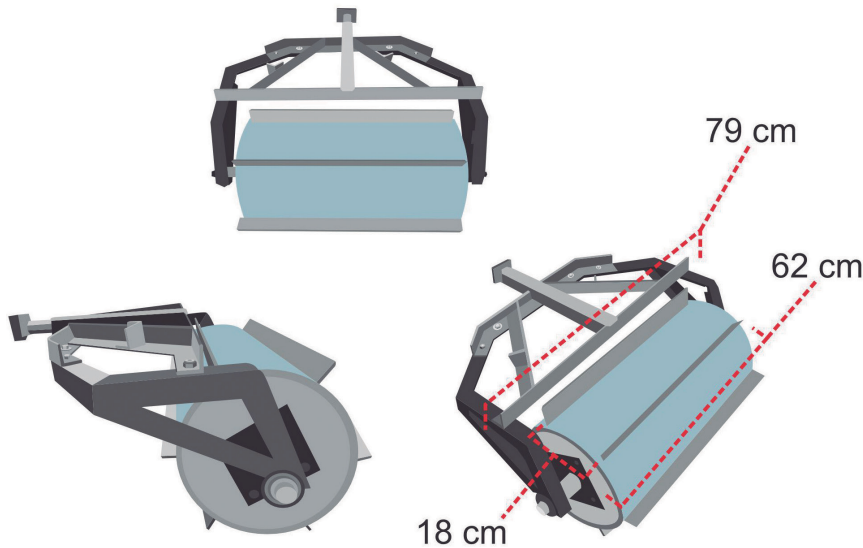


Illustration: Cristiano Ceia

This work is based on the innovative experience of farmer and technician Fábio Anderson and farmer and technician Elaine Vicente and farmers Cecílio Cândido Nunes and Cleverson Godinho Nunes¹⁹. The implement was built with scrap iron bars and a reel from a threshing machine and is suitable for tillers of at least 6.5 hp.

Building a knife-roller for small tractors (up to 55 hp)

This work is based on the innovative experience of farmer and technician Neomar Pinto Ribeiro, his son Cauã and farmer Lori Custódio²⁰. The NCL knife-roller implement was built with repurposed iron bars, with the purchase of a used two-row planter chassis, and new 20-inch disks, with a furrower attached so there would be no clogging. Mounting was done on two fixing rods,

with adjustment of height through two threaded clamps. The disks were also mounted using threaded clamps. A spring allows the equipment to work without lifting.

The equipment can be easily dismantled for transportation. The knife-roller can be filled with water or sand to increase its weight, if you need to rake a denser mulch. The implement is suitable for tractors up to 55 hp.

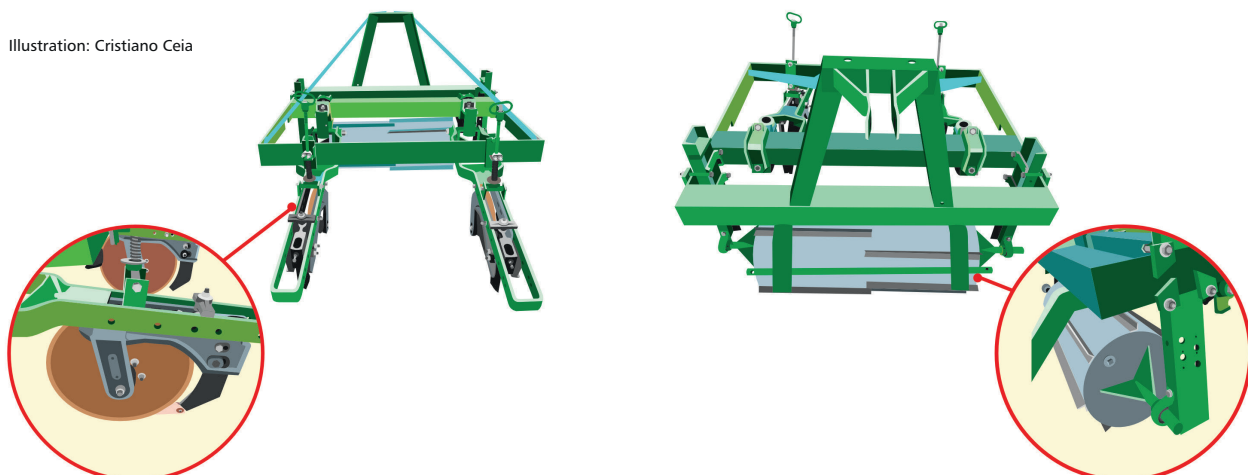


Illustration: Cristiano Ceia

19 - Núcleo Planalto Serrano (SC)
20 - Núcleo Alto Vale Rio do Peixe (SC)

Care

- it is important to pay attention to the length of the knife-roller in uneven terrain and sloping areas, where there will be uneven lodging if the equipment is longer than 1.20 m²¹; for the same reason, it is better for the knives not to be continuous, but to be half the length of the roller and interspersed;
- a knife-roller that is not heavy enough may not properly fluff or crush the cover crops, which then show resurgence²²;
- if possible, attach a cutting disk with a ridger to the back of the knife-roller to cut the straw in the row and prepare the planting furrow, thus making the next job easier. Or attach the knife-roller to the front of the tractor and the Knapik planter with cutting disk to the back, to carry out a single operation. As an alternative, farmer Cecílio Cândido Nunes²³ prepared the planting line with the wood-cutting disk from the brushcutter. In the absence of more suitable equipment, farmer and technician Alex Sandro Souza²⁴ used a duckfoot (subsoiler plow) to lightly move the soil in the row.

Photo: José Maria Tardin



The couple Joselaine Lima and Neomar P. Ribeiro, and one of the directors of Coopercontestado, Alvadi da Silva, 2025

It's important to note that technician Miqueli Sturbelle Schiavon²⁵ has developed a piece of equipment that also weeds, cuts the straw and crosses out the planting line. With the support of the Ministry of Agrarian Development (MDA), some specimens will be produced for testing in different conditions. A detailed manual teaching step-by-step manufacturing will also be distributed.

Photo: Aires Niedzielski



Knapik planter-hitter, 2024

d) Planting

The right time to plant is just after the cover crops have lodged. There is already specific equipment for direct sowing, for motor cultivators and small tractors, such as the planter developed by the Knapik industry in Porto União (SC), a partner of the Innova Ecovida project²⁶. The Knapik planter is good for planting grains such as corn, beans, amaranth, etc. It has a cutting disc that makes it suitable for planting on green, matted phytomass, as wilting makes the operation more difficult.

It is possible to sow green manures in the fall, after a rain, with the plants from the previous crop still standing and then tilling them in. In areas

21 - MONEGAT, 1991 (quoted above)

22 - Núcleo Arenito (PR)

23 - Núcleo Planalto Serrano (SC)

24 - Núcleo Maria Rosa Anunciação (PR)

14 - Núcleo Vale do Rio Pardo (RS)

26 - Núcleos Planalto Norte-SC, Serra Gaúcha (RS)

where there are many birds, they can eat the small seeds in the over-seeding system, if the knife-roller is not used to encourage the seed to come into contact with the soil (as observed by farmer and technician Jean Christian Boukouna²⁷). With the passage of time and the accumulation of dry matter on the soil, over-seeding can become more difficult.

Planting vegetable seedlings, on the other hand, should preferably be done with Knapik's woodpecker transplanter, which has produced excellent results in the field. Farmer and technician Roberto Petroski²⁸ suggests complementing the transplanter with a metal stirrup at the base, to increase the pressure force using one foot, in order to make it easier to work in the region's clay soils.

Photo: : Ecological Center



Climbing pea supported by dried crotalaria stems, 2025

Photo: Aires Niedzielski



Alliaceae in protected cultivation, 2025

No-tillage planting of vegetable seedlings with Knapik's woodpecker planter in papaya phytomass, agro-ecosystem of farmer Paulo Brizola and farmer Sandra Mayer, 2024



Photo: Nataly Espitia e Ilustração Cristiano Ceia

Adaptation suggested by farmer and technician Roberto Petroski, which can be performed locally by welding a piece of iron to the base of the planter

Farmer Leoclides Marcon²⁹ used the dry standing crotalaria to support climbing peas. He lodged interspersed rows of crotalaria with the tiller and planted the pea seedlings in the standing crotalaria row, with which he formed arches. SPDH can also be used in protected crops.

A very important aspect is the size of the vegetable seedlings for the SPDH, as seedlings from conventional-sized trays have poorly developed roots. Trays of no more than 128 cells are recommended, or tubes in the case of plants such as tomatoes³⁰.

Photo: : FLD Archive



Comparison between the development of the aerial part and the root system of tomato seedlings planted on the same day in tubs (left) and 128-cell trays (right), 2025

Care³¹

When planting vegetables in SPDH, it is necessary to monitor the occurrence of ants more frequently, because with the straw, it is more difficult to identify an infestation. You can leave a "cleaner" area around the field for monitoring.

It is important to take better care of watering in the first 5 days of planting, as the seedlings will be more sensitive and setting is a little slower than in conventional planting.

27 - Núcleo Alto Uruguai (RS)

28 - Núcleo Alto Uruguai (RS)

29 - Serra Gaúcha Center (RS)

30 - Núcleo Alto Uruguai (RS)

31 - Núcleo Maria Rosa Anunciação (PR)

e) Plant nutrition

The SPDH teaches you to observe some signs that the plant is healthy and that the fertilization is correct³²:

- about 15% of young (upper) growing leaves with a slightly lighter green color;
- plant body with a darker green color;
- base leaves without translocation of nutrients (no yellowing).

Very dark green young leaves, "soft" tissues and exuberant growth indicate over-fertilization, while yellowing and poor development indicate under-fertilization.

In general, it is recommended to plant legumes before grasses, for an extra supply of nitrogen, considering that, in the process of decomposing the straw, the bacteria present in the soil use the available nitrogen, immobilizing it.

In order to obtain a sufficient amount of fat, you need to treat the green manure as a crop. The farmers have been fertilizing the green manure, either at planting or as a top dressing, according to the soil analysis or later by observing the signs of the plant. They have used various organic fertilizers, as well as syrups, biofertilizers, biologicals (isolated and in communities) and

homeopathics.

In the case of organic fertilizers applied to the soil, it is important to remember that it takes several days for the nutrients to become available to the plants.

There are also technical publications that can be consulted on the best time to fertilize each crop, which should be done directly in the cradle or in the row.

Photo: Centro Ecológico



Top dressing on oats, farmer Flávio Zanotto³³, 2024

f) Spontaneous plants

It is hoped that a good cover of green phytomass and then dry straw will reduce the emergence of weeds. However, it may be necessary, especially in years with lower phytomass production if necessary, selectively

control with a brushcutter in the inter-row and, if necessary, with a sickle (rice sickle) in the crop row. In general, there has also been a change in the species that appear.

g) Challenges

There is a challenge in establishing the SPDH in regions with a warmer climate, such as the northwest of Paraná, where it is still necessary to set up a calendar with the sequence of operations, in order to reach the end of summer/beginning of autumn with the phytomass from the green manure still standing, since the local climatic conditions make it very difficult to plant leafy vegetables and brassicas before April/May³⁴.

For families who work with markets or bag deliveries and need constant production, the SPDH is also challenging, as it requires planning with green manure plots that are ready for planting throughout the year.

Given that fertilization in agroecological production systems is based on organic matter and its relationship with the soil biota, or on foliar

32 - ARL, Valdemar; FAYAD, Jamil A.; TOMAZZI, Joel; Comin, Kelly E. SPDH+: um método de transição agroecológica para toda agricultura familiar. FETRAF (SC) 2022

33 - Serra Gaúcha Center (RS)

34 - Núcleo Arenito (PR)



fertilizing research is needed into the Daily Absorption Rate (DAAR) of nutrients for different crops in this condition.

Although some specific machinery and equipment for the SPDH has been developed in local innovation processes, there is no large-scale production capable of meeting the needs of interested women and men farmers.

It is recommended that more attention be paid to the botanical identification of the spontaneous plant species that emerge in areas cultivated under SPDH or conventional management, in order to obtain ecological information related to their status as biological indicators.

h) Facilitating adhesion

It is advisable to start planting in SPDH with more adapted crops, such as fruit trees, cucurbits and cabbage³⁵, as well as mentoring the tomato crop, always observing the appropriate seasons.

The SPDH requires a significant cultural change on the part of farmers, so it is prudent to start with "study plots" of 100m², gradually increasing each year as more information becomes available about its implementation and how to deal with the challenges that arise³⁶. This is particularly important if you decide to experiment with more complex mixes or no-tillage on papaya, for example.

Ways can be sought to help peasant families gradually become accustomed to the use of mulch and to non-tillage practices before formally initiating

the No-tillage Vegetable Production System (SPDH). An initial practice could be to cover the beds with straw brought in from outside the garden (grass passed on to the forager, or leftovers from crops such as beans). Another way to familiarize yourself with the use of cover crops is to plant them between the beds, cut them down and then use them to cover the beds³⁷.

As far as liming is concerned, research has shown that the distribution of lime on soil cover plants (green or spontaneous fertilizers) at the point of full vegetative development and at a maximum amount of 5 t/ha, can achieve the neutralization of acidity and toxic aluminium up to 25 cm deep through the action of the organic acids exuded by the plants³⁸.

COOPERATION

Cooperation is of fundamental importance for the performance of agroecology, and this is no different with the HPS, where it can occur in different ways:

a) it may not be feasible to acquire or build a knife-roller or planter individually; however, a nucleus or group of the Ecovida Agroecology Network can organize collective forms of acquisition and use³⁹;

b) how green manure seeds usually are expensive

are expensive and difficult to obtain, it is important for groups to organize themselves so that each family produces seeds of a certain species, so that they can exchange them later;

c) cooperatives can take on the freight for transporting equipment and machinery, as is the case with Ecoterra in Erechim (RS)^{40 41}; or distribute green manure kits, like Coopercon-testado⁴².

36 - HOLTZ-GIMÉNEZ, E. Campesino a campesino: Voces de Latinoamérica. Movimiento Campesino para la Agricultura Sustentable. Managua: SIMAS, 2008.

37 - Practices present in various centers.

38 - Researcher Marcos A. Pavan, from the Agronomic Institute of Paraná-IAPAR. Field day information. See also: CASSIOLATO, Marcelo E., MEDA, Anderson R., PAVAN, Marcos A., et al. Evaluation of oat extracts on the efficiency of lime in soil. Brazilian Archives of Biology and Technology, 2000, vol. 43, p. 533-536.

39 - As is the case with Núcleo Alto Vale do Rio do Peixe (SC)

40 - Núcleo Alto Uruguai (RS);

41 - We use Erechim with an 'x' to respect the indigenous origin of the word - from the Tupi-Guarani meaning "Small Field".

42 - Núcleo Alto Vale do Rio do Peixe (SC)



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