
penergetic
the natural biotechnology
With the impulse of nature
...for intelligent agriculture

*"If you want to find the secrets of the universe, think in terms of energy, frequency and vibration ..."* **Nikola Tesla**

# *Dear Readers,*

*Nature demands that we treat her with care. We have become increasingly aware that overuse and aggressive treatments harm soils, plants and animals and disrupt their systems.*

**The magazine "Geo Kompakt", issue 5 – 12/05, Geheimnis Natur (The secrets of nature), tells us wondrous things about how plants communicate with each other, but also with insects, birds and bats. German television recently reported on research that has been carried out on the communication between the roots of trees in a forest.**

**18 years ago, Penergetic International AG started their research and development work on a process for transferring biological information onto carrier materials. What seemed slightly esoteric at the time has now been accepted into the mainstream. The principles of biodynamic agriculture are, not least, also based on the targeted use of relevant information on the crops' reproduction (yield development) and self-protection (health). The results from various research institutions at faculties of biological science underpin the positive impact of using gentle, bioactive materials. Hundreds of documented trials are testament of the positive and gentle cultivation of soil, of qualitative and quantitative crop improvement in Europe, South America, Canada and Southeast Asia.**

**Large farms benefit from a reduced use of chemical fertilizers. In different area of this world, overfertilized fields are recovering. Wheat, potatoes, coffee plants, grape vines respond to the information that has been transferred through the Penergetic system with healthy growth and high yields.**

**Penergetic International AG is a family-run company based in Romanshorn, Switzerland. The experience of three generations of the family is reflected in the continuous development of the products. Many long-standing partners distribute Penergetic products for animals, plants, soil, liquid manure, compost and water locally and advise customers in how to optimize their efficiency. Penergetic has accepted the challenge to solve a variety of agricultural issues and is developing a broad range of biologically active and gentle materials. This documentation of detailed results in the most diverse areas and impressive photographic material on the achieved results reflects Penergetic International AG's considerable contribution to improving the situation of worldwide food production.**

**Paul Meiler**

# Penergetic International

*Agriculture is one of the oldest economic sectors and most important occupations of mankind. Around 5.6 billion hectares or 11% of the Earth's surface are used for agricultural purposes. More than 40% of all employees worldwide work in this sector.*

These may be enormous figures, but if we look at the global population of around 8 billion people, whose food comes from those 11% of surface area used for agricultural purposes, then we might get an idea of how important food production is. Unfortunately, this pressure to produce enough food, has an adverse effect on food production standards. The focus has been increasingly on quantity rather than quality. This has long-lasting effects on the soil, plants, animals and, consequently, on us humans. In addition, approximately 6 million hectares of agricultural land are lost to erosion, salinization, desertification or building development. Change is urgently needed and penergetic products can make an important contribution that will also yield commercial benefits.

Penergetic International AG is leading the change. Its vision is to think of future generations today and to drive the smart agricultural revolution. This is already being implemented in many countries! penergetic products were developed to promote a sustainable, high-performing and efficient agriculture. In this way, the company wants to achieve its goal of saving resources and optimally utilizing existing potentials, and thus achieve the sustainable, ecologically sound, economically viable and independent agriculture of the future.

**The penergetic product range comprises**

- penergetic b – for soil
- penergetic p – for plants
- penergetic t – for animals
- penergetic g – for liquid manure
- penergetic k – for compost and livestock bedding
- AquaKat – for water vitalization

This product range tackles the root causes rather than just relieving the symptoms. At the same time, the individual products form one large system in which they support each other.

# Cover Crops



*Cover crop has been used in soil conservation since ancient times. During the collaboration with Dr. Ademir Calegari, Penergetic noted that cover crop and no-till methods have additional positive effects when penergetic products are used. For this reason, we want to introduce the different areas of applications for cover crops and contribute further to developing smart agricultural methods.*


**Dr. Ademir Calegari**
Soil Scientist Researcher
Senior Agronomist IAPAR
Londrina, PR Brazil


## A milestone in agriculture

**All the information comprised can be applied to the plots in the rural areas, after an appropriate diagnosis of the local conditions for the implementation of cover crops species plants that best fit to the specifically cropping / farming systems according to the need of soil and commercial crops.**

The introduction of these species, isolated or in cocktails (mix), are fundamental tools for the improvement of the crop rotation system and for the development of a no till system with quality. The adequate use of these species certainly will contribute to the soil protection, improvement of physical, chemical and biological attributes, as well as promoting greater biodiversity in the production systems, contributing to a smarter and sustainable agriculture.

# Project Living Soil

## What is the Project Living Soil (PLS)?

**A tool that works par excellence for the bioactivation of the productive systems (soil and plant) through the cover crops.**

The “Living Soil Project” is an initiative of the WebBio Academy in Brazil, which makes it possible to identify select and at field level, alternatives, strategies and management practices of sustainable agricultural productions that promote a better balance between the soil-water-plant relationship. This should lead to greater productivity and profitability with a minimal environmental impact, providing a better and more intelligent use of the natural resources and greater rationality in the use of the necessary inputs to the means of agricultural production.


*“The project will last three years in the same area, covering the main Brazilian productive states.”*

## Importance of the project

**Redeem of soil health**

- To provide the soil with a high productive potential for crops through balance in their chemical, physical and biological attributes.

**Integrating tools that contribute to a better management of the soil-plant-water system and harmonize the various components of the production system**

- Massive adoption of different cover crops (isolated or cocktails) according to needs identified by the diagnosis of each area
- Integrated crop-livestock-forestry Systems (CLFS)
- Technologies in bioactivation
- Biological assets

**Diversification, combination and rotation of crops**

- Customized evaluation for each property
- Analysis of plant tissue for determination of nutrient contents

**Return to the true no till system on straw with quality**

- Soil protection and erosion risk reduction
- Elevation in infiltration rates and water retention in the soil profile
- Increase of organic matter
- Increased availability of nutrients
- Increase in macro-, meso-, microfauna and flora populations
- Less occurrence and propagation of weeds

## Action strategies

**Diagnostic of the area**

**Before planting**

- Standard georeferenced soil analyzes of 0 – 10 cm, 0 – 20 cm, 20 – 40 cm and nematological analyzes for all treatments.

**During the growth of coverage**

- Biological evaluations (nematodes and microorganisms)
- Periodical measuring of the vegetative growth of plants
- Evaluation of root growth and soil profile effects (compaction), through the opening of trenches
- Evaluation of the dry matter of cover crops, which should be carried out in the full flowering of the plants, before the accomplishment of the management (mechanical and / or chemical)
- Evaluation of the suppression of invasive (weed) plant populations

**After coverage management**

- Evaluation of qualitative soil attributes (chemical, physical and biological)

As a strategic tool for better results, the penergetic b bio-activator for soil should be applied in total area before PLS implantation. Agronomic and economic evaluations will be carried out in all areas of the PLS.

## Implantation of summer crops on the PLS

**The crops should follow the recommendation of fertilization and soil correction by the technical team, and the use of the bio-activators penergetic b for soil in the imple-mentation of the project and penergetic p for plants during the development of the crop is recommended.**

## Harvest

**The cover crop areas will be compared to the management used by the farmer. Summer crops will be harvested (soybean, corn, cotton, beans, etc.) over the crops and compared to the farmer’s control areas. These evaluations should be conducted in the same locations (side by side).**

## Expected results

- Recuperation of soil health by promoting the rebalancing of biota through No Till System with quality (including cover crops, crop rotation) and the use of tools that promote the bioactivation.
- Adequate and rational use of inputs, reducing production costs and increasing the profitability of the agricultural activity.
- Contribution to the development of sustain-able production systems, improving the quality of the lives of those who consume and of those who produce food.

## *Pearl millet*

### *Spring – Summer Soil Covers*

| | | |
|---|---|---|
| **Identification** | Common name | Millet |
| | Scientific name | Pennisetum glaucum |
| | Family | Poaceae (Grasses) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 3,7 a 4 |
| | Root system | Fasciculated |
| | Height (m) | 1,5 a 2,5 |
| | Growing habit | Erect thicket |
| | Flowering (days) | 45 to 50 |
| | Cycle (days) | 130 to 140 |
| | Green mass (mt/ha) | 50 to 60 |
| | Dry mass (mt/ha) | 8,0 to 15 |
| | Frost tolerance | Susceptible |
| | **Seeding season** | **Late spring – early summer** |
| **Seeding** | In line (kg/ha) | |
| | throwing sowing (kg/ha) | |
| | In mixtures with 2 to 3 coverages (kg/ha) | |
| | In mixtures with 4 to 6 coverages (kg/ha) | |
| **Consortium with corn** | In line (kg/ha) | ——— |
| | throwing sowing (kg/ha) | ——— |
| **Nematodes**[1] | Pratylenchus brachyurus | RF < 1 |
| | Meloidogyne incognita | RF < 1 |
| | Meloidogyne javanica | RF < 1 |
| | Heterodera glycines | RF < 1 |
| | Rotilenchulus reniformis | RF < 1 |
| | Pratylenchus coeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 0,34 a 3,40 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,13 a 0,29 |
| | Potassium $K_2O$ (% in dry matter) | 1,05 a 3,80 |
| **Indications** | **Benefits:** Little picky in phosphorus. Reduces fusarium and rhizoctonia. | |
| | **Attention points:** Can increase population of caterpillars. | |

RF = reproduction factor

## *Crotalaria spectabilis*

### *Spring – Summer Soil Covers*

| | | |
|---|---|---|
| **Identification** | Common name | Crotalaria spectabilis |
| | Scientific name | Crotalaria spectabilis |
| | Family | Fabaceae (Leguminous) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 16 to 19 |
| | Root system | branched-penroot |
| | Height (m) | 1,0 a 1,5 |
| | Growing habit | shrubby erect |
| | Flowering (days) | 110 to 140 |
| | Cycle (days) | 170 to 180 |
| | Green mass (mt/ha) | 20 to 30 |
| | Dry mass (mt/ha) | 4 to 6 |
| | Frost tolerance | Tolerant |
| | **Seeding season** | **Late spring – early summer** |
| **Seeding** | In line (kg/ha) | 12 to 15 |
| | throwing sowing (kg/ha) | 15 |
| | In mixtures with 2 to 3 coverages (kg/ha) | 10 |
| | In mixtures with 4 to 6 coverages (kg/ha) | 8 |
| **Consortium with corn** | In line (kg/ha) | 10 |
| | Throwing sowing (kg/ha) | 20 |
| **Nematodes**[1] | Pratylenchus brachyurus | RF < 1 |
| | Meloidogyne incognita | RF < 1 |
| | Meloidogyne javanica | RF < 1 |
| | Heterodera glycines | RF < 1 |
| | Rotilenchulus reniformis | Susceptible |
| | Pratylenchus coeae | RF < 1 |
| | Pratylenchus zea | RF < 1 |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 1,97 to 3,30 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,07 to 0,25 |
| | Potassium $K_2O$ (% in dry matter) | 0,78 to 1,78 |
| **Indications** | **Benefits:** Reduces nematode population. | |
| | **Attention points:** Difficult control of plants out of stage. | |

RF = reproduction factor

## *Crotalaria ochroleurca*

### *Spring – Summer Soil Covers*

| | | |
|---|---|---|
| **Identification** | Common name | Crotalária ochroleuca |
| | Scientific name | Crotalaria ochroleuca |
| | Family | Fabaceae (Leguminous) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 6 to 8 |
| | Root system | profound penroot |
| | Height (m) | 1,5 to 2,0 |
| | Growing habit | shrubby erect |
| | Flowering (days) | 120 to 135 |
| | Cycle (days) | 125 to 135 |
| | Green mass (mt/ha) | 20 to 30 |
| | Dry mass (mt/ha) | 7 to 10 |
| | Frost tolerance | Susceptible |
| | **Seeding season** | **Late spring – early summer** |
| **Seeding** | In line (kg/ha) | 10 |
| | throwing sowing (kg/ha) | 12 |
| | In mixtures with 2 to 3 coverages (kg/ha) | 10 |
| | In mixtures with 4 to 6 coverages (kg/ha) | 8 |
| **Consortium with corn** | In line (kg/ha) | 5 to 8 |
| | throwing sowing (kg/ha) | 20% more |
| **Nematodes**[1] | Pratylenchus brachyurus | RF < 1 |
| | Meloidogyne incognita | Not hostess |
| | Meloidogyne javanica | Not hostess |
| | Heterodera glycines | RF < 1 |
| | Rotilenchulus reniformis | RF < 1 |
| | Pratylenchus coeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 0,80 to 1,25 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,06 to 0,08 |
| | Potassium $K_2O$ (% in dry matter) | 0,50 to 0,87 |
| **Indications** | **Benefits:** Fast growth, pivoting roots, soil reclaimer, high biomass | |
| | **Attention points:** Attention to the management of vegetation before full bloom (increase fibers), which can make it difficult to plant the later culture. | |

RF = reproduction factor

## *Crotalaria juncea*

### *Spring – Summer Soil Covers*

| | | |
|---|---|---|
| **Identification** | Common name | Sunn Hemp |
| | Scientific name | Crotalaria juncea |
| | Family | Fabaceae (Leguminous) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 50 |
| | Root system | deep taproot |
| | Height (m) | 2,0 to 3,0 |
| | Growing habit | shrubby erect |
| | Flowering (days) | 70 to 130 |
| | Cycle (days) | 170 to 180 |
| | Green mass (mt/ha) | 35 to 60 |
| | Dry mass (mt/ha) | 10 to 15 |
| | Frost tolerance | Susceptible |
| | **Seeding season** | **Late spring – early summer** |
| **Seeding** | in lines | 25 (kg/ha) |
| | broadcast sowing | 30 (kg/ha) |
| | Spacing between rows (25 to 50 cm) | 25 to 30 (seeeds/linear m) |
| | In mixtures with 2 to 3 crops | 10 to 12 (kg/ha) |
| | In mixtures with 4 to 6 crops | 8 to 10 (kg/ha) |
| **Intercropping with corn** | in lines | 16 (kg/ha) |
| | broadcast sowing | 20% more |
| **Nematodes**[1] | Pratylenchus brachyurus | Susceptible |
| | Meloidogyne incognita | Susceptible / Resistent mod. |
| | Meloidogyne javanica | RF < 1 |
| | Heterodera glycines | RF < 1 |
| | Rotilenchulus reniformis | RF < 1 |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 1,13 to 4,40 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,09 to 0,37 |
| | Potassium $K_2O$ (% in dry matter) | 0,57 to 3,37 |
| **Indications** | **Benefits:** High nitrogen fixing capacity. Soil recovering and improvement. Allopathic effects on several invasive plants (weeds) | |
| | **Attention points:** Hostesses of *Pratylenchus brachyurus*, and some fungi. Biomass when incorporated, effects of tissue with glucosinolates are transformed into isothiocyanates and control nematodes (Pratylenchus, and others) and soilborne diseases trough “biofumigation”. These molecules are volatile and toxic to soil microorganisms and nematodes. | |

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## Buckwheat

### Spring – Summer Soil Covers

| | | |
|---|---|---|
| **Identification** | Common name | Buckwheat |
| | Scientific name | Fagopyrum esculentum |
| | Family | Polygonaceae |
| **Characteristics** | Weight of 1,000 seeds (grams) | 32 to 37 |
| | Root system | Vigorous Taproot |
| | Height (m) | 0,6 to 1,2 |
| | Growing habit | Erect |
| | Flowering (days) | 35 to 50 days |
| | Cycle (days) | 75 to 85 |
| | Green mass (mt/ha) | 15 to 28 |
| | Dry mass (mt/ha) | 3 to 6 |
| | Frost tolerance | Susceptible |
| | **Seeding season** | **Late spring – summer** |
| **Seeding** | in lines | 40 to 60 (kg/ha) |
| | broadcast sowing | 20% more |
| | Spacing between rows (17 to 40 cm) | 25 a 30 (seeeds/linear m) |
| | In mixtures with 2 to 3 crops | 18 to 25 (kg/ha) |
| | In mixtures with 4 to 6 crops | 15 to 18 (kg/ha) |
| **Intercropping with corn** | in lines | 30 to 40 (kg/ha) |
| | broadcast sowing | 20% more |
| **Nematodes**[1] | Pratylenchus brachyurus | Not hostess |
| | Meloidogyne incognita | Not hostess |
| | Meloidogyne javanica | Not hostess |
| | Heterodera glycines | Not hostess |
| | Rotilenchulus reniformis | ——— |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 1,80 to 2,01 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,20 to 0,31 |
| | Potassium $K_2O$ (% in dry matter) | 3,00 to 3,71 |
| **Indications** | **Benefits:** The deep roots with high amount of mycorrhiza fungi make support long drought period. The dense, fibrous roots produce mild acids that release nutrients from the soil. Quick soil cover, efficient weed control, nectar for pollinators and beneficial insects, topsoil loosening rejuvenator for low-fertility soils. Excellent in beekeeping (high amount of pollen and nectar). The flowers attract beneficial insects that parasitize aphids, mites and other pests. Including hover flies *(Syrphidae)*, predatory wasps, minute pirate bugs, insidious flower bugs, tachinid flies and lady beetles. | |
| | **Attention points:** Weeds can grow in low plant population. | |

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## Sunflower

### Spring – Summer Soil Covers

| | | |
|---|---|---|
| **Identification** | Common name | Sunflower |
| | Scientific name | Helianthus annuus |
| | Family | Compositae |
| **Characteristics** | Weight of 1,000 seeds (grams) | 50 to 95 |
| | Root system | branched-tap root |
| | Height (m) | 1,8 to 3,0 |
| | Growing habit | erect |
| | Flowering (days) | 60 to 80 |
| | Cycle (days) | 70 to 120 |
| | Green mass (mt/ha) | 40 to 70 |
| | Dry mass (mt/ha) | 7 to 15 |
| | Frost tolerance | Moderately tolerant |
| | **Seeding season** | **Late spring – summer** |
| **Seeding** | in lines | 3 to 20 (kg/ha) |
| | broadcast sowing | 20% more |
| | Spacing between rows (17 to 34 cm) | 12 a 15 (seeeds/linear m) |
| | In mixtures with 2 to 3 crops | 3 to 4 (kg/ha) |
| | In mixtures with 4 to 6 crops | 2 (kg/ha) |
| **Intercropping with corn** | in lines | 4 to 6 (kg/ha) |
| | broadcast sowing | 5 to 7 (kg/ha) |
| **Nematodes**[1] | Pratylenchus brachyurus | Susceptible |
| | Meloidogyne incognita | Susceptible |
| | Meloidogyne javanica | Susceptible |
| | Heterodera glycines | RF < 1 |
| | Rotilenchulus reniformis | RF < 1 |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 1,02 to 1,80 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,15 to 0,24 |
| | Potassium $K_2O$ (% in dry matter) | 2,40 to 2,78 |
| **Indications** | **Benefits:** Develops well in sandy soils, clayey, acid (pH from 5.1), fast initial phase growing; Alternative for oil production, for biofuel with the use of the pie in animal feed. | |
| | **Attention points:** Excessive rainfall and high temperatures, as well as crop residues can trigger attacks diseases of: Alternaria spot, rot of the stem (Erwinia sp.), Macrophomina, etc. Not recommended to rotate with beans (common diseases). | |

RF = reproduction factor

## *Finger millet*

### *Spring – Summer Soil Covers*

| | | |
|---|---|---|
| **Identification** | Common name | Finger millet |
| | Scientific name | Eleusine coracana |
| | Family | Poaceae (Gramineae) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 2,3 to 2,5 |
| | Root system | Fasciculated Root |
| | Height (m) | 0,8 to 1,2 |
| | Growing habit | erect |
| | Flowering (days) | 80 to 110 days |
| | Cycle (days) | 130 to 170 |
| | Green mass (mt/ha) | 25 to 40 |
| | Dry mass (mt/ha) | 6 to10 |
| | Frost tolerance | Susceptible |
| | **Seeding season** | **Late spring – summer** |
| **Seeding** | in lines | 8 to 10 (kg/ha) |
| | broadcast sowing | 20% more |
| | Spacing between rows (17 to 34 cm) | 45 a 60 (seeeds/linear m) |
| | In mixtures with 2 to 3 crops | 3 to 5 (kg/ha) |
| | In mixtures with 4 to 6 crops | 2 to 4 (kg/ha) |
| **Intercropping with corn** | in lines | ——— |
| | broadcast sowing | ——— |
| **Nematodes**[1] | Pratylenchus brachyurus | ——— |
| | Meloidogyne incognita | Susceptible |
| | Meloidogyne javanica | Susceptible |
| | Heterodera glycines | RF < 1 |
| | Rotilenchulus reniformis | RF < 1 |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 1,03 to 1,53 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,06 to 0,17 |
| | Potassium $K_2O$ (% in dry matter) | 1,24 to 1,89 |
| **Indications** | **Benefits:** Fasciculate roots (can produce more than 6 mt/ha of roots), indicated mainly in sandy soil where increase soil particle aggregates. Grows on poor soils and supports long drought season. High weed suppression. | |
| | **Attention points:** After biomass managed it´s recommended to wait 15–25 days before sowing the next crop (slow decomposition of root system, which can lead to N temporary immobilization). | |

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## *Brachiaria ruziziensis*

### *Spring – Summer Soil Covers*

| | | |
|---|---|---|
| **Identification** | Common name | Brachiaria ruziziensis * |
| | Scientific name | Urochloa ruziziensis |
| | Family | Poaceae (Gramineae) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 12.5 |
| | Root system | Fasciculated root |
| | Height (m) | 0,8 to 1,2 |
| | Growing habit | caespitosus |
| | Flowering (days) | 40 to 50 |
| | Cycle (days) | perennial |
| | Green mass (mt/ha) | 20 to 55 |
| | Dry mass (mt/ha) | 12 to 16 |
| | Frost tolerance | low |
| | **Seeding season** | **Late spring – summer** |
| **Seeding** | in lines | 7 to 10 (kg/ha) |
| | broadcast sowing | 9 to 12 (kg/ha) |
| | Spacing between rows (17 to 34 cm) | 30 to 40 (seeeds/linear m) |
| | In mixtures with 2 to 3 crops | 4 to 5 (kg/ha) |
| | In mixtures with 4 to 6 crops | 2 to 3 (kg/ha) |
| **Consortium with corn** | in lines | 6 to 8 (kg/ha) |
| | broadcast sowing | 20% more |
| **Nematodes**[1] | Pratylenchus brachyurus | Susceptible |
| | Meloidogyne incognita | RF < 1 |
| | Meloidogyne javanica | RF < 1 |
| | Heterodera glycines | RF < 1 |
| | Rotilenchulus reniformis | RF < 1 |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 0,75 to 2,01 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,04 to 0,15 |
| | Potassium $K_2O$ (% in dry matter) | 0,60 to 1,49 |
| **Indications** | **Benefits:** Grows in soils with medium chemical fertility. Precocity and high biomass production. Can be intercropped with corn and other crops, ease of handling, high nutrients recycling and high C/N ratio (around 40). Reduces Fusarium sp., Rhizoctonia sp. (white-mold). | |
| | **Attention points:** Attempt for continuous use and every 2 years to perform nematode analysis (Pratylenchs brachiurus), since it is host and can increase these populations and provoke damage to the next crops. | |

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## *Dwarf pigeonpea*

### *Spring – Summer Soil Covers*

| | | |
|---|---|---|
| **Identification** | Common name | Dwarf pigeonpea |
| | Scientific name | Cajanus cajan |
| | Family | Fabaceae (leguminosa) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 65 to 80 |
| | Root system | vigorous / tap root |
| | Height (m) | 1,0 to 1,8 |
| | Growing habit | harpy / erect |
| | Flowering (days) | 70 to 100 |
| | Cycle (days) | 130 to 160 |
| | Green mass (mt/ha) | 12 to 45 |
| | Dry mass (mt/ha) | 3 to 12 (mt/ha) |
| | Frost tolerance | Susceptible |
| | **Seeding season** | **Late spring – summer** |
| **Seeding** | in lines | 35 to 40 (kg/ha) |
| | broadcast sowing | 20% more |
| | Spacing between rows (17 to 34 cm) | 18 to 25 (seeeds/linear m) |
| | In mixtures with 2 to 3 crops | 15 to 20 (kg/ha) |
| | In mixtures with 4 to 6 crops | 12 to 18 (kg/ha) |
| **Intercropping with corn** | in lines | 20 to 25 (kg/ha) |
| | broadcast sowing | 20% more |
| **Nematodes**[1] | Pratylenchus brachyurus | RF < 1 |
| | Meloidogyne incognita | RF < 1 |
| | Meloidogyne javanica | RF < 1 |
| | Heterodera glycines | RF < 1 |
| | Rotilenchulus reniformis | RF < 1 |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 1,32 a 3,35 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,09 a 0,25 |
| | Potassium $K_2O$ (% in dry matter) | 0,47 a 2,84 |
| **Indications** | **Benefits:** Grows in soils with medium fertility, biological chisel plow (disrupting soil compacted layers); Allopathic effects on invasive plants (weeds). Reduces Fusarium sp. and Rhizoctonia sp. | |
| | **Attention points:** Avoid highly compacted soils, since the roots of this legume may not be so efficient. In this case use the giant pigeonpea, because their vigorous tap root system. | |

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## *Oilseed radish*

### *Autumn – Early Winter Soil Covers*

| | | |
|---|---|---|
| **Identification** | Common name | Oilseed radish |
| | Scientific name | Raphanus sativus |
| | Family | Brassicaceae (cruciferae) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 8 to 14 |
| | Root system | deep / tuberous / tap root |
| | Height (m) | 0,8 to 1,6 |
| | Growing habit | Herbaceous determinated |
| | Flowering (days) | 60 to 90 |
| | Cycle (days) | 140 to 160 |
| | Green mass (mt/ha) | 20 to 65 |
| | Dry mass (mt/ha) | 3 to 9 |
| | Frost tolerance | Tolerant |
| | **Seeding season** | **Spring – late summer – early autumn** |
| **Seeding** | in lines | 10 to 17 |
| | broadcast sowing | 20% more |
| | Spacing between rows (17 to 34 cm) | 25 a 35 (seeeds/linear m) |
| | In mixtures with 2 to 3 crops | 4 to 5 (kg/ha) |
| | In mixtures with 4 to 6 crops | 2 to 3 (kg/ha) |
| **Consortium with corn** | in lines | 5 to 8 (kg/ha) |
| | broadcast sowing | 20% more |
| **Nematodes**[1] | Pratylenchus brachyurus | Not hostess |
| | Meloidogyne incognita | RF < 1 |
| | Meloidogyne javanica | Susceptible |
| | Heterodera glycines | ——— |
| | Rotilenchulus reniformis | ——— |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 0,92 to 2,96 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,18 to 0,33 |
| | Potassium $K_2O$ (% in dry matter) | 2,02 to 3,90 |
| **Indications** | **Benefits:** Fast growth – deep roots that can break down soil compacted layers, and high nutrient recycling (N, S, P). During growth period it can promote weed suppression. | |
| | **Attention points:** Do not sow in areas with Sclerotinia problems. Intercropped with other species such as rye, oat, millet, buckwheat, etc., may be use 2 to 3 kg/ha, will decrease white mold and undermine the later crops. Can be successfully mixed with grasses, legume and other cover crop species. | |

RF = reproduction factor

## Common vetch

### Autumn – Winter Soil Covers

| | | |
|---|---|---|
| **Identification** | Common name | Common vetch |
| | Scientific name | Vicia sativa |
| | Family | Fabaceae (leguminous) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 36 to 60 |
| | Root system | Tap root |
| | Height (m) | 0,5 to 0,8 |
| | Growing habit | decumbent |
| | Flowering (days) | 120 to 150 |
| | Cycle (days) | 180 to 200 |
| | Green mass (mt/ha) | 20 to 30 |
| | Dry mass (mt/ha) | 4 to 6 |
| | Frost tolerance | Tolerant |
| | **Seeding season** | **Late summer – early autumn** |
| **Seeding** | in lines | 50 to 80 (kg/ha) |
| | broadcast sowing | 20% more |
| | Spacing between rows (17 to 34 cm) | 25 to 30 (seeds/linear m) |
| | In mixtures with 2 to 3 crops | 18 to 25 (kg/ha) |
| | In mixtures with 4 to 6 crops | 12 to 18 (kg/ha) |
| **Intercropping with corn** | in lines | ——— |
| | broadcast sowing | ——— |
| **Nematodes**[1] | Pratylenchus brachyurus | Susceptible and hostess |
| | Meloidogyne incognita | Susceptible and hostess |
| | Meloidogyne javanica | Susceptible and hostess |
| | Heterodera glycines | ——— |
| | Rotilenchulus reniformis | ——— |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 0,20 to 3,47 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,13 to 0,38 |
| | Potassium $K_2O$ (% in dry matter) | 2,10 to 2,56 |
| **Indications** | **Benefits:** Efficient weed population control (mattress over the ground). High nitrogen supply by biological fixation and N recycling. Can be used as animal fodder (isolated or mixed with oat, rye, raygras, etc.). | |
| | **Attention points:** Better development in soils with high level of Ca and high soil pH. | |

RF = reproduction factor

## Hairy vetch

### Autumn – Winter Soil Covers

| | | |
|---|---|---|
| **Identification** | Common name | Hairy vetch |
| | Scientific name | Vicia villosa |
| | Family | Fabaceae (leguminous) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 36 to 60 |
| | Root system | Tap root |
| | Height (m) | 0,5 to 0,8 |
| | Growing habit | decumbent |
| | Flowering (days) | 140 to 160 |
| | Cycle (days) | 200 to 230 |
| | Green mass (mt/ha) | 20 to 30 |
| | Dry mass (mt/ha) | 4 to 6 |
| | Frost tolerance | Tolerant |
| | **Seeding season** | **Autumn and summer – late winter** |
| **Seeding** | in lines | 30 to 60 (kg/ha) |
| | broadcast sowing | 20% more |
| | Spacing between rows (17 to 34 cm) | 25 to 30 (seeds/linear m) |
| | In mixtures with 2 to 3 crops | 18 to 25 (kg/ha) |
| | In mixtures with 4 to 6 crops | 12 to 18 (kg/ha) |
| **Consortium with corn** | in lines | ——— |
| | broadcast sowing | ——— |
| **Nematodes**[1] | Pratylenchus brachyurus | Susceptible and hostess |
| | Meloidogyne incognita | Susceptible and hostess |
| | Meloidogyne javanica | Susceptible and hostess |
| | Heterodera glycines | ——— |
| | Rotilenchulus reniformis | ——— |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 1,88 to 4,36 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,10 to 0,41 |
| | Potassium $K_2O$ (% in dry matter) | 2,30 to 4,26 |
| **Indications** | **Benefits:** Rustic crop that fits well in soils with low content of pH, Al and P. Provide high N to the soil and next crops in temperate and subtropical regions. Trough mulching effects, soil structure, higher water retention, crop root development, soil biological activity leads to increase crop yields. Can be mixed with oat, rye, ryegrass, radish, buckwheat, phacelie, etc., produces quality fodder with high protein content. | |
| | **Attention points:** Mix hairy vetch with rye and other grasses reduce drastically N leaching and enhance cash crop yield. In France low cycle varieties. | |

RF = reproduction factor

## *Rye*

### *Autumn – Winter Soil Covers*

| | | |
|---|---|---|
| **Identification** | Common name | Rye |
| | Scientific name | Secale cereale |
| | Family | Fabaceae (gramínea) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 16 to 20 |
| | Root system | fasciculated with tiller |
| | Height (m) | 0,6 to 0,8 |
| | Growing habit | Clump/Erect |
| | Flowering (days) | 60 to 90 |
| | Cycle (days) | 140 to 150 |
| | Green mass (mt/ha) | 20 to 30 |
| | Dry mass (mt/ha) | 2 to 5 |
| | Frost tolerance | Tolerant |
| | **Seeding season** | **Late summer – early autumn** |
| **Seeding** | in lines | 50 to 70 |
| | broadcast sowing | 20% more |
| | Spacing between rows (17 to 34 cm) | 60 to 70 (seeds/linear m) |
| | In mixtures with 2 to 3 crops | 20 to 25 (kg/ha) |
| | In mixtures with 4 to 6 crops | 10 to 15 (kg/ha) |
| **Intercropping with corn** | in lines | ——— |
| | broadcast sowing | ——— |
| **Nematodes**[1] | Pratylenchus brachyurus | Susceptible |
| | Meloidogyne incognita | Susceptible |
| | Meloidogyne javanica | Susceptible |
| | Heterodera glycines | ——— |
| | Rotilenchulus reniformis | ——— |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 0,58 to 1,22 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,08 to 0,29 |
| | Potassium $K_2O$ (% in dry matter) | 0,75 to 1,45 |
| **Indications** | **Benefits:** Rye grows fast (even in cold fall) helps trap snow in winter, further boosting winter hardiness. Weed suppression, erosion control and soil root disease reduction. Due to lignin, hemicellulose and cellulose tissue content, remain higher soil covering. Deep roots promote better drainage, nutrient recycling of P, K and other nutrients. Quick maturity in spring can help maintain late-spring soil moisture. Can be mixed with oat, can avoid leaf rust attack; with vetch and other legume, more N during higher period for the next crop. | |
| | **Attention points:** Better soil effects when mixed with other cover crops such as hairy vetch, oat, lupine, field pea, radish, mustard, buckwheat, etc | |

RF = reproduction factor

## *White lupine*

### *Autumn – Winter Soil Covers*

| | | |
|---|---|---|
| **Identification** | Common name | White lupine |
| | Scientific name | Lupinus albus |
| | Family | Fabaceae (Leguminous) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 300 to 500 |
| | Root system | tap root |
| | Height (m) | 0,8 to 1,2 |
| | Growing habit | Bushy erect |
| | Flowering (days) | 50 to 70 |
| | Cycle (days) | 180 days |
| | Green mass (mt/ha) | 20 to 30 |
| | Dry mass (mt/ha) | 2 to 3 |
| | Frost tolerance | Tolerant |
| | **Seeding season** | **Late summer / early autumn – winter** |
| **Seeding** | in lines | 60 to 80 |
| | broadcast sowing | 20% more |
| | Spacing between rows (17 to 34 cm) | 15 to 20 (seeds/linear m) |
| | In mixtures with 2 to 3 crops | 25 to 30 |
| | In mixtures with 4 to 6 crops | 15 to 20 |
| **Consortium with corn** | in lines | ——— |
| | broadcast sowing | ——— |
| **Nematodes**[1] | Pratylenchus brachyurus | RF > 1 |
| | Meloidogyne incognita | RF > 1 |
| | Meloidogyne javanica | RF > 1 |
| | Heterodera glycines | RF > 1 |
| | Rotilenchulus reniformis | ——— |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 1,22 to 1,97 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,09 to 0,29 |
| | Potassium $K_2O$ (% in dry matter) | 1,00 to 2,66 |
| **Indications** | **Benefits:** used as a cover crop, oil (seeds), forage (sweet varieties) and animal fodder. High fixing nitrogen and cycling phosphorus and other nutrients. Nitrogen fixing can vary from 100 to 200 kg N $ha^{-1}$. P fixed by Fe, Al, and Ca phosphates can be released by root exudates (citric acid secretion) and citrate. The bitter seeds have higher protein content. | |
| | **Attention points:** As it is a host plant of several species of nematodes, it is recommended to mix with oat, rye, millet, triticale, among others to diminish these effect. | |

RF = reproduction factor

## *Black oat*

### *Autumn – Winter Soil Covers*

| | | |
|---|---|---|
| **Identification** | Common name | Black Oat |
| | Scientific name | Avena strigosa |
| | Family | Poaceae (Gramínea) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 13 to 16 |
| | Root system | Fasciculated/tillering |
| | Height (m) | 0,8 to 1,2 |
| | Growing habit | caespitose |
| | Flowering (days) | 80 to 110 |
| | Cycle (days) | 120 to 180 |
| | Green mass (mt/ha) | 30 to 60 |
| | Dry mass (mt/ha) | 3 to 6 |
| | Frost tolerance | little Tolerant |
| | **Seeding season** | **Late summer / early autumn – middle autumn** |
| **Seeding** | in lines | 55 to 70 |
| | broadcast sowing | 20% more |
| | Spacing between rows (17 to 34 cm) | 60 to 70 (seeds/linear m) |
| | In mixtures with 2 to 3 crops | 30 to 40 (kg/ha) |
| | In mixtures with 4 to 6 crops | 25 to 30 (kg/ha) |
| **Intercropping with corn** | in lines | ——— |
| | broadcast sowing | ——— |
| **Nematodes**[1] | Pratylenchus brachyurus | RF < 1 |
| | Meloidogyne incognita | RF < 1 |
| | Meloidogyne javanica | RF < 1 |
| | Heterodera glycines | RF < 1 |
| | Rotilenchulus reniformis | RF < 1 |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 0,70 to 1,68 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,10 to 0,42 |
| | Potassium $K_2O$ (% in dry matter) | 1,08 to 3,08 |
| **Indications** | **Benefits:** Very fast growth. High biomass production, efficient soil protection, efficient suppressing weed population and high versatility to fit in different cropping rotation systems, Soil attributes improvement. Can be used also as fodder (forage and grains) to animals. Good results can be achieved when mixed with other cover crop species (legume and other species). When mixed with rye, the rust occurrence can be highly decreased. Normally oats are more tolerant of wet soil than barley, but require more moisture. | |
| | **Attention points:** Oat can be used as soil covering (mulch or straw), forage or hay, and grain options. | |

RF = reproduction factor

## *Field pea*

### *Autumn – Early Spring Soil Covers*

| | | |
|---|---|---|
| **Identification** | Common name | Austrian winter peas (black); Canadian field peas (spring peas) |
| | Scientific name | Pisum sativum ssp. Arvense |
| | Family | Fabaceae (leguminous) |
| **Characteristics** | Weight of 1,000 seeds (grams) | 95 to 125 |
| | Root system | Tap root |
| | Height (m) | 0,6 to 0,8 |
| | Growing habit | climbing |
| | Flowering (days) | 40 to 50 |
| | Cycle (days) | 80 to 110 |
| | Green mass (mt/ha) | 20 to 30 |
| | Dry mass (mt/ha) | 4 to 6 |
| | Frost tolerance | No tolerant |
| | **Seeding season** | **Autumn – early spring** |
| **Seeding** | in lines | 25 to 40 (kg/ha) |
| | broadcast sowing | 45 to 50 |
| | Spacing between rows (17 to 50 cm) | 15 to 20 (seeds/linear m) |
| | In mixtures with 2 to 3 crops | 12 to 20 (kg/ha) |
| | In mixtures with 4 to 6 crops | 10 to 14 (kg/ha) |
| **Consortium with corn** | in lines | very efficient, sow when maize are around 0,60 to 0,80 m. |
| | broadcast sowing | ——— |
| **Nematodes**[1] | Pratylenchus brachyurus | Susceptible |
| | Meloidogyne incognita | Susceptible |
| | Meloidogyne javanica | ——— |
| | Heterodera glycines | ——— |
| | Rotilenchulus reniformis | ——— |
| | Pratylenchus coffeae | ——— |
| | Pratylenchus zea | ——— |
| **Recycling of nutrients** | Nitrogen (% in dry matter)[2] | 0,20 to 3,47 |
| | Phosphorus $P_2O_5$ (% in dry matter) | 0,13 to 0,38 |
| | Potassium $K_2O$ (% in dry matter) | 2,10 to 2,56 |
| **Indications** | **Benefits:** Fast growing, high biomass and soil covering. In spring can suppress weeds properly. Used as forage – normally 18-20% of protein or grain, isolated or mixed with oat, rye, raygras, etc , May be used as cash crop. Attract beneficial organisms. Nitrogen cycling. | |
| | **Attention points:** Moderately cold and drought tolerant. Can adapt in semi-arid climate, in soils with medium fertility. Mycosphaerella and Ascochyta pisi foot rot are the main diseases of economic importance in field pea. Also can be susceptible to Sclerotinia sp. in some regions. | |

RF = reproduction factor

# Consortium, cocktail and mix of cover crops

## Consortium spring / summer

- Millet ADR-300 (5 – 8 kg/ha) + buckwheat (15 – 20 kg/ha)
  + crotalarias (spectabilis, breviflora and ochroleuca) (6 – 8 kg/ha each)
  * may be mixed or each species individually.
- Millet ADR-300 (5 – 8 kg/ha) + buckwheat (15 – 20 kg/ha)
  + crotalaria (spectabilis, breviflora and ochroleuca) (6 – 8 kg/ha each)
  + dwarf pigeon pea or mucuna (10 – 15 kg/ha)

## Consortium autumn / winter – Indicated for areas with altitude

- Forage turnip (3 – 4 kg/ha) + black oats (20 – 25 kg/ha)
  + common vetch (15 – 20 kg/ha)
- Black oats (20 – 25 kg/ha) + white lupine (30 – 35 kg/ha)
  + rye (15 – 20 kg/ha)

**Markings**

[1] RF = reproduction factor
RF < 1 initial population of nematodes is reduced
RF = 1 initial nematode population is maintained (does not increase or decrease)
RF > 1 initial population of nematodes is increased

[2] The values expressed in Nitrogen (N) are relative to biological fixation and recycled for legumes and recycled for other families.

**General observations**

The recommendation of seed density may vary from crop to crop, according to the weight, germination, vigor and purity of the seeds. The information in this leaflet has been summarized from the available literature for the practice of green fertilization, and not used for forage or seed and grain production. For any species, planting season and region it is important to comply with the soil moisture conditions for seed germination and development. The information and values may vary with plant age, plant type, soil, fertility, climate, season and sowing density.

## Seed quantity (kg/ha)

| Covers | Single | Cocktail with 2 or 3 covers | Cocktail with 5 to 6 covers | Intercropping with corn |
|---|---|---|---|---|
| Pearl millet | 20 | 6 – 8 | 5 – 6 | – |
| Crotalaria spectabilis | 15 | 8 – 10 | 6 – 8 | 10 |
| Crotalaria ochroleurca | 12 – 15 | 8 – 10 | 6 – 8 | 10 |
| Crotalaria juncea | 20 | 8 – 10 | 6 – 8 | – |
| Buckwheat | 60 | 20 | 15 | – |
| Sunflower | 30 | 5 | 2 | – |
| Finger millet | 10 | 5 | 3 | – |
| Brachiaria ruziziensis | 10 | 6 | 3 | 3 |
| Dwarf pigeon pea | 35 | 20 | 15 | 20 – 25 |
| Oilseed radish | 20 | 4 – 5 | 2 – 3 | – |
| Common vetch | 50 | 30 | 15 | – |
| Rye | 60 | 30 | 20 | – |
| White lupine | 100 | 50 | 20 | – |
| Black oat | 65 | 40 | 29 | – |

**References**


CALEGARI, A.; COSTA, M.B.; MONDARDO, A.; WILDNER, L. do P.; ALCÂNTARA, P.B.; MIYASAKA, S.; AMADO, T.; Adubação Verde no Sul do Brasil. 2.ed. Rio de Janeiro: AS-PTA, 1993. 346p. 2ª. Edição

CALEGARI, A.;.DONIZETI CARLOS, J.A._ Recomendações de plantio e informações gerais sobre o uso de espécies para adubação verde no Brasil. In: LIMA FILHO, O. F. de; AMBROSANO, E. J.; ROSSI, F.; CARLOS, J. A. D. (Ed.). Adubação verde e plantas de cobertura no Brasil: fundamentos e prática. Brasília, DF: Embrapa, 2014. v. 2, Cap. 27,_ p. 453-478.

CALEGARI, A. Plantas de cobertura. Manual Técnico. Fev. 2016. Penergetic. Uberaba, MG 24p. (3a. edição).

CARLOS, J. A. D.; Tabelas de recomendações – Pirai Sementes, 2016.

DERPSCH, R.; CALEGARI, A.; Adubação verde de inverno. Londrina, IAPAR, 2ª edição, 1992. p. 80. (IAPAR, Boletim, 73).

Managing cover crops profitability? Project manager and Editor 3rd ed.
Agriculture Network handbook series, bk 9. ISBN 978-888626-124 (pbk). Sustainable Agriculture Network. 10300 Baltimore ave. Bldg. 046, Beltsville, MD 20705 HYPERLINK “http://www.sare.org” www.sare.org, 2007. 244p.

Serrantonio, Marianne . Metodologies for screening soil improving legumes. 1956. ISBN – 0-87857-8=989-3 Rodale Institute Research Center, Rodale Institute. 611 Siegfriedale Road. Kutztown, Pa. 19530, USA. 1991, 312 p.

WUTKE, E. B.; CALEGARI, A.; WILDNER, L. DO P. Espécies de adubos verdes e plantas de cobertura e recomendações para uso. In: LIMA FILHO, O. F. de; AMBROSANO, E. J.; ROSSI, F.; CARLOS, J. A. D. (Ed.). Adubação verde e plantas de cobertura no Brasil: fundamentos e prática. Brasília, DF: Embrapa, 2014. v. 1, p. 59–168.



**Technical Manual of Cover Crops – Edition 02 • September 2016**

# Some additional cover crops in the U.S.A. and in Europe

In 2003, Ademir Calegari visited France and shared experiences and ideas and encouraged Frédéric Thomas, researcher and farmer from France, to start with different trials, testing and validating some different mix cover crops.

So, these different mix cover crops can be tested and used in different countries in Europe, U.S.A and also some other countries.

*Phacelia tanacetifolia, Vigna unguiculata (cowpea), Faba bean, Lotus corniculatus (bird's trefoil), Melilotus officinalis, Lollium multiflorum (Ryegrass), X-Triticosecale (Triticale), (Hordeum vulgare) Barley, Sorghum bicolor (Sorghum), Sudan grass, Brassica sp. (Oil seed rape), Asian radish, Fodder radish, Moha, (Sinapis sp.) white and Black mustard, Alexandrian clover (Bersim clover), Subterranean clover, Persian clover, Crimson clover, White clover, Red clover, Lathyrus sp., Faba bean, Faenun graecum, Camelina sp., Linun usitatisimum (Flax), etc.*

## Species / basics

| Basics | During the period between cash crops, seeding any cover crop is a big step forward in restoring water quality, maintaining and developing soil fertility and in the long term saving fertilizer inputs and reducing the need for tillage. Each plant has its own attributes that fit specific or diverse situations. Therefore, it is very important to have a good knowledge of each one of these important "agronomical tools" in order to use them properly and gain the maximum benefits. |
|---|---|
| Common (white) mustard | Seeding rate: 8 – 10 kg/ha single (3 – 4 kg/ha into a mix)<br>Most widely used cover crop, easy to establish, quickly covers soil surface but very sensitive to stress (lack of water, lack of nitrogen or very high temperatures) and can run to seed very quickly. Biomass rapidly becomes fibrous, breaks down slowly and during decomposition, N losses can be high. |
| Phacelia | Seeding rate: 6 – 10 kg/ha<br>Requires better establishment, small roots, very beneficial in improving surface soil structure, especially in clay soils. Popular with bees. Improves density in mixtures and can easily be destroyed by knife roller; its black coloured residues help to warm up the soil (just like field bean residues). If N is available (manure or legumes), it produces a lot of biomass; also a good K scavenger (indeterminate flowering habit and produces a lot of seeds). |
| Oat (spring or winter variety) | Seeding rate: 70 – 90 kg/ha<br>Not expensive and easy to establish, oats are better suited as autumn and winter cover crops. When drilled too early they produce low levels of biomass and are susceptible to rust and aphids. Generally, crop is not killed by frosts and will re-grow in spring. |
| Fodder radish | Seeding rate: 6 – 8 kg/ha<br>Versatile plant suited to almost all soil types and conditions. Developes huge biomass and leaves a good soil structure. Resists to drought and is not attractive to slugs. Good basis for a lot of mixes. |
| Rye | Seeding rate: 70 – 100 kg/ha<br>Very aggressive plant with good soil restructuring root system. Does not develop a lot of biomass after autumn seeding but becomes very productive in the following spring. Very sensitive to slugs when young. Useful for thick mulch to direct drill legumes, maize or vegetable crops. High residue in C/N ratio, risk of early N deficiency. Mixing with vetches or peas is advisable. |
| Triticale | Seeding rate: 80 – 120 kg/ha<br>Same properties as rye but little bit less aggressive and more susceptible to pests and diseases. Should be sown as hibernate cover crop. |
| Barley (spring or winter variety) | Useful and cheap cover crop, can supply some biomass in autumn (spring varieties).<br>Barley is sensitive to stress and diseases. Not advisable in rotation with winter cereals. |
| Rye grass | Seeding rate: 17 – 22 kg/ha<br>Slow early growth, once established becomes very aggressive. Better suited to cover crops which will be hibernate. Can supply a useful source of forage and is a N scavenger. One of the few species that can grow under maize, but can be very difficult to manage either mechanically or chemically. |
| Oil seed rape | Seeding rate: 8 – 12 kg/ha<br>Very inexpensive cover crop, aggressive with good soil structuring attributes. To get best from OSR as cover crop needs to be sufficient N available. Used in any rotation where OSR is not a part. OSR will encourage slugs, this should be taken into account when considering. |
| Fodder rape | Seeding rate: 8 – 12 kg/ha<br>Very similar to OSR but with more foliage (better cover) and can be grazed. |

## Species / "new species"

| "New species" | These species have been introduced recently as potential cover crops with some useful attributes. It is not a complete list; new species are screened every year by min-till and no-tillage organisations and also by seed suppliers. There are many other species which might be suited as cover crops but it is a case of finding them and trialling them on a local basis. |
|---|---|
| Sunflower | Seeding rate: 20 – 25 kg/ha<br>Best suited to hot and dry conditions, supplies good levels of biomass if planted early in the summer. Good option for summer cover crops in rotations where it is not planted as a cash crop; killed by frost. In biomass type mixtures form a basis, which absorbs N, P and K: Doesn't provide much soil cover but does absorb a lot of nutrients and helps suppress weeds. |
| Rough oat or Brazilian oat (avena strigosa) | Seeding rate: 35 – 45 kg/ha<br>Will grow under all conditions. Is close to forage oat, quite aggressive and produces a heavy biomass that can be converted into quality forage (could be fibrous). As a cover crop, remaining straw on soil can be difficult to break down and may require some extra N: therefore risk of N deficiency in next crop. Can be reduced by including a legume. |
| Flax | Seeding rate: 20 – 30 kg/ha<br>Easy to establish even under dry conditions. Low surface biomass, produces a good level of roots and competes well with weeds. Remaining residue can block tillage tools and seeders. |
| Buckwheat | Seeding rate: 45 – 55 kg/ha<br>Quite easy to establish in stubble during summer, competes well with broadleaved weeds (allotropic effect). Quite easy to use as "double" crop or catch crop. Remaining seeds after harvest or in cover crops biomass will germinate next spring when temperature reaches 12°C. Not recommended as cover crop or mix before maize, sugar beet, and sunflower. Encourages bees and wildlife. Good P scavenger. |

| | |
|---|---|
| Camelina | Seeding rate: 8 – 12kg/ha<br>Oil seed plant, seeded very shallow, emerges and grows quickly and competes well with weeds. With a growing cycle (90–100 days), a high risk of producing viable seeds. Can be used as double crop and companion crop especially in association with legumes (e.g. lentil, soybean, lupine). |
| Asian radish | Seeding rate: 5 – 8kg/ha<br>Quite easy to establish, absorbs a lot of N. Unlike the fodder radish, stem doesn't grow (if sown late summer and autumn) but develops rapidly and produces long tap roots. In sufficient soil fertility, root can become very big and weigh several kg. Usually killed by winter frosts (-7 or -8°C) or by rolling or shallow tillage. Crucifer. Crop returns fertility stored in its root as a low C/N ratio. |
| Turnip | Seeding rate: 6 – 10kg/ha<br>Cruciferous species mopping up a lot of residual N. Like OSR, no growth of stem in autumn and foliage is good for grazing. Will not be killed during winter and continue to absorb N. During spring growth initially depletes N available for the following crop. This N will be only available later to the cash crop. |
| Moha millet | Seeding rate: 25 – 30kg/ha<br>Summer grass, need high temperatures, water and N. Excellent source of forage and useful cash crop, when in conjunction with legume (e.g. Alexandrian clover). Sensitive to sunlight, must be seeded early (before mid-July), long day length stimulates growth. |
| Sorghum | Seeding rate: 15 – 25kg/ha<br>Very aggressive tropical grass producing heavy biomass and roots, when planted early. Drought resistant when well established (needs to be well seeded). Benefits from high temperatures, moisture and N. Several types (grain, sugar, paper) can produce different volumes and qualities of vegetation. Good source of forage. |
| Black mustard | Seeding rate: 2 – 3kg/ha<br>Very low thousand grain weight and strong emergence (vegetal development a little bit like OSR, produce a stem in autumn), can be seeded at very low seed rate. Growth cycle is longer than white mustard, chance of producing seed lower, therefore less competitive with weeds. Could be employed as a "bio-fumigant" on nematodes. |
| Nyger | Seeding rate: 8 – 12kg/ha<br>Closely related to sunflowers and best suited to hot moist conditions. If drilled early, it can produce high levels of biomass and will smother volunteers and weeds. First light frost will kill it. Attractive to slugs. If planted early is a versatile cover crop. Planted alone or in mixture, gives good results. Should be a companion crop with autumn sown OSR (attracts slugs) and killed with first frost, will not compete with crop. |

## *Species / legume cover crops*

| **Legume cover crops** | **In Europe, few are included in our crop rotations, so they should be included in cover crops mixes. This is probably at odds with the concept of the N holding cover crops aimed at reducing nitrate level in drainage water. They bring more diversity, promote a higher biomass production and, none the less, fix some N, which can reduce the dependence on artificial fertilizer. Finally, legumes have a low C/N ratio so do not tie up soil N. As an essential natural plant species, they should be included wherever possible.** |
|---|---|
| Common vetch<br>(spring or winter cultivars) | Seeding rate: 40 – 50kg/ha<br>Slow to establish, but as a climber will smother other species in autumn (or spring if seeded late). Very good N fixer, that combines quite well with cover crops and forage mixes. Easily controlled with knife roller or any other mechanical destruction. Tendency to re-grow and can block up tine based tillage machinery. Its shallow root system aids biologic activity. |
| Hairy vetch | Seeding rate: 35 – 45kg/ha<br>Initially slower to establish than common vetch, once growing can become quite aggressive. Can dominate any species or mixture and will smother weeds on volunteers by its very high levels of vegetation. Has trait of having 3–5% seeds remaining dormant and may well germinate in the following cash crop. Risk of contamination is limited by conservation tillage and direct drilling, but could be a problem for organic growers. |
| Bengal vetch | Seeding rate: 40 – 50kg/ha<br>Same traits as common vetch but with faster growth: depending on conditions, of 25% to 40% more biomass in 3 months in summer and autumn. Quite good choice where sown between winter cereal crops supplying N to the following crop. |
| Cerdagne vetch (Mountain vetch) | Seeding rate: 30 – 40kg/ha<br>Well suited to dry and harsh conditions. Like bitter vetch, various species are not yet catalogued so cannot be differentiated in between. |
| Alexandrian clover<br>(Berseem clover) | Seeding rate: 8 – 12kg/ha<br>Annual or biennial clover, develops rapidly during summer and autumn if conditions are favourable. Prefers deeper soils with a good natural fertility and sufficient moisture. Significantly less competitive under dry conditions. Under good conditions it can produce high levels of biomass (3–4mt of DM/ha are possible after barley or wheat crop), fixing significant amounts of N. Very good source of forage alone or in mixes but also very good cover crop between two straw crops. No need to destroy before planting next straw crop (can be dealt by herbicides during the autumn and winter). |
| Persian clover | Seeding rate: 8 – 12kg/ha<br>Like Alexandrian clover it provides biomass during summer. Grows better in poorer soils and harder conditions: more resistant to frost and harder to destroy. |
| Crimson clover | Seeding rate: 12 – 15kg/ha<br>Biennial clover, quite slow to establish in autumn but opposed to Berseem clover performs better under more difficult climatic conditions and lighter soils. Quite winter hard, will regrow again in spring very fast (the main production period). Good source of forage and a useful complement for cover crop mix with early spring biomass production. Despite its qualities, is not a big N fixer: In field trials, often at bottom of the list. Good cover crop to use on wet soils before maize, as long as it is killed off before using up all soil moisture. |
| Field bean | Seeding rate: 150 – 200kg/ha<br>Despite large seed size and heavy seed rates, very useful and versatile plant as cover crops (volunteers are a good indication). Produces a considerable amount of biomass and tap root is good for soil re-structuring. Able to quickly fix the high amounts of N (80–200kg N/ha in 3–4 months). Not ideal forage crop but can be used in silage or haylage. Can be included in many summer, autumn or winter mixes. Usually killed by winter frost but if sown late (after corn harvest), will go through winter easily and start to grow again in spring. Good companion crop (OSR, sunflower, corn, cereals), not very competitive against weeds. Spring variety "Diana" with a lot smaller grain size (300–400gr/1000 grains) tested by conservation agriculture networks, seems to bring equal results at half seed rate. |
| Forage pea | Seeding rate: 60 – 80kg/ha<br>Very versatile legume well suited cover crop. A lot hardier, producing a bigger biomass and more disease resistant than varieties used for grain production. Good supplement of any cover mix. Produces good quality forage useful in forage and grain mixes. |
| Latyrus | Seeding rate: 35 – 45kg/ha<br>Better suited to calcareous soil where it can produce good levels of biomass. In these conditions good N fixer. Grain is toxic, can't be used as forage, but useful as companion plant especially for OSR (short growing cycle and easily killed by frost). |
| Lentil | Seeding rate: 25 – 35kg/ha<br>Generally prefers calcareous and non-acidic soils. Does not produce high levels of biomass, still quite competitive with weeds (when drilled at high seed rates). Rarely used as cover crop and especially not in mixtures. Very useful as companion crop for OSR, if used GFL mix (Gesse/ fenugreek/lentil). Black fodder lentil, produces more biomass and is more aggressive, but seed is in short supply. |
| Fenugreek | Seeding rate: 10 – 15kg/ha<br>Typical smell of curry (plant and seeds). Suited to clay and calcareous soil and quite hardy conditions. With lentils, fenugreek is not an aggressive plant. Potential biomass is not great but for forage has high quality (not for dairy cows – curry taste goes into the milk). Does not perform well in cover crop mixtures; good companion crop for OSR. Its strong smell can deter insects but attract hares and deer. |

## Species / classical blends

| Classical blends | Not an exhaustive list but contains the main species used at present. Other plants can also be used as cover crops alone or in mixtures. Researchers, seed dealers and conservation agriculture networks continue to investigate other species and select some specific varieties that can perform new functions. Below are listed only few examples to give some ideas, associations and mixtures. Please note that the more species put in a mix, the better they will perform in terms of soil structure, fertility, biomass, weed control, stability, etc.: the more complex the blend, the more simple it becomes! |
|---|---|
| Mustard \| phacelia | Seeding rate: 4kg/ha \| 5kg/ha<br>Conventional and very classic mix for fields with good levels of N or where some kind of manure or slurry will be applied. Usually high biomass production. Depending on fertility and weather conditions, mustard can become dominant (in this case reduce the seed rate of mustard or dilute it with a third species). Seedbed must be sufficiently good for phacelia to establish well. |
| Winter oat \| mustard | Seeding rate: 20kg/ha \| 4kg/ha<br>Easy mix to use with a good potential of biomass production if sufficient N available. Mix is good for weed control but residues are high in C and may use more N from the soil during decomposition than return any for the next crop. Is even more evident if cover crop is incorporated or ploughed down, if following crop is directly drilled. Residue remains on the soil surface, decomposition is slower tying up less soil N. |
| Spring oat \| vetch | Seeding rate: 50kg/ha \| 25kg/ha<br>Mix is better suited for seeding later in the season, possilbility to hibernate and completing its work the following spring. Earlier sowed oats may not be competitive enough and could leave space for weeds to develop. Winter cover crop and addition of some field beans with reduced seed rate of oats and vetch will be a better option (40kg/ha oat, 20kg/ha vetch and 40kg/ha Berseem) and will fix more N. |
| Winter oat \| phacelia | Seeding rate: 20kg/ha \| 5kg/ha<br>Good potential biomass producer with a better balanced C/N ratio. Care must be taken as oats can become dominant. Better to mix with a third species (a legume like vetch). |
| Winter oat \| phacelia \| vetch | Seeding rate: 15kg/ha \| 3kg/ha \| 15kg/ha<br>Very well balanced mix with species that have got different and complementary vegetative behaviours. Adding vetch will improve biomass production, soil coverage and increase N pool. While lowering average C/N ratio of residues. Mix can give good results after winter cereals crops (long intercrop period) as well as after maize (where it will hibernate).<br>In this situation it is recommended to increase the seed rates by 10 to 20% in order to get more quickly better cover. |
| Alexandrian clover \| phacelia | Seeding rate: 5kg/ha \| 5kg/ha<br>Two less competitive species that can cooperate well together to produce a good cover and a well-balanced biomass. Easy to manage. Mix needs to be established well and prefers deep silty soils with good natural fertility. Mixture is useful between two winter cereals or for longer inter crop periods where, if planted too early, it will be held back by winter frosts. |
| Radish \| forage pea | Seeding rate: 5kg/ha \| 25kg/ha<br>More impressive and bushy, able to produce a large biomass (4–6mt of DM/ha) if sown early. Good couple for short intercrop periods before winter cereals if OSR is not one of the main crops in the rotation. Performance will be improved by incorporating other species in the mixture like sunflower, phacelia, flax, vetch. |
| Pea \| vetch \| field bean | Seeding rate: 25kg/ha \| 20kg/ha \| 50kg/ha<br>Quite well balanced mixture with the objective of fixing max. N to boost soil's natural fertility. For summer-autumn or winter-spring intercropping it is recommended to add some oats, phacelia or radish or maybe all three to boost biomass production and level of cover without reducing ability to fix N. Pure legume mix, fits well in no-till and organic farming systems. Care should be taken when the crop is distroyed, possible for N leaching, breaching environmental legislation. |

## Species / "Biomax" type blends

| "Biomax" type blends | The word "Biomax" explains the objective of the multiple species cover crops: to produce the maximum level of biomass encouraging a maximum amount of bio-diversity in the soil and the surface. Once again, this list of examples is obviously not complete. Never the less it should supply ideas and guidelines to help growers understand how to blend plants types in order to be able to make their own Biomax mixes according to their conditions, objectives and available seed. |
|---|---|
| Mustard \| phacelia \| pea \| vetch | Seeding rate: 2kg/ha \| 2kg/ha \| 20kg/ha \| 12kg/ha<br>Mixture is quite well balanced with some good conventional cover crops associated with a couple of very good legumes. Well suited for sowing from middle to the end of august for autumn and winter intercropping. If sown too early, risk that mustard will run to seed even if the seed rates are reduced. |
| Sunflower \| radish \| phacelia \| pea \| vetch | Seeding rate: 6kg/ha \| 2kg/ha \| 2kg/ha \| 15kg/ha \| 10kg/ha<br>Mixture produces more impressive vegetation and a bigger biomass capable of fixing good levels of N. Possible to drill early, right after harvesting winter cereals. Can be used for longer intercrop periods or between two winter cereals. Usually controlled by the winter weather and does not need to be destroyed chemically or mechanically. |
| Radish \| flax \| phacelia \| pea \| vetch | Seeding rate: 3kg/ha \| 7kg/ha \| 2kg/ha \| 15kg/ha \| 10kg/ha<br>If sunflower is grown on the farm as a cash-crop, it is possible to increase amount of radish and add some flax. Mix probably less productive in term of biomass but with soil structuring effect in combination with radish and flax makes a useful cover crop. |
| Asian radish \| phacelia \| field bean \| Alexandrian or Crimson clover \| vetch or pea | Seeding rate: 2kg/ha \| 2kg/ha \| 30kg/ha \| 3kg/ha \| 10kg/ha<br>Cover consists five "levels" with the tillage radish dealing with "deep underground level". Biomax will be a bit shorter with slightly less biomass but its vegetation will be very dense. Good N fixer with fast return to next crop. Ideal cover crop between winter cereal crops. |
| Oat \| field bean \| Pea \| vetch \| phacelia | Seeding rate: 25kg/ha \| 50kg/ha \| 20kg/ha \| 15kg/ha \| 2kg/ha<br>Mixture for winter-spring intercropping, slightly higher seed rate. Drilled in October or November, majority of plants will go through the winter and come up in spring. As most are legumes, their growth will not only absorb soil moisture but also increase level of N fixed and of C returned to the soil during the intercrop period. Oat can be easily replaced by summer oat, rye or any other winter cereals by adjusting seed rate. |
| Sorghum \| radish \| moha rough oat \| pea \| vetch \| Alexandrian or Crimson clover | Seeding rate: 3kg/ha \| 2kg/ha \| 5kg/ha \| 10kg/ha \| 10kg/ha \| 5kg/ha<br>Summer biomax for forage production. Should be sown early after winter barley or OSR. Potential of biomass production is very high and such a diversity of plants will easily adapt to and compensate adverse climatic conditions. |
| Field bean \| vetch \| pea \| Alexandrian clover \| lentil | Seeding rate: 30kg/ha \| 10kg/ha \| 15kg/ha \| 3kg/ha \| 5kg/ha<br>Pure legume biomax for max. N fixation. During 3–4 months summer intercrop period, possible that mixture can produce 4–5mt/ha of DM with 100–180kg of N/ha (kept in total biomass: surface vegetation and roots) a large percentage (40–50%) will be available for the next crop. |
| Sunflower \| phacelia \| radish \| OSR \| rough oat \| flax \| nyger \| pea \| vetch \| Alexandrian clover \| field bean | Seeding rate: 3kg/ha \| 2kg/ha \| 1kg/ha \| 3kg/ha \| 4kg/ha \| 3kg/ha \| 1kg/ha \| 6kg/ha \| 5kg/ha \| 2kg/ha \| 15kg/ha<br>Ten species are a very complex biomax mixture. If weather conditions are favourable, (when sown after a winter cereal), possible for this type of mixture to produce 10mt/ha of DM with 150–250kg of N/ha recycled and fixed in the surface vegetation. Mixture is a real soil fertility booster. |

# Penergetic Products


*A passion for nature. Made in Switzerland.*

***We encourage a sustainable and gentle agriculture for humans, animals and the environment since 20 years. We are based in Switzerland, the ideal place to turn our vision into reality. State-of-the-art production facilities, innovative product development and a highly qualified team ensure a production to the highest quality standards.***

Penergetic's development work is based on a holistic approach. It is important to take into account as many interrelations of natural process chains in agriculture and the environment as possible into account, ideally all of them. Biological systems are open cycles. In various process chains that are interlinked with each other, they form our eco-system.

Penergetic products stimulate biological systems with natural impulses. In this way, cycles can be optimized and the efficiency of individual processes can be improved. Increased yields and higher profits together with improved well-being of the animals ensure the future viability of the farms. The Penergetic product system covers six areas of use.

The individual products are cycles within themselves and interact with one another. The products are optimized continuously and their effects complement each other.

***penergetic products***

- for water
- for plants
- for animals
- for liquid manure
- for compost
- for soils

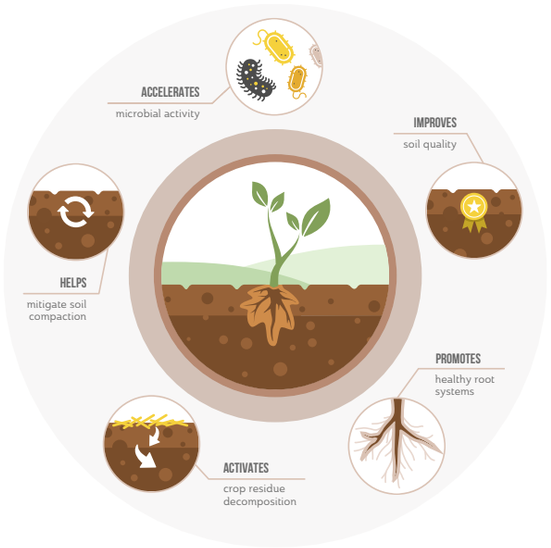
# Soil penergetic b

## *Soil life – soil health – these are the farmer's most important assets and must be supported and promoted.*

**penergetic b has been designed to stimulate soil biology and to promote its activity. By stimulating the soil organisms, the mycorrhizae and indirectly the root growth are activated. The crop residues in the fields should not be neglected. They are useful and important food for soil organisms.**

***Benefits***

- Accelerates microbial activity and soil quality
- Increases phosphorus availability
- Reduces influence of harmful micros
- Activates crop residue decomposting
- Helps mitigate soil compaction
- Increased number of beneficial fungi in the soil
- Less fertilizer needed due to improved soil fertility
- Optimised soil structure (air, water, heat balance)
- Easier tillage
- Less machinery work needed
- Redudes weed pressure



# Practical experience reports



**Penergetic U.S.A.**
**Willenbring Dairy Farm**
**Minnesota U.S.A.**

# Improvement in soil structure with ‘activated’ manure

## Observation of soil structure and soil quality over two years (2015–2016)

- Aerobic activation with liquid manure and penergetic b
- Willenbring Farm, Minnesota U.S.A.

Field 2 and field 6 were both treated with penergetic b and p for the first time in the spring of 2015 and again in the spring of 2016.

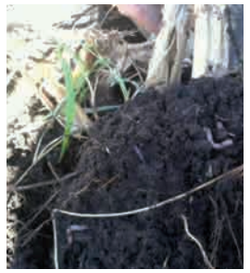
Both fields received 1,500–2,000gal/ac (14–18$m^3$/ha) of penergetic g/k treated (aerobically activated) liquid dairy manure for the first time in September of 2016.

Notice how much different the Sulfur levels are for both fields in 2016.

Also how the pH of both fields have gone form alkaline to balanced since the use of penergetic products.

| Sample identification | soil pH | sulfur (ppm) |
|---|---|---|
| Field 2 – 2011 | 8.1 | 7 |
| Field 2 – 2014 | 7.3 | 8 |
| Field 2 – 2016 | 6.8 | 20 |
| | | |
| Field 6 – 2011 | 8.3 | 9 |
| Field 6 – 2014 | 7.2 | 9 |
| Field 6 – 2016 | 6.8 | 27 |

All of the soil samples were taken in the fall of each year.
Tested at Midwest Laboratories Omaha, NE.



**left:** Sept. 2016 – after 1 year of penergetic g/k use with no agitation since May 2016. Aerobically activated liquid dairy manure. Nutrients are in an organically bound form = no risk to the groundwater.
**right:** Field 6 on 17.09.2016: An example of a healthy, loose soil with good air, water and nutrient exchange.

*“Through the use of the penergetic products, I am beginning to find significantly more earthworms and signs of life in our soils.”*

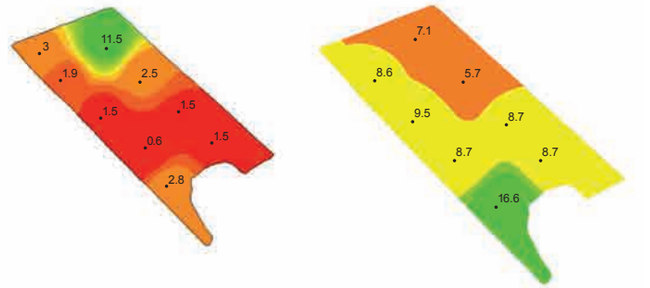
Matthew Willenbring

# Fertile soil without phosphorus even after five years of cultivation

**Development of soil fertility of the Fazenda Boa Fè by the use of penergetic b and p**
The Farm Boa Fè goes into the 14th harvest without phosphorus fertilization. The remaining nutrients are used as required. The productivity of the farm is comparable to that of the neighbours. The fields are alternately used for soya and corn. On these fields, hay has been cultivated two times in the intermediate harvest as winter food for the cattle.

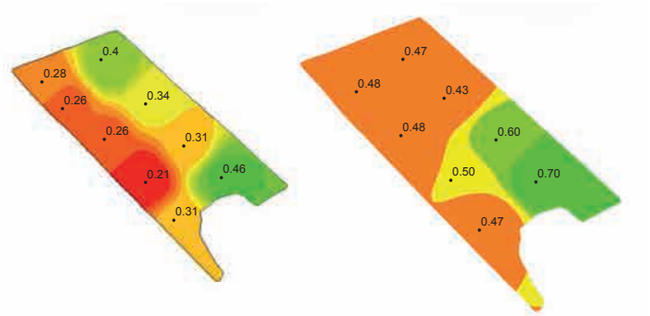
**Levels of phosphor**
left: 2010 (Averages of 3,06mg/dm³)
right: 2015 (Averages of 9,20mg/dm³)

| | **2010** mg/dm³ | **2015** mg/dm³ |
|---|---|---|
| | 0.60 – 1.64 | lower than 5.70 |
| | 2.34 – 3.32 | 5.70 – 8.42 |
| | 4.69 – 6.21 | 8.43 – 11.15 |
| | 7.79 – 9.32 | 11.16 – 13.88 |
| | 10.53 – 11.50 | 13.89 – 16.60 |



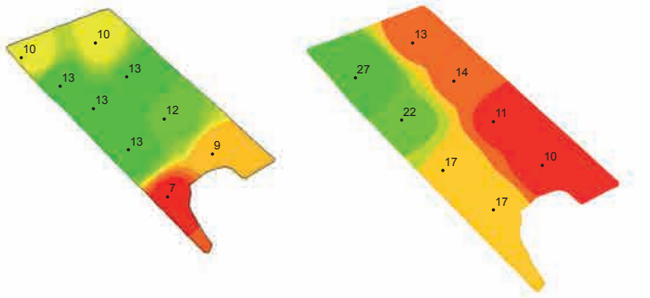

**Levels of potassium**
left: 2010 (Averages of 0,32cmolc/dm³)
right: 2015 (Averages of 0,52cmolc/dm³)

| | **2010** mg/dm³ | **2015** mg/dm³ |
|---|---|---|
| | 0.21 – 0.24 | lower than 0.43 |
| | 0.27 – 0.30 | 0.43 – 0.49 |
| | 0.32 – 0.35 | 0.50 – 0.56 |
| | 0.38 – 0.41 | 0.57 – 0.63 |
| | 0.44 – 0.46 | 0.64 – 0.70 |




**Levels of sulfur**
left: 2010 (Averages of 11,07mg/dm³)
right: 2015 (Averages of 16,38mg/dm³)

| | **2010** mg/dm³ | **2015** mg/dm³ |
|---|---|---|
| | 7.00 – 7.39 | 10.00 – 12.05 |
| | 8.05 – 8.77 | 12.06 – 14.93 |
| | 9.58 – 10.33 | 14.94 – 17.80 |
| | 10.99 – 11.71 | 17.81 – 20.68 |
| | 12.46 – 13.00 | 20.69 – 23.56 |
| | —— | 23.57 – 27.00 |






# Poor yields on alkaline soils have been transformed into productive fields

**Before:** typical alkaline soil

Nothing of value had grown on this land in southern Alberta in the past 30+ years: yet, it has been used for a little cattle grazing. Historically, some koshia (an alkaline soil pH tolerant invasive weed) has been about the only thing that has grown on this ground.

**penergetic b converts a non-productive alkaline field into producting alfalfa field in just 12 month.**

**Treatment**
- August 2015:
  800gr/ac (2kg/ha) penergetic b
- Spring 2016:
  300gr/ac (750gr/ha) penergetic b

» *Note: No penergetic p has been applied!*

**Results**
- Field previously planted in alfalfa, cut in late July 2016
- Yield: 1mt/ac = 2.5mt/ha!

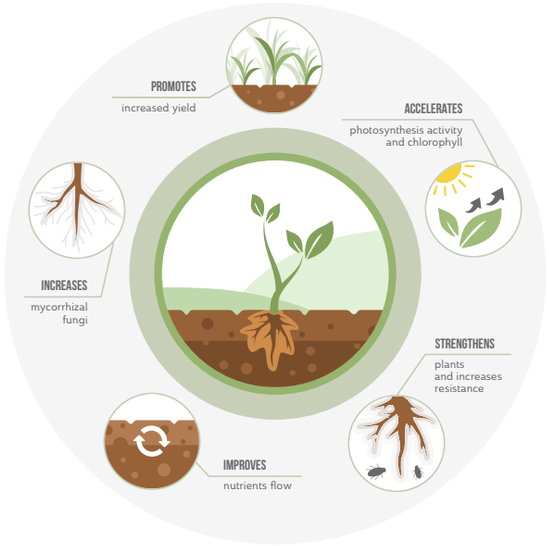
» *penergetic b made this formerly alkaline field productive!*

**After:** see the difference

# Plants
# penergetic p

*Plant growth depends largely on the health of the soil and the fertilizer that is used. A good and healthy quality of the product ensures an optimal agricultural cycle for the benefit of animals and humans.*

**penergetic p is used as a plant tonic. The product has a stabilizing effect on plant growth and strengthens the immune system of the plants. This reduces susceptibility to diseases and pest infestation. Additional benefit is the stimulation of microbiology in the root area and the increase of the plant's natural nutrient uptake. Plants become more resistant and through that show a better productivity.**




***Benefits***

- Improved assimilation of nutrients
- Stimulates plant growth
- Increases mycorrhizal fungi
- Strengthens plants
- Reduction of fertilizer
- Accelerates chlorophyll and photosynthesis activity
- Improved yield and enhanced crop quality
- Increased stress resistance
- Activates the symbiosis of soil-root-plant
- Stabilisation of the biological optimum for plants
- Works synergistically with other agri-inputs

## Practical experience reports




**Penergetic Brazil**
**Araunah Agro**


# Performance of the Penergetic Technology in soybean


**June Faria Scherrer Menezes**
PhD in Plant Science/UFV,
Professor and Researcher of
the Department of Agronomy
of UniRV, Rio Verde/GO


**The Penergetic Technology operates in soil and plant bioactivation with the potential to promote positive effects on plant vitality.**

With the use of penergetic, some authors found positive results in the reduction of inputs, indicating a better use of existing fertility, better release and utilization of nutrients to plants and existing natural resources, consequently the increase in crop productivity. In this sense, the purpose of the work was to evaluate the performance of Penergetic Technology in soybean production in the crop of 2015/16.

### Material and methods

For the performance of the test, the following treatments were evaluated:

**Table 1:** Description of the treatments used in the test (Rio Verde/GO, crop of 2015/16)

| Treatment | Dose of penergetic products | Application time |
|---|---|---|
| **1** Standard fertilizer (100% mineral fertilizer) | – | – |
| **2** Fertilizer adjusted (50% mineral fertilizer) | – | – |
| **3** Zero fertilizer (0% mineral fertilizer) | – | – |
| **4** Standard fertilizer + 250gr/ha penergetic b* + 250gr/ha penergetic p** | 250gr penergetic b / 2 x 125gr penergetic p | Dry/V3 – V4/ 15 – 20 days after first application |
| **5** fertilizer adjusted + 250gr/ha penergetic b + 250gr/ha penergetic p | 250gr penergetic b / 2 x 125gr penergetic p | Dry/V3 – V4/ 15 – 20 days after first application |
| **6** Zero fertilizer + 250gr/ha penergetic b + 250gr/ha penergetic p | 250gr penergetic b / 2 x 125gr penergetic p | Dry/V3 – V4/ 15 – 20 days after first application |

* penergetic b – 250gr/ha applied before sowing, with desiccation management (single dose application).
** penergetic p – 250gr/ha divided into two applications, whereas: 125gr/ha applied to V3 – V4 and 125gr/ha applied to the 15 to 20 days after the first application.
Applications made with $CO_2$ pressurized precision pulverizer, using 150 lt/ha of syrup.

All cultural treatments were carried out according to the technical indication for the crop, and according to the schedule of the farm, except for the fertilization that followed the treatments. To perform the test, it was used to cultivate soybean the Nidera 7000, in the commercial area of central pivot, the Fontes do Saber Farm, belonging to the University of Rio Verde (UniRV). The evaluations were carried out in plots of 22.5m², representing 9 planting lines by 5m in length. For the harvest, four central lines were used for 4m in length, in a completely randomized design with four repetitions. In order to avoid influence among the treatments, a distance of 20m was used between the plots.

During the crop cycle, the following evaluations were carried out: soil analysis, performed before planting, at depths of 0–10cm, 10–20cm and 20–40cm; root volume by water displacement in full flowering; dry mass of the area and root in the R1/R2 stage; average rate of chlorophyll in stage R1/R2; number of nodules at 30 days after emergence; average height of the plants in the stage R1/R2 and at harvest and grain yield. The grain yield was adjusted to 13% moisture and calculated at sc/ha$^{-1}$. All data of the analyzed variables were submitted to analysis of variance and average test (Tukey to 5% of probability) to obtain the final results.

## Results and discussion

The average height of plants in R1/R2 was higher in plots that received the Penergetic Technology, with 72.62cm. The height of plants in the plots without penergetic application were similar regardless of fertilization. The plots that did not receive mineral fertilization (0% fertilization) showed higher plant height, both in the general average and with the application of penergetic, with 79.05cm (Table 2)

The plots fertilized with penergetic presented higher chlorophyll index, in relation to plots without penergetic (Table 2). Possibly, the higher the chlorophyll index, the higher the N and Mg content in the leaf. The dry mass of the soybean root in R1/R2 didn't show any difference between treatments and the application or not of penergetic (Table 2). Results similar to those obtained from the root volume (Table 2). The dry mass of the aerial part of the plants at R1/R2 was higher in the plots without application of penergetic and the fertilization that presented the highest dry mass of the aerial part was with 50% of the mineral fertilization (Table 2).

The number of nodes in the R1/R2 stage was similar in all plots where there was application of penergetic. However, in plots that did not receive penergetic, the number of nodules was higher, and the soybean of the part that was not fertilized had the highest number of nodules per plant, 39.6 (Table 2). The plant height at harvest (116 days after sowing) was higher in plots that received the Penergetic Technology, with 64.85cm. The height of plants in the plots without penergetic application were similar regardless of fertilization. Inferring that the penergetic interfered positively in the final height of plants (Figure 1). The plots that did not receive mineral fertilization (0% A.M.) presented higher plant height, regardless of whether they received penergetic or not (Figure 1). The height results of plants at the time of harvest were similar to the evaluation of the height of plants in R1/R2 in the first evaluation of the test (Table 2). The treatment with 100% of mineral fertilizer and penergetic presented the highest grain yield (74sc/ha), 11% more in relation to the treatment that did not receive penergetic (66sc/ha), as can be seen in Figure 1.

**Table 2:** Evaluation parameters R1/R2 stage

| Treatments | Plant height | | |
|---|---|---|---|
| | w/o penergetic | with penergetic | average |
| 100% fertilizer | 69.05 | 68.15 B | 68.60 AB |
| 50% fertilizer | 63.15 | 70.65 B | 66.90 B |
| 0% fertilizer | 64.25 | 79.05 A | 71.65 A |
| Average | 65.48 b | 72.62 a | 69.05 |
| CV (%) | 4.65 | | |

| Treatments | Chlorophyll Index | | |
|---|---|---|---|
| | w/o penergetic | with penergetic | average |
| 100% fertilizer | 43.2 | 44.42 | 43.81 |
| 50% fertilizer | 43.67 | 44.97 | 44.32 |
| 0% fertilizer | 43.02 | 45.1 | 44.06 |
| Average | 43.30 b | 44.83 a | 44.07 |
| CV (%) | 3.9 | | |

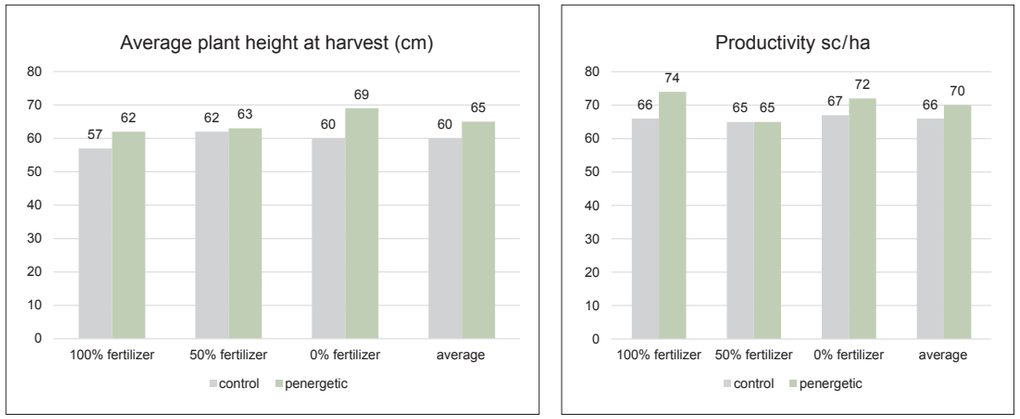
| Treatments | Dry matter of root (g/plant) | | |
|---|---|---|---|
| | w/o penergetic | with penergetic | average |
| 100% fertilizer | 16.4 | 14.4 | 15.3 |
| 50% fertilizer | 17.8 | 15.8 | 16.8 |
| 0% fertilizer | 14 | 14.1 | 14.2 |
| Average | 16.1 a | 14.8 a | 15.5 |
| CV (%) | 13.85 | | |

| Treatments | Dry matter of plant (g/plant) | | |
|---|---|---|---|
| | w/o penergetic | with penergetic | average |
| 100% fertilizer | 23.2 B | 23.46 B | 23.4 B |
| 50% fertilizer | 30.6 A | 24.5 A | 27.5 A |
| 0% fertilizer | 23.9 B | 19.7 AB | 21.8 B |
| Average | 25.9 a | 22.6 b | 24.2 |
| CV (%) | 10.07 | | |

| Treatments | Root volume (ml/plant) | | |
|---|---|---|---|
| | w/o penergetic | with penergetic | average |
| 100% fertilizer | 5.37 | 6.19 | 5.78 |
| 50% fertilizer | 7.25 | 6.5 | 6.87 |
| 0% fertilizer | 6.62 | 5.82 | 6.12 |
| Average | 6.42 a | 6.1 a | 6.26 |
| CV (%) | 21.34 | | |

| Treatments | Number of nodules per plant | | |
|---|---|---|---|
| | w/o penergetic | with penergetic | average |
| 100% fertilizer | 28.7 B | 19.4 | 24.0 b |
| 50% fertilizer | 26.8 B | 21.9 | 24.3 b |
| 0% fertilizer | 39.6 A | 23.8 | 31.7 a |
| Average | 31.7 a | 21.7 b | 26.7 |
| CV (%) | 13.21 | | |

**Figure 1:** Height average of plants at harvest and productivity

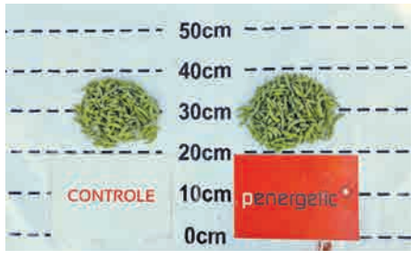


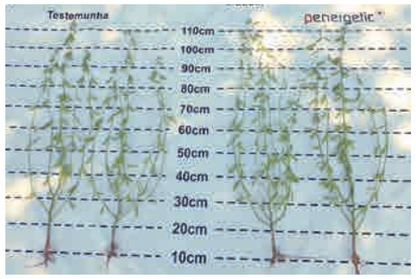

## Conclusion

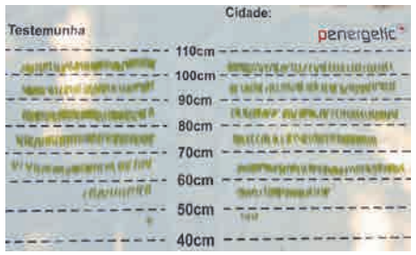
The use of bioactivators of soils (penergetic b) and plants (penergetic p) in the soybean crop promoted greater homogeneity in the plant stand; largest population of plants per hectare; higher plant height; higher chlorophyll content and higher grain yield.

# Some user photos concerning the effect of penergetic p


Reginaldo Maeda

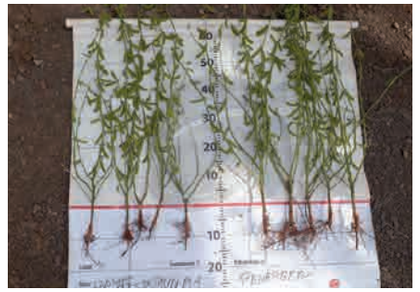


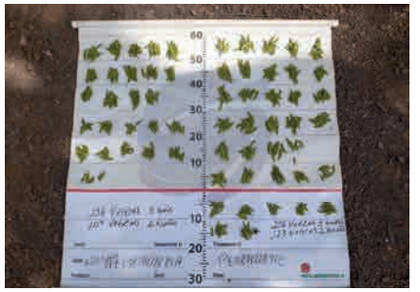




Jose Rossi


Janpier Bresson





Anauri Nicolino


Michel Marques Dezan

# Optimized corn growth with increased stalk diameter and more cobs

*Silage corn is an important agricultural crop feed to livestock in the United States and elsewhere. Silage corn grown with penergetic shows many advatages.*

**Remarkable results his first year make WA State corn grower a true believer in using penergetic products.**

The first time Peter Gines, a corn grower (Outlook, WA) used penergetic he ended up calling his local penergetic dealer, mid-July and said: “I think I might have the tallest corn in the valley! You bette get out her.” From that phone call until harvest (mid-September) the results of the penergetic treated corn vs. control were truly impressive.

Size and quality of cobs

July 21st: Gines penergetic cornis >11 feet (>3m) tall

**Treatments**

First year of use only 3.5oz/ac (250gr/ha) penergetic p. After the dramatic results the grower experienced the first year he has become a regular penergetic user by increasing his use onto more acerage and now using the full penergetic program like below:

- 200gr/ac (500gr/ha) penergetic b soil treatment
- 100gr/ac (250gr/ha) penergetic p seed treatment
- 100gr/ac (250gr/ha) penergetic p 2 – 6 leaf stage
- 100gr/ac (250gr/ha) penergetic p ear formation (optional)

## Roots and stalk diameter one month before harvest

Comparison in all pictures: treated *(left)* and control *(right)*

**Results (all one month before harvest)**

- Significantly larger roots and brace roots
- Greater diameter of corn stalks (approx. 20% larger)
- Size difference of the corn ears and approx. 6 times more stalks with 2 ears
- Bigger cobs, 13% more and bigger kernels
- 100% pollination in penergetic treated corn
- 7 mt/acre (15.9mt/ha) more corn yielded (treated vs. untreated)

*“I’ve never had corn this good on July 21st and at harvest penergetic caused a major difference in yield.”*

Peter Gines, Oultook, WA

**Penergetic Sri Lanka**
**DIMO Agribusiness**

# Effects of penergetic applications on corn with different quantity of fertilizer

**Sri Lanka is not only known for its Ayurveda medicine and tea. The country has also a rich agriculture. In order to prove the effectiveness of the penergetic products, a test was carried out in corn.**

## Comparison in corn with different applications and fertilizer combinations

**Variety:** Jet 999
**Trial duration:** 110 days
**Plot size:** 2,000 m²
**Plant spacing:** 60x30cm
**NPK fertilizer:** 100% in Test 1 & control and 80% in Test 2

Both Test 1 and Test 2 were treated with the same quantities of penergetic:

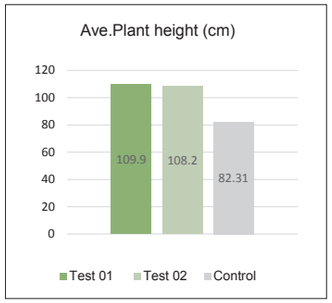
- **penergetic b:** 1 application of 60gr, 3 weeks before seeding
- **penergetic p:** 3 applications of 40gr

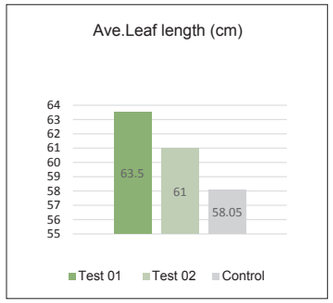
## Trial Design – Complete block design

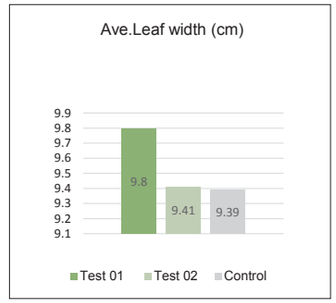
Boarder plant Jet 999

| Jungle | **Test 1** 100% NPK fertilizer | **Test 2** 80% NPK fertilizer | **Control plot** without penergetic | Road to the field |
|---|---|---|---|---|

## Plant growth parameters two months after planting




**left: Seedlings two weeks after planting**
control *(left)*, penergetic b *(right)*

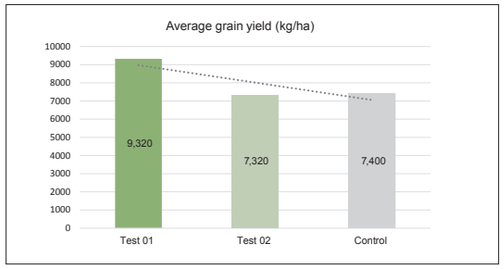
**right: Seedlings 50 days after planting**
control *(left)*, penergetic b & p *(right)*

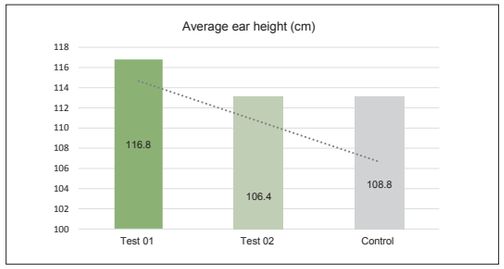
### Agronomic characters

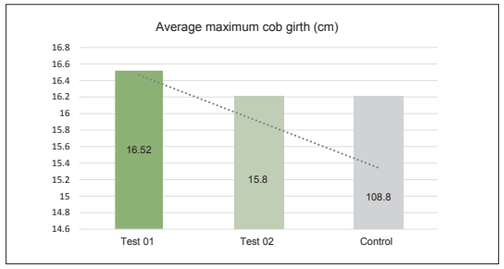
| Agronomic characters | Test 1 (100% NPK) + penergetic | Test 2 (NPK 80%) + penergetic | Control |
|---|---|---|---|
| Average grain yield (kg/ha) | 9,320 | 7,320 | 7,400 |
| Days to harvest | 110 | 110 | 110 |
| Average plant height (cm) – 2WAP | 6.3 | 6.1 | 5.9 |
| One month after planting | 56.97 | 52 | 47.7 |
| Average ear height (cm) | 116.8 | 106.4 | 108.8 |
| Average cob length (cm) | 19.8 | 18.8 | 18.3 |
| Average maximum cob girth (cm) | 16.52 | 15.8 | 15.4 |
| Number of seed rows | 14 | 14 | 14 |
| 1000 grain weight (gr) | 301 | 298 | 270 |
| Seed colour | Orange | Orange | Orange |
| Pest and disease (Sheath blight/stem borer) | No pest found | No pest found | No pest found |

**Note:** Plant height was taken by collar region of the plant to upper most bud of the plant.
Leaf length and leaf width was taken by 2nd leaf from upper most bud.

**left:** penergetic treated
**right:** control



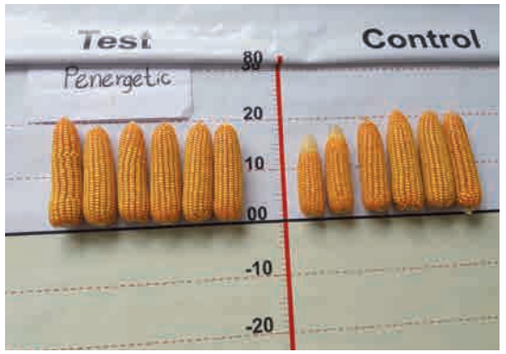



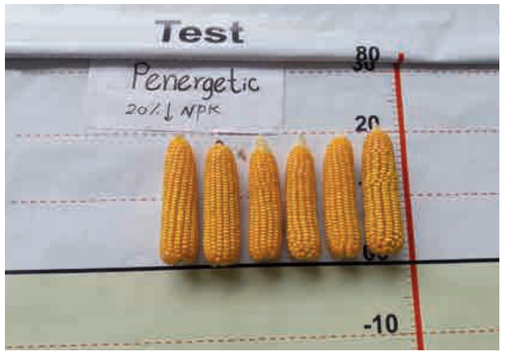




The graphs are showing the effect of the penergetic application in conjunction with fertilizer. All graphs give the signs, that 100% fertilizer and penergetic products give the best result.

## *Yield comparison – 10 cobs*

**left:** Test 1 – treated with penergetic b & p with 100% NPK 1.684gr/10 cob (12% moisture)
**middle:** Test 2 – treated with penergetic b & p, 20% less NPK 1.329gr/10 cob (12% moisture)
**right:** Control – non treated with penergetic 1.342gr/10 cob (12% moisture)




**Test and control cobs were selected randomly, harvested 5m x 5m area in each plot.**
**left:** Test 1 – 100% NPK and control
**right:** Test 2 – 80% NPK

### Conclusion

According to the results Test 1 showed considerable yield increase towards the control and the Test 2 (20% with respect to the control plot). However, Test 2 showed yield reduction with respect to the control.

Test 1 showed highest cob length, cob girth and grain weight than the Test 2 and control. However, Test 2 was the lowest. Therefore we can conclude that there is positive impact for plant growth by using penergetic treatment but reduction of fertilizer such as NPK 20% lead to yield and growth reduction.

# Differences between penergetic treated and untreated (control) corn are clearly visible

*Better development and higher corn yields. These are just two of the advantages found in the use of penergetic p in corn.*

**Treatment of corn variety "Maizex"**
**CHU Range:** 2,400 – 2,500
**Date of seeding:** Mai 22, 2015
**Date of comparison:** August 12, 2015
**Harvest:** scheduled for early September, 2015

**Summary Introduction**

- Comparative cob weigh tests showed penergetic treated cobs to be 15% to 20% heavier (on average) 3 to 4 weeks before harvest.
- Cobs from penergetic treated corn appear healthier and more robust.
- Kernels are more uniform in size.

**Facts and figures**
**Control:** GSP (Grower Standard Practice): 225lbs/ac (252kg/ha) with 9-40-9 + micros
**penergetic treated:** GSP 225lbs/ac with 9-40-9 + micros + 200gr/ac (=500gr/ha) penergetic b (applied with fertilizer).
Seed treatment: 100gr/ac (=250gr/ha) penergetic p.
Applied with Roundup: 100ml/ac (=250ml/ha) penergetic p molasses

**Results**

- Increased yield
- Higher quality (kernel size and shape, more uniformity, cob weight)

**August 19, 2015:** Control *(left side)* and penergetic treated *(right side)*

## Comparison photos August 12, 2015

**Above:** control
**Below:** penergetic treated

**Left:** control
**Right:** penergetic treated

**Left:** control
**Right:** penergetic treated

*"Once I cut the headland*, the difference in the development and height of the penergetic treated portion (compared to the control) readily became apparent. Fantastic!"*

Mark Van Klei, Rosedale, B.C. (Canada)

* The front rows of corn planted perpendicular to the main field.

# penergetic p demonstrates strong residual effect on perennial crops

**“A picture is worth a thousand words.” In this areal view of alfalfa crop in Central California the advantage of using penergetic p is clearly evident.**

Historically, the east field (lower right hand side) has always outperformed the west field (upper left hand side). However, as evidenced by this aerial photo, since starting to apply penergetic p, the westerly (penergetic-treated) field now outperforms the easterly (control) field.

**penergetic rate**
penergetic p molasses at 3.5fl oz/ac (250ml/ha)

**Application schedule**
Applied after 5th cut

This picture was taken when the 7th cut of alfalfa was still in the field. In other words, this was the second cut since penergetic p was applied, yet there is still a clearly visual difference in crop volume between where penergetic was previously applied. As experienced elsewhere, this provided clear evidence that in the case of perennial crops (such as alfalfa) that penergetic application can have a residual effect – meaning its efficacy can last longer than one crop (or cut).

**Aerial view from drone**
penergetic treated *(left side)* and control *(right side)*



# penergetic use exceed expectation in terms of quality and yield

**Alfalfa is an important silage crop grown in North America. Be it a conventional or organic crop; under irrigation or dryland, penergetic use on alfalfa has consistently shown terrific results both in terms of an increase in yield and quality.**

Silica Ridge Farm in Eastern Washington State an organic alfalfa crop is grown under irrigation. Qualtiy alfalfa hay is for the export market.

The 160 acres (64ha) were treated with

- penergetic b molasses 3.5 fl.oz/ac (250ml/ha) and
- penergetic p molasses 3.5 fl.oz/ac (250ml/ha)

Also retained 20 acres (8ha) untreated (as control). Note: Several core samples were pulled by the grower from both the treated and untreated bales and sent to lab for analysis. Tonnage results were also complied.

*“As recommended by Reed, my penergetic adviser, to properly evaluate the effectiveness of the penergetic products on my alfalfa, we retained a 20 acre section of the same pivot that was untreated (meaning no penergetic used). I got our farm crew to walk out in the field to see if they could observe any differences between the two sections. It was obvious – even to the naked eye – in the penergetic treated portion the plants were much thicker and had fuller growth than in the untreated section. Based on the visual differences, it seemed likely the component analysis and yield monitoring would further confirm things. When the results came back they exceeded my expectations – both in terms of quality and yield. As a result, I’ve decided to implement the penergetic program over our entire farm (about 1.200 acres). It’s simply too effective and has such a high ROI it wouldn’t make sense not to.”*
Jared Omlin, owner/operator, Silica Ridge Farms

**Comparative Results**

| Component | Untreated | penergetic treated | Difference in % |
|---|---|---|---|
| Moisture % | 13.1 | 12.4 | 5.3% lower |
| ADF % | 30.5 | 24.9 | 18.4% lower |
| NDF % | 40.3 | 29.4 | 27.1% lower |
| Crude Protein % | 19.6 | 24.5 | 25.0% higher |
| RFV % | 150.0 | 220.0 | 46.7% higher |
| Yield (tons/acre) | 1.75 | 2.21 | 26.2% more |

**Penergetic South Africa**
**Boland Organic Solutions CC**

# *Evaluation for the use of penergetic products in potatoes*

**Potatoes are a basic foodstuff cultivated worldwide. Various combinations of penergetic products and organic fertilizers were evaluated to respond to the requirement for organic farming.**

Trial run in South Africa's Western Cape region on potatoes (var. Mondeals). We are using a spray programme for foliar fertilization containing penergetic p Bentonite. The control is the regular spray programme usually used on the farm.
Our trial programme is done at a cost about 20% of that of the control spray programme. Soil fertilizers were the same for both control and test.

**Variety: Mondeals**
Yield in mt/ha: Test 67 mt, Control 58 mt, regional norm 55–60 mt

**Results**

- + 15% yield
- - 80% costs for spraying programme (foliar)
- Bigger plants
- Thicker stalks
- More and bigger tubers

## Spray programme for the trial area

| Plant stage | Application | Product | Dosage/ha |
|---|---|---|---|
| 80% emergence | Blister pulverizer | Herbali | 1 lt |
| | | GroStim | 1 lt |
| | | penergetic p | 200 gr |
| Week 2 | Blister pulverizer | Herbali | 500 ml |
| | | GroStim | 1 lt |
| | | penergetic p | 200 gr |
| Week 4 | Blister pulverizer | GroStim | 1 lt |
| Week 6 | Blister pulverizer | GroStim | 1 lt |
| | | Cal-Up | 1 lt |
| Week 8 | Blister pulverizer | Cal-Up | 1 lt |
| Week 10 | Blister pulverizer | Cal-Up | 1 lt |

**Uitvlug (Variety: Mondeals) Week 4**
Control *(left side)* and penergetic treated *(right side)*

**Differences in stem thickness**
**left:** control
**right:** penergetic treated

**Remarks / Conclusion**
We ran a few trial before and found that our best results are obtained by using penergetic p during the early stages of crop growth. No more penergetic was given after week 4 (but GroStim contains some penergetic p molasses).

The use of herbicides and pesticides remained the same as that was not part of the criteria for the study. We were interested in getting a better result for cheaper. penergetic was part of a cheaper program providing way better results than the more expensive program.

# Province of Quebec, good results achieved for late potato varieties on various farms

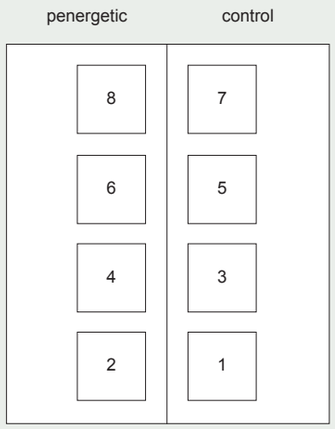
**The province of Quebec is one of the largest area in Canada were potatos are growing. In this test the effectiveness of penergetic products in potato cultivation have been determined.**

Various farms through the Province of Quebec were involved in this trial series. All farms had a control and a test field (the penergetic field was 8ha/20ac in size). With the exception of adding the penergetic protocol the control and the penergetic treated sections were identical in terms of quality of the land/soil, variety, other inputs, etc.

At harvest, using the FCI Canada official testing method of evaluation, potatoes were dug up from four 3m (10 feet) length of a sample row from both the control and penergetic field areas. This data was then used to calibrate the yield per acre in terms of hundredweight (cwt) – which is 100 pounds of potatoes. The results are summarized in the table “yield comparison”; whereas, the following pages provide more farm specific details.

### Methodology

- Even horizon for control / penergetic
- Even number of plants, on 10 linear feet
- Each sample is weighed individually
- Official method for FCI Canada



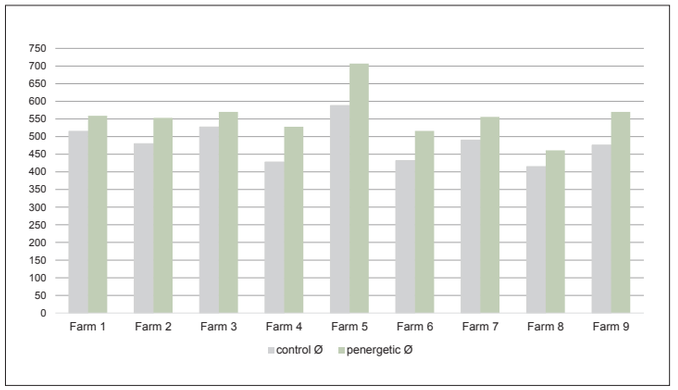

## Treatments

| Penergetic | Soil treatment | Seed treatment | Foliar application | Remarks |
|---|---|---|---|---|
| | acre (ha) | acre (ha) | acre (ha) | |
| penergetic b | 300gr/acre (750gr/ha) | | | Soil treatment can be mixed with herbicede, NOP or other products. Apply 15 days before seeding. Can be applied in Autumn. |
| penergetic p | | 100gr/acre (250gr/ha) in the furrow | | Can be used with other products on seed. Inoculate 100gr/ac (250gr/ha) in the furrow. |
| penergetic p | at first leaves | | 100gr/acre (250gr/ha) | Can be mixed with NPK, foliar fertilizer or farm chemicals. Reduce fertilizer use by 20%. |
| penergetic p | at beginning of flowering | | 100gr/acre (250gr/ha) | Can be mixed with NPK, foliar fertilizer or farm chemicals. Reduce fertilizer use by 20%. |

## Results in yield

| Farm | Location | Potato variety | cwt/ac difference | % difference to control |
|---|---|---|---|---|
| **1** Rondeau | Lanoraie | AC Chaleur | +44 | +9% |
| **2** Rondeau | Lanoraie | Goldrush | +73 | +16% |
| **3** Fiset | Lyster | Norland | +43 | +8% |
| **4** Réal Pinsonneault & fils | Napierville | Murdoch | +100 | +23% |
| **5** Réal Pinsonneault & fils | Napierville | Vivaldi | +119 | +22% |
| **6** Isabel | Napierville | Belmont | +84 | +20% |
| **7** Anonymous | Ste-Eulalie | Goldrush | +66 | +14% |
| **8** Valupierre | Ile d’Orléan | Murdoch | +46 | +11% |
| **9** MGE Ouellet | Rivière du Loup | Russet | +94 | +21% |
| **Average** | | | **+74.33** | **+16%** |

### Yield comparison all farms (cwt/ac)

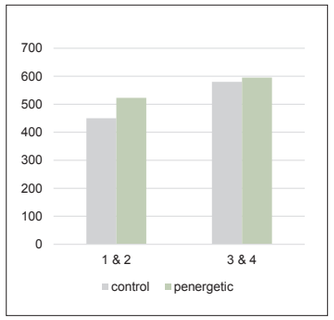



For this comparison the average of the samplings of each control and penergetic fields per farm was taken.

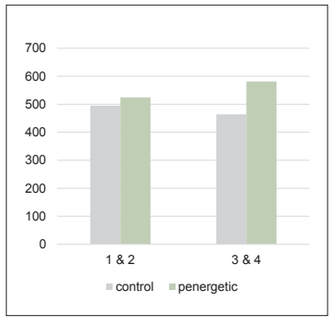
## *Results and photos of the fields*

General note: Best results have been achieved with all kind of late potatoes, for penergetic has more time to work well.

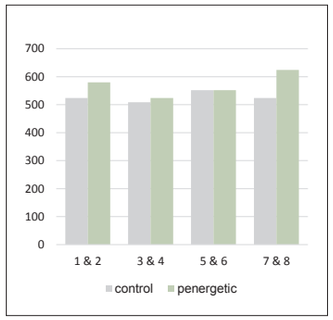
**Yield comparison (cwt/ac)**



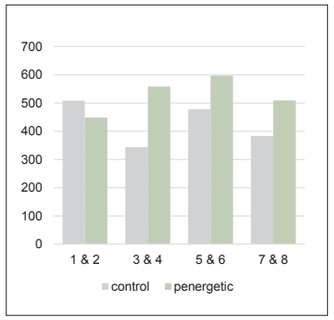

**1** Ferme Rondeau, variety AC Chaleur



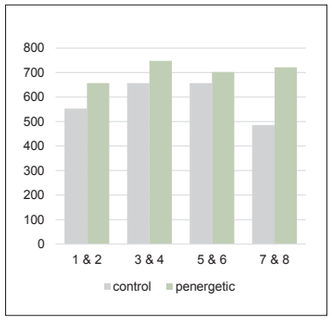

**2** Ferme Rondeau, variety Goldrush



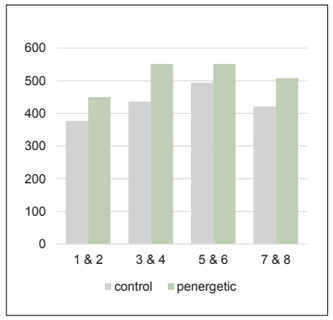

**3** Ferme Fiset, variety Norland



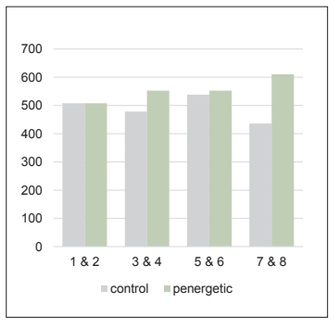

**4** Ferme Réal Pinsonneault & fils, variety Murdoch



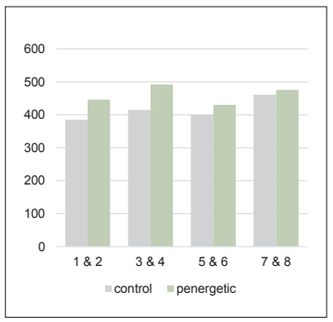

**5** Ferme Réal Pinsonneault & fils, variety Vivaldi



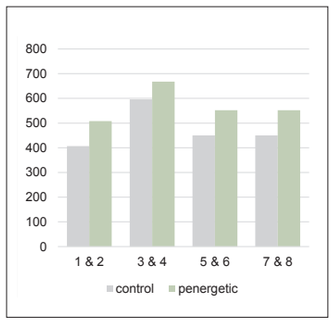

**6** Ferme Isabel, variety Belmont




**7** Ferme anonyme, variety Goldrush




**8** Ferme Valupierre, variety Murdoch




**9** Ferme MGE Ouellet, variety Russet

**All photos are from penergetic fields:**
**1** Ferme Rondeau, variety AC Chaleur
**2** Ferme Rondeau, variety Goldrush
**3** Ferme Fiset, variety Norland
**4** Ferme Réal Pinsonneault & fils, variety Murdoch
**5** Ferme Réal Pinsonneault & fils, variety Vivaldi
**6** Ferme Isabel, variety Belmont
**7** Ferme anonyme, variety Goldrush
Mr. Denis Dutil, expert in potatoes for over 50 years

Penergetic Chile
Agrotrust Ltda. Soc. Comercial

# More yield, better quality and larger cherries with penergetic

**Effect on productivity and quality in cherry orchards with the use of penergetic b and penergetic p as bio-stimulants for soil and plants.**

### Dosage / Recommendations (same for both orchards)

| Penergetic | Pre-treatment | Pre-flower | Flowering | Fruit set | Post-harvest | Observations |
|---|---|---|---|---|---|---|
| penergetic b | 300gr/ha | | | | | Application to the soil at the beginning of the season. Can be combined with herbicide. |
| penergetic p | | 250gr/ha | | | | Can be mixed with NPK or foliar fertilizers. Fertilization reduce of 20%. Can be mixed with herbicides. |
| penergetic p | | | 200gr/ha | | | |
| penergetic p | | | | 200gr/ha | | |
| penergetic b | | | | | 300gr/ha | To improve the soil and com-posting of organic matter. |

## Orchard 1, 2016

The evaluated treatments considered a control (T0) without application of the products to evaluate and a treatment (T1) with application of products to evaluate in an area of approximately 1.6 hectares. All the applications were made on the ridge with pulverizer and python aimed at the root zone.

**Location:** Reserva de Comalle, located in Comalle
**Variety:** Cherry cv Royal Down
**Start test:** August 2016
**End test:** December 2016

## Results

### Fruit-bearing load, yield and productivity

| Field | Fruit-bearing | |
|---|---|---|
| | Fruits/tree | Fruits/ASTT |
| T0 | 2,537 | 18.0 |
| T1 | 2,449 | 15.0 |

| Field | Yield and productivity | | |
|---|---|---|---|
| | kg/tree | kg/ASTT | kg/ha |
| T0 | 18.9 | 0.13 | 16,818 |
| T1 | 19.8 | 0.12 | 17,600 |

+ 782 kg/ha = 4.65%

ASTT: trunk cross-sectional area

### Quality of the fruit

| Field | Mean fruit weight (grs) |
|---|---|
| T0 | 7.5 |
| T1 | 8.2 |

+ 0.7gr = 9.33%

Fruit weight

| Field | Mean firmness (Lb) |
|---|---|
| T0 | 12.0 |
| T1 | 11.9 |

Firmness

| Field | Mean °BRIX |
|---|---|
| T0 | 15.6 |
| T1 | 16.3 |

+ 0.7gr = 4.49%

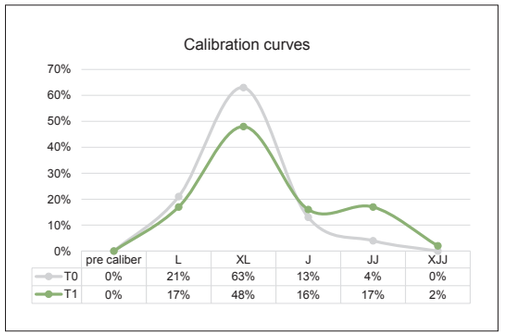
Soluble solids

## Results of the commercial evaluation of the products penergetic b and penergetic p

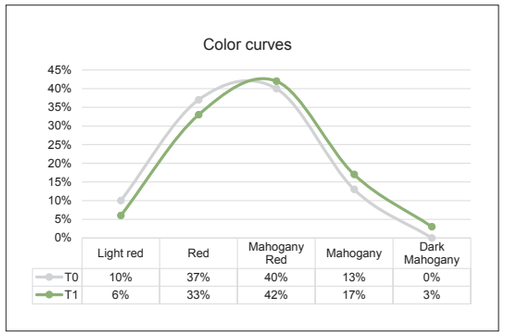
### Operational business benefits

| Field | kg/ha | cost/kg | cost/ha | NP/ha | product cost/ha US$ | US$/ha |
|---|---|---|---|---|---|---|
| T0 | 16,818 | 1.2 | 20,182 | 56,752 | 0 | 36,571 |
| T1 | 17,600 | 1.2 | 21,120 | 66,177 | 51 | 45,006 |
| Difference | | | | | | 8,435 |

## Calibration




## Color



## Orchard 2, 2017

The evaluated treatments considered a control (T0) without application of the products to evaluate and a treatment (T1) with application of products to evaluate in an area of approximately 0.5 hectares each. The plants were planted in 2014 with a distance of 4.25m x 2.3m to each other.

**Location:** Agrícola Montefrutal, sector La Higuerilla, communitiy of Sagrada Familia
**Variety:** Cherry cv Lapins
**Start 2. test:** September 2017
**End 2. test:** December 2017

### Results

| Field | Yield | | | |
|---|---|---|---|---|
| | Fruit/ plant | kg/ plant | kg/ha | |
| T0 | 1188 | 10.5 | 9,347 | |
| T1 | 1377 | 16.6 | 14,711 | + 5,364 kg/ha = 57.38% |

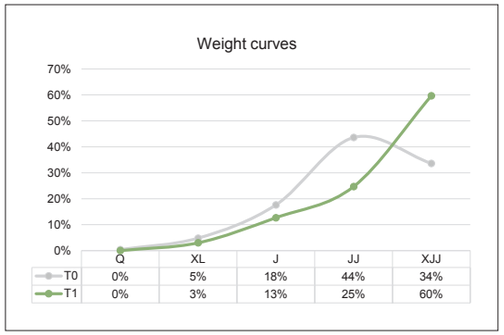
### Fruit quality

| Field | Quality of fruit | | | |
|---|---|---|---|---|
| | Ø Weight in gram | Firmness DU | SS °Brix | |
| T0 | 11.6 | 70.0 | 19.8 | |
| T1 | 12.5 | 75.1 | 18.6 | + 0.9gr = 7.8% |

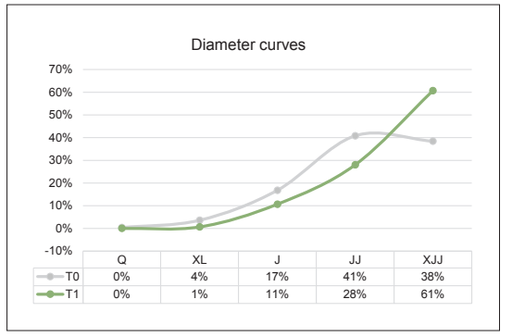
### Calibration curves

| Weight and size | | | | | |
|---|---|---|---|---|---|
| Calibration | Q | XL | J | JJ | XJJ |
| Weight in gram | 4.1-6.4 | 6.5-8.9 | 9.0-9.9 | 10.0-11.9 | >12 |
| Diameter in mm | 22-24 | 24-26 | 26-28 | 28-30 | >30 |

### Weight




### Diameter




## These photos were taken in a farm in the area near Curicó where farmers are using penergetic

**Penergetic Costa Rica**
**Fabricio Alfaro**

# Reduced nutrient loss and better nutrient uptake in rice cultivation

*Rice – another basic foodstuff all over the world. This report demonstrates the effectiveness of penergetic p in rice cultivation.*

**Measurement test of the effect of penergetic b and penergetic p in the cultivation of rice in the variety Lazarroz in Hacienda Mojica**
**Ing. Hernán Rodríguez A. 2016**

## Final Report

This study is an effort to provide new tools in managing the cultivation of rice, as part of a commitment to give the farmer basic information for making decisions in the agronomic management of rice cultivation. The application of products that improve the efficiency of utilisation and absorption of the nutrition employed is becoming of vital importance, taking into account that fertilization is one of the highest-costing roubles in rice production. Fertilization is performed according to the phenological stages and for this it is done taking into account the number of leaves growing, where V3, V4 indicates the start of tillering, V5, V6 active tillering and V8, V9 the start of floral primordium, these being the stages in which fertilization is performed. In this way, the work is done according to the moments the plant requires it. Moreover, index concepts are integrated, which allow us to evaluate and quantify methods for achieving greater efficiency of N applied and to be able to synchronise the fertilization with demand for the crop. To carry out this study, we relied on the support and supervision of an interdisciplinary team, consisting of Dr. Rafael Salas, a specialist in soils, and Dr. Juan Ramón Navarro, a specialist in agricultural statistics.

**Test of densities and increasing doses of nitrogen in two varieties of rice.**

### Location

The proposed test was performed in Hacienda Mojica, located in the province of Bagaces, Costa Rica, which is located between the coordinates: 10.41804-85.181063.


**Location of Hacienda Mojica**
Bagaces, Guanacaste, Costa Rica


### Climate

**Maximum and minimum temperatures**
As can be seen in table 1, the maximum temperature during the period of the test was below 35°C, this being a critical value that can cause hollowing. Each degree of increase in temperature can cause up to 30% hollow grain. The minimum temperature is another very influential factor. Nocturnal temperatures should not be higher than 22°C; with each degree of increase, production can decrease by up to 15%. The tendency in the last few years has been towards an increase in minimum temperatures. This is presenting itself during this period, which has seen temperatures above 25°C. It is necessary to pay attention to it and to observe its impact on rice production and, even more so, on the selection of new materials. The rate of development of the crop is directly linked to the temperature, above a base temperature above which the crop grows until a maximum temperature is reached.

### Maximum and minimum relative humidity

Table 2 shows the values of maximum and minimum relative humidity during the test. Relative humidity is linked to solar radiation, for which reason, in general, it is not taken into account for evaluating its influence on yields. Rather, its influence is indirect, determining the higher or lower presence of diseases. As can be seen and for the period in which the test was performed, the relative humidity values were favourable; hence, no diseases presented themselves.

### Precipitation

Precipitation has little direct impact on the growth and development of the crop; its effect is more indirect, influencing sowing opportunities. Moreover, with rice being a flooded crop, the influence of precipitation is low. This crop cycle was characterised by a year denominated Niño, with a pattern of little precipitation, as can be seen in table 3, in which the maximum precipitation was 39.6 mm, with the aggregate amount for the period being 374.6 mm.

**Table 1**
Maximum and minimum temperatures in ° C from 1/03/2016 to 31/07/2016

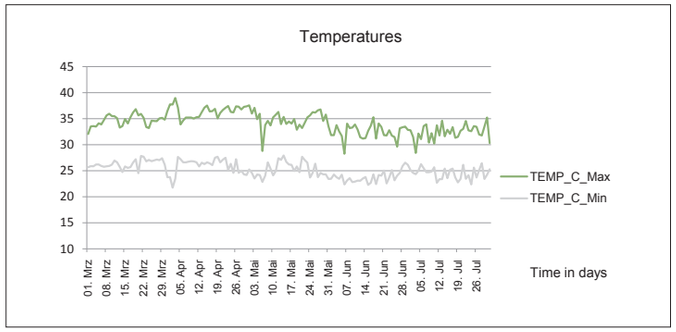



**Table 2**
Graph of maximum and minimum relative humidity in the period from 01/03/2016 to 31/07/2016

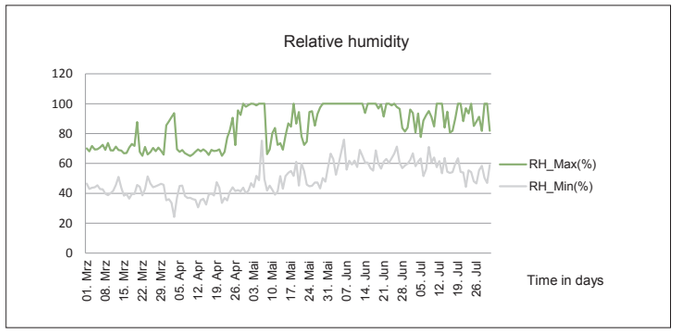



**Table 3**
Precipitation chart for the period from 01/03/2016 to 31/07/2016

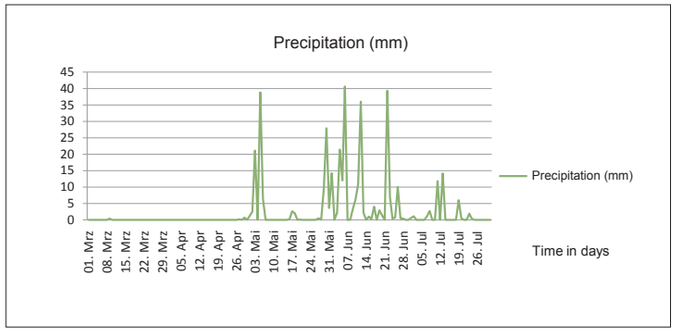
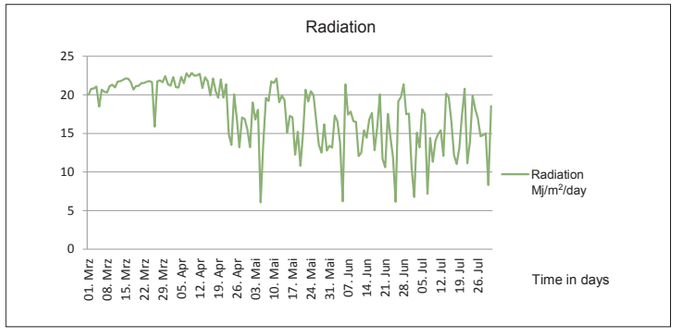



**Table 4**
Radiation in Mj/m²/day for the period 01/03/2016 to 31/07/2016




## Radiation

Solar raditation (table 4) is the climatic variable with the greatest effect on yields. Its effect is minor in the first stages of development. However, it is very strong in the reproductive stage (from differentiation of the primordium to the flowering period), affecting the number of grains per panicle.

## Test

To develop the study, the following protocol was used:

- Evaluation of the products penergetic b and penergetic p
- Variety: Lazarroz
- The experimental design used was that of simple random sampling without replacement
- Weights and germination tests
- 5 treatments and 5 repetitions were established
- Setup in the field (marking, sowing and fertilization)
- Evaluation of pests and diseases
- Application of fertilization in the corresponding periods
- Harvest

**Distribution of treatments in the test field**

The experimental units were distributed in the field at random in order to follow the statistical model of simple random sampling without replacement.

**Table 5:** Distribution of treatments in test field

| Treatment | Treatment |
|---|---|
| M1 | Trichoderma + penergetic p (application 22 days after seeding) |
| M2 | Farm witness (control) |
| M3 | penergetic b in V2 + penergetic p in V4 |
| M4 | penergetic b in V2 |
| M5 | penergetic p in V4 |

penergetic b – 100gr Bentonite + 100ml Molasses
penergetic p – 200ml Molasses

## Management of the test

**Characteristics of the test soil**

The test soil is classified as: Fluventic Ustropept

- Fluventic = alluvial plain
- Ust = Practical humidity pattern; the soil remains dry for 90 days or more consecutively
- Ept = Inceptisol, well defined soils with horizon

The soil analyses are presented in table 6.
As can be seen, the phosphorus is the element that presents a concentration far below the established critical value.

**Table 6:** Soil analysis Río Blanco plot

| Concentration of elements in the soil | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Identification | pH | cmol (+) / l | | | | Cationic ratios | | | | | mg / l | | | | |
| | $H_2O$ | Ca | Mg | K | Ac. Int | CIC E | Ca / Mg | Ca / K | Mg / K | Ca + Mg / K | P | Cu | Fe | Mn | Zn |
| PLOT C10 | 5.7 | 12.6 | 4.91 | 0.29 | 0.16 | 18.0 | 2.58 | 43.6 | 16.9 | 29.59 | 2 | 11 | 61 | 62 | 4.8 |

**Notes:**
1. The units are expressed in m/vol (cmol(+)/L, %=g/100 ml, mg/L).
2. Procedure: pH in water, in soil: solution ratio 1:2.5; acidity, Ca and Mg in KCl 1M, 1:10; P, K, Zn, Fe, Mn and Cu in Olsen Modified (NaHCO3 0.5M, disodic EDTA 0.01M, Superfloc 127, pH 8.5), 1:10. Acidity by titling (CIA-SC09-01-02-P04)*, P for Spectrophotometry UVV (CIA-SC09-01-02-P06)* and the rest for Spectrophotometry of AA (CIA-SC09-01-02-P05)*.
* www.eca.or.cr (Laboratory of Soils and Foliage, Centre of Agronomic Studies, University of Costa Rica).

**Distribution and periods of application of the fertilizer**

The periods and distribution of the fertilizer are shown in the following boxes

**Table 7:** Fertilizer applied per element

| | Dosage | N | $P_2O_5$ | $K_2O$ | S | Stage |
|---|---|---|---|---|---|---|
| 29.3 – 23.2 – 0 | 4 | 58.6 | 46.4 | | | V4 |
| 18.6 – 14.7 – 13 – 6.6 (S) | 6 | 55.8 | 44.1 | 45 | 19.8 | V6 |
| 27.4 – 0 – 14.4 – 7.3 (S) | 5.5 | 75.35 | | 39.6 | 16.5 | V9 |
| | | 189.75 | 90.5 | 84.6 | 36.3 | |

The applications of fertilizer were performed in the periods described in table 8; the phenological stages were determined as key in the agronomic management of the rice.

**Table 8:** Percentage distribution of fertilizer per element per phenological stage.

| Phenological Stage | Element: N | Element: $P_2O_5$ | Element: $K_2O$ |
|---|---|---|---|
| V3 – V4 | 31% | 51% | 0% |
| V6 – V7 | 30% | 49% | 53% |
| V8 – V9 | 39% | 0% | 47% |

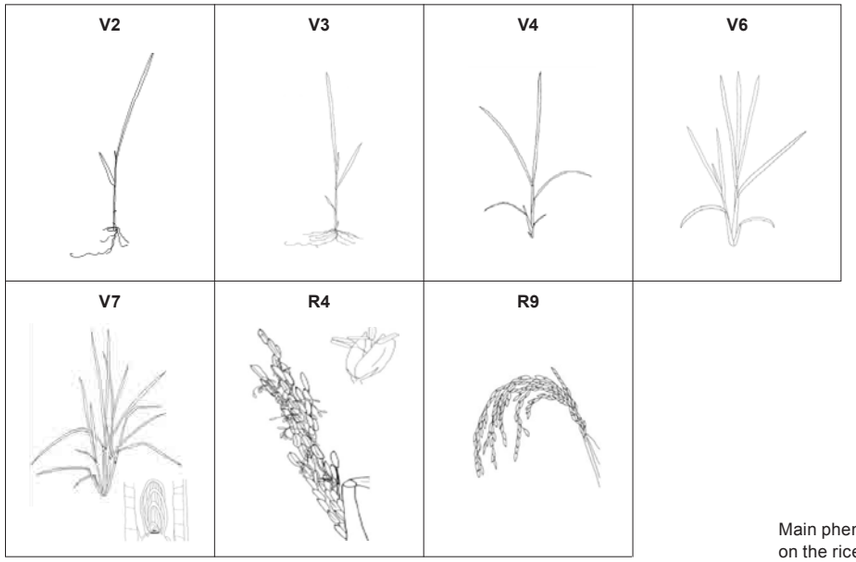
**Phenological stages in rice**

The system of description of the stages of development allows better identification of the crop development. This provides a better tool for performing work such as fertilization at the time when the crop requires it. And not with the method of days often used by old-fashioned fertilization. This system, proposed by Counce, is based on the number of leaves, where S is denominated for the stages of seed germination, V for the leaves, the first complete leaf with the presence of a foliar necklace being on the main stem, and R for the panicle formation stage, initiating floral primordium until physiological maturity (Counce, 2003).

**Variety Lazarroz**

Its main characteristics include:

- Average days to harvest: 115 to 120 days
- Intermediate tillering
- Moderately tolerant of flattening
- Average plant height 115 to 120cm
- Less than 10% hollowing
- Type of growth: semi-erect
- Low threshing
- Weight of a thousand grains: 27.7gr
- Long grain
- Entire grain 90%
- Mill yield 69%
- Entire yield 62%
- Amylose 29.7%
- White centre 0.8
- Good cooking (50 to 60 days)




Main phenological stages on the rice plant

**Evaluated products**

The products that are going to be evaluated are:

- penergetic b

  *"penergetic b is a bio-stimulant developed in Switzerland whose objective is to increase and improve the biological activity of the soil. This makes it possible to make efficient use of organic resources such as stubble and other vegetal residues, as well as recycling nutrients in the soil and thus leaving them available for crop. penergetic b is an environmentally friendly and efficient product that achieves good results with low dosages. It is easy to use, as it can be combined with herbicides. It is a novel economic tool and efficient for keeping soil healthy"*.

  Tec. Adrian Gutiérrez. (2016)

  Improves and accelerates the process of decomposition and mineralisation of the stubble, establishes a better balance of the microorganisms of the soil, stimulates the formation of humus.
- penergetic p

  A bio-stimulant developed in Switzerland with high technology whose objective is to promote vigorous and healthy development of crops. It manages to increase the productive potential of these by making better use of the resources available in the environment and of those supplied by man. An enhancer of growth, it increases the root mass, reduces the use of pesticides and fertilizers, increases the efficiency of consumables and improves the assimilation of nutrients by the plant.

## Results

The following tables show the data obtained from the samples sent to the soil laboratory of the UCR (CIA).

### Absorption in kg/ha in the different phenological stages

In **table 10**, it can be seen that treatment M5 is the one that had the highest absorption of nitrogen, with treatment M4 being the one with the lowest absorption. As is seen in table 10, after V6 there is a greater increase in the absorption of nitrogen. In **table 11**, it can be seen that treatment 5 is the one with the highest absorption of phosphourus and that treatment 4 is the one with the lowest, with a greater increase in absorption in all the treatments of stage V6 to R9. In **table 12**, treatment 5 is the one with the highest absorption of potassium and treatment 4 the one with the lowest absorption, with treatment 3 second in terms of absorption at 293.24kg/ha. In **table 13**, all the treatments absorbed more nitrogen in grain than in biomass, with treatment 5 being the one with the highest absorption. In **table 14** it is shown that there is greater absorption of phosphorus in the biomass than in the grain in all the treatments, with treatment 5 being the one with the highest absorption and treatment 4 the one with the lowest. In **table 15**, it can be highlighted that the majority of the potassium absorbed is in the straw and not in the grain. This indicates that it is found in high availability in the soil, since this absorption corresponds to the native elements and those added by the fertilizer. **Table 16**: The same trend is reflected as in the previous graphs, where treatment M5 is the one with the highest absorption and treatment M4 the one with the lowest absorption. **Table 17:** As shown in table 10, treatment 5 is the one that obtained the highest yield and treatment 4 the one with the lowest production.

### Final conclusions

- As was seen in the previous charts, treatment 5, in which only penergetic p was used, was where the best results were achieved, both in production – 9.213kg/ha – and in absorption of all the nutrients analysed. This is described in the literature as one of its functions, the increase in efficiency in the absorption of nutrients and an increase in yields.
- Treatment 4, penergetic b, was the one with the lowest yield – 6134.67kg/ha. It also showed lower absorption of all the nutrients. The conclusion is that it will be necessary to evaluate this product in various cycles due to its mode of action.
- Establish these tests in the dry period to obtain clearer production data.

**Table 9:** Efficiency indices in nitrogenised fertilization in the test treatments

| Treatment | Yield/ha | Grain/straw ratio | Harvest index | EI | FPP |
|---|---|---|---|---|---|
| M1 | 8,606.67 | 0.94 | 0.48 | 51.33 | 45.36 |
| M2 | 7,684.00 | 0.95 | 0.49 | 48.91 | 40.50 |
| M3 | 9,150.67 | 0.94 | 0.49 | 56.11 | 48.22 |
| M4 | 6,134.67 | 0.93 | 0.48 | 54.47 | 32.33 |
| M5 | 9,213.33 | 0.93 | 0.48 | 54.47 | 48.56 |
| Suitable | | 0.70 – 0.80 | 0.45 | ≥ 50 | 50 – 60 |

The results of the previous box indicate that for the harvest index, which is the ratio of the weight of the grain to the total biomass including the grain and the ratio of grain to straw, the values obtained for all the treatments are higher than the desired values.

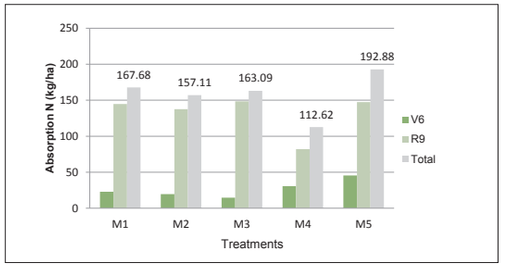



**Table 10** Absorption of nitrogen (kg/ha) in V6 and R9

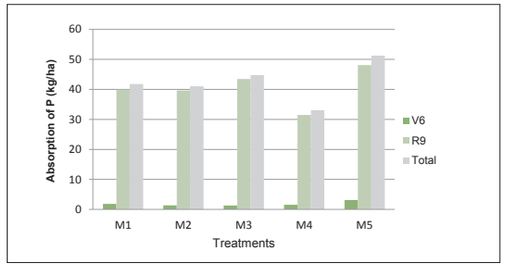



**Table 11** Average absorption of phosphorous kg/ha in V6 and R9

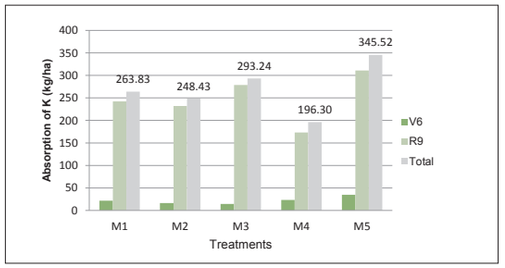



**Table 12** Average absorption of potassium (kg/ha) in V6 and R9

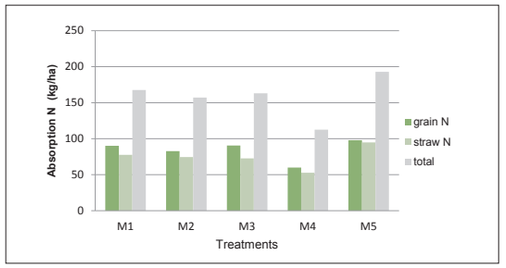



**Table 13** Absorption nitrogen in grain and straw in kilos per hectare

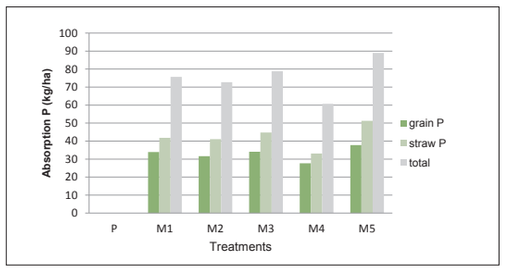



**Table 14** Absorption phosphorus in grain and straw in kilos per hectare

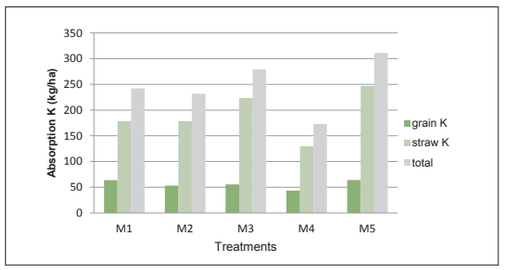



**Table 15** Absorption potassium in grain and straw in kilos per hectare

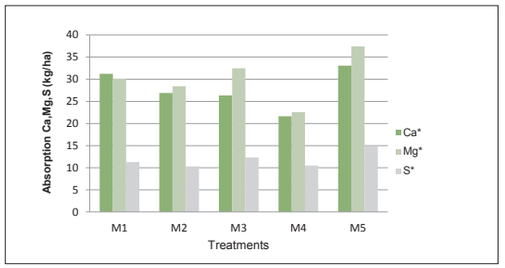



**Table 16** Total absorption Ca, Mg, S in kilos per hectare

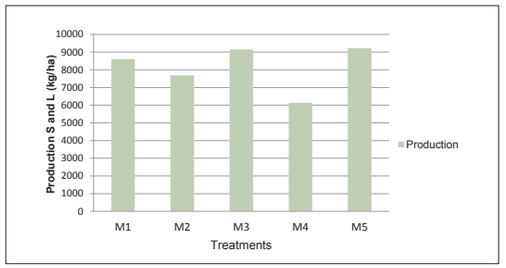



**Table 17** Dry and clean production in kilos/ha per treatment

# Significant more first class carrots and les discards

**Brazil is one of the largest agricultural producers. Not only soy beans, but also vegetables like carrots are cultivated. In various regions different varieties were used and evaluated in a 150-day cycle.**

**Effect of penergetic p and penergetic b in carrots:** It lacks scientific and statistical rigor, being field works with objective results. The application of penergetic products provided higher yields, more uniform and better carrot patterns for the market are still in the field.

## *Farmer: Edio Pascal – Mauá da Serra/PR – Variety: Juliana*

**Table 1:** Comparison of the productivity with and without penergetic

| Treatments | Area (ha) | Date | | Productivity in boxes/ha | |
|---|---|---|---|---|---|
| | | Sowing | Harvest | Real | Relativ % |
| Standard fertilization | 20 | 20.05.2013 | 06.01.2014 | 1,500 boxes | 100 |
| Standard fertilization + penergetic | 12 | 20.05.2013 | 06.01.2014 | 1,845 boxes | 123 |

+ 23%

**Table 2:** penergetic dosage

| Treatments | Fertilizer at sowing | | Topdressing | |
|---|---|---|---|---|
| | Formular | kg/ha | Formular | kg/ha |
| Standard fertilization | 02 28 00 | 1,200 | 04 14 08 | 1,500 |
| Standard fertilization + penergetic | 02 28 00 | 1,200 | 04 14 08 | 1,500 |

penergetic b: 500g/ha pre-emerging, or preparation of the area
penergetic p: 500g/ha post-emergence of culture, divided in 2 applications

**Conclusions**
The investment with the Penergetic Technology was 23 boxes/ha, what represented a net income of 322 boxes of carrots/ha, with a cost of R$ 15 per box. The profit of the Farmer was R$ 4,830 per hectare

**Comparison**
**left:** control / **right:** penergetic

## *Farmer: Aparecido Mendes – Mauá da Serra/PR – Variety: Juliana*

**Table 3:** Comparison of the productivity with and without penergetic

| Treatments | Area (ha) | Date | | Productivity in boxes/ha | |
|---|---|---|---|---|---|
| | | Sowing | Harvest | Real | Relativ % |
| Standard fertilization | 15 | 30.08.2013 | 06.01.2014 | 510 boxes | 100 |
| Standard fertilization + penergetic | 5 | 30.08.2013 | 06.01.2014 | 705 boxes | 139 |

+ 39%

**Table 4:** penergetic dosage

| Treatments | Fertilizer at sowing | | Topdressing | |
|---|---|---|---|---|
| | Formular | kg/ha | Formular | kg/ha |
| Standard fertilization | 02 28 00 | 1,000 | 04 14 08 | 1,400 |
| Standard fertilization + penergetic | 02 28 00 | 1,000 | 04 14 08 | 1,400 |

penergetic b: 600gr/ha pre-emerging, or preparation of the area
penergetic p: 600gr/ha post-emergence of culture, divided in 4 applications, each 15 days

**Conclusions**
The evaluation was made through carrot of first, second class and discards. With the penergetic treatment, the farmer obtained more carrots within first class, which reaches a significant better price on the market and less discards.

**Comparison**
**left:** control / **right:** penergetic

## *Farmer: Irmãos Bergamasco – Perdizes County/MG – Variety: Bangoea*

**Table 1:** Comparison of the productivity with and without penergetic

| Treatments | Productivity in boxes / linear meter | |
|---|---|---|
| | Real | Relativ % |
| Standard fertilization | 3,600 boxes | 100 |
| Standard fertilization + penergetic | 4,340 boxes | 121 |

+ 21%

**Table 2:** penergetic dosage

| Treatments | Fertilizer at sowing | | Topdressing | |
|---|---|---|---|---|
| | Formular | kg/ha | Formular | kg/ha |
| Standard fertilization | 02 30 10 | 2,000 | 12 06 18 | 300 |
| Standard fertilization + penergetic | 02 30 10 | 2,000 | 12 06 18 | 300 |

penergetic b: 600gr/ha pre-emerging, or preparation of the area
penergetic p: 600gr/ha post-emergence of culture, divided in 4 applications, each 15 days

**Conclusions**

The good results were possible, although the area hat high level of nematodes.


**Comparison**
**left:** penergetic / **right:** control

**Penergetic U.A.E.**
**Lanner General Trading L.L.**

# *Interesting results regarding vegetable growth in the desert*

**Much importance is given to organically produced food in Abu Dabi. Practically without soil and water, but with a well elaborated management program and penergetic products, amazing things can be achieved.**

**Dosage and test design for all applications**

**Test overview period**

- February 2018 until June, 2018

**Dosage**

- penergetic b: 100gr/ha
- penergetic p (molasses): 50ml/ha
- penergetic p (powder): 50gr/ha

**Test design**

- penergetic b:
  15 days before planting
  applied without fertilizer
- penergetic p:
  15 days, 30 days, 45 days and 60 days after planting (molasses and powder)

## *Case 1*
## *Okra (Abelmoschus esculentus)*

**Observations**

- The stem and the nodes are stronger
- The growth rate becomes fast
- The number of nodes increases which leads to more production
- Reduction of the downy mildew and erysiphales without application of pest spray and vitamins
- The color of okra becomes darker and shiny

**Conclusion**

Applying penergetic b and p in okra plant improves the quality of the plant itself. It strengthens the stem and nodes, which results in higher production rate, having a higher quality in terms of size, color, smell and taste.

## Case 2
## Cucumber (Cucumis sativus)

**left:** control / **right:** penergetic

**Test site**

- 18 greenhouses having 4,896 sqm
- Located in Excalibur Organic Farm, Al Bahia, Abu Dhabi

**Observations**

- The roots increase their quantity and dimension by 20% to 30% that helps to strengthen the growth and immune system from sickness and insects
- Improvement of quality, taste, smell or aroma and size
- Increase in production by 30% to 40% from the normal harvest
- Extend the shelf life of the product
- The harvesting period increased from 65 days to 80 days
- Reduce the application of own organic fertilizer (vitamins and nutrients) by 40%

**Conclusion**

Applying penergetic b and p (use small quantity per hectare) regenerates the soil life (humus formation) as well as the formation of mycorrhizae. By activating soil life, soil fertility is lastingly improved and the soil structure (tillage) is optimized. In addition, rotting is promoted (aerobic metabolic processes in the soil), which speeds up the rotting process. The application increases the growth rate, quality and production of cucumber.

## Case 3
## Beetroot

**Test site**

- Open field, Abu Dhabi
- Located in Excalibur Organic Farm, Al Bahia, Abu Dhabi

**Observations**

- The roots become longer, and increase of root nodes
- The size of beetroot becomes bigger, colors become darker and there is an increase in sweetness
- Increase of production by 40%
- Unsusceptible to diseases and pest

**Conclusion**

The application of both penergetic b and p has provided a big difference regarding the previous harvest. The production increases, the quality and the cost in terms of maintenance, using own organic spray or own organic fertilizer are reduced.

After application of penergetic b and p

## Case 4
## Onion (Allium Cepa)

**Test site**

- Open field, Abu Dhabi
- Located in Excalibur Organic Farm, Al Bahia, Abu Dhabi

**Observations**

- Increase the size of onion by 20% from the normal onion harvested
- The outer layer of the bulb or tunic becomes thicker
- Improvement of quality, smell or aroma and production
- Longer shelf life span having the same 100% quality
- The onion bulb is stronger after the application
- The taste becomes sweeter and juicier
- The shoot and the stem bark becomes thicker, longer and the color becomes darker and shiny
- No evidence of black mould on the tunic bulb

**Conclusion**

It is therefore concluded that by applying penergetic b and p, regeneration of soil life as well as the formation speeds up the rotting process. It becomes unsusceptible to black mould and other diseases even without using pesticides or other artificial sustenance.
The taste quality increases and it boosts the nutritional composition of the onion such as the calcium, iron foliate, magnesium, phosphorus and potassium. There is an improvement in the physical appearance; it becomes firm and compact with no abnormal development and the outer skin or tunic is strong enough to protect the flesh of the bulb.

After application of penergetic b and p

**Dosage and test design for all applications**

**Test overview period**

- February 2018 until June, 2018

**Dosage**

- penergetic b: 100gr/ha
- penergetic p (molasses): 50ml/ha
- penergetic p (powder): 50gr/ha

**Test design**

- penergetic b:
  15 days before planting
  applied without fertilizer
- penergetic p:
  15 days, 30 days, 45 days and 60 days
  after planting (molasses and powder)

## *Case 5*
## *Potato (Solanum tuberosum)*

**Test site**

- Al Wathba Farm, Abu Dhabi

**Observations**

- The stems are thicker and taller from 40cm to 50cm
- Strong endurance to phytophthora infestation
- The tuber increases its production from 3 to 5
- The outer layer skin is stronger and unsusceptible for scratches or damages
- The size increases to 5%
- The color becomes whiter and shiny
- Longer shelf life having the same quality in terms of taste, smell and appearance
- Increase in production by 30% to 40%

**Conclusion**

Applying penergetic b and p in potato improves the production, having a higher quality in terms of size, appearance and taste.

Farm Visit from the Minister of Climate Change and Environment
*(middle) (left: Mr. Saif Almahairi, right: Mr. Sameer (Agr. Ing.))*

## *Case 6*
## *Corn (Zea mays)*

**Test site**

- Open field
- Located in Excalibur Organic Farm, Al Bahia, Abu Dhabi

**Observations**

- The corn stalk becomes greener, taller and thicker
- The husk becomes thicker and greener and protects more the kernel and the cob
- Instead of one cob they have two cobs of the same size
- The corn cob is more covered with kernels
- The kernels are bigger, heavier, tastier and become golden yellow
- There is an increase of production by 40%

**Conclusion**

The application of penergetic b and p has tremendously increased the harvest. It provides not only quantity but it also improves the net weight, color, size and quality.

**Penergetic Greece**
**DEC GmbH, Gert Dieterle**

# *Neighboring farmers are shocked about the huge difference in cotton fields*

**Cotton is used in different areas of our daily life, such as clothing, medicine, household etc. of our living environment. It is recommendable to use as less pesticides and sprays as possilble.**

**Evident difference between penergetic treated cotton plants and control**
The difference between penergetic plants and control plants was evident from beginning. Between the 2nd and 3rd fertilization application the neighbor farmers were shocked about the big difference, also to their own plants and they asked, what he has done on his trial field.

**Area:** 72 stremma or 7.2 ha
**Quality of the soil:** Poor
**Applied products:**
- penergetic p molasses
- penergetic p bentonite
- Nitrogen N40 and N46
- Pesticides

**Applications**
- 3rd June – 4 leaf stage – 300 ml/ha penergetic p molasses
- 14th June – plant height 25 cm – 300 ml/ha penergetic p molasses
- 20th July – fertilization application – 300 gr/ha penergetic p bentonite.

**Observed differences on the penergetic plants**
- much more intense in green color
- looking much more healthy
- 5–10 cm more height
- complete root system was much longer and stronger than control
- higher cotton quality

| Applications for one cotton season | control field | penergetic field |
|---|---|---|
| NPK | € 1,224 | € 1,224 |
| Pesticides | € 1,008 | € 1,008 |
| Herbicides | € 720 | – |
| penergetic products | – | € 375 |
| Total costs | € 2,952 | € 2,607 |

*"I have never seen that happen before. I will use Penergetic again!"*
D. Georgios, Greece

**Cotton harvest result**
- Control field: 1 stremma / 200 kg or 1 ha / 2,000 kg
- penergetic field: 1 stremma / 360 kg or 1 ha / 3,600 kg

» *The profitability was close to 80%*

The farmer has only used two times nitrogen (N40 and N46) and one time phosphorus and pesticides. The whole year he has not used any herbicides, e.g. against worms, like he did before.

The farmer was scared about the first application of penergetic and did not reduce the recommended Penergetic reduction of fertilizer and sprays by at least minus 20%.

» *Additional income in 2017: € 7,257 = +128%*

The pictures were taken during 2nd spaying with molasses at 14th June 2017
*(left: penergetic, right: control)*

# Field Report Viticulture – penergetic application since 2006

**The Nepomuk Winery was a conventionally managed company until 2006. From 2006 on, penergetic products were added to the spraying agents. Spray was reduced each year until the final 65% reduction was achieved in 2011.**

Christian and Maria Grassl

## Status 2011: Reduction of conventional pesticides by approx. 65%

**The Nepomuk Farm – our home**

Our farm and its vineyards are nestled in the charming Arbesthaler hills, right in the middle of the wine region of Carnuntum – a liveable region that also offers many special features. When one thinks of Goettlesbrunn, one thinks of wine. No other beverage reflects the land from which it comes to a higher degree. Carnuntum is an ideal testing ground for modern cultivation and vinification of red wines. The hot, sunny climate between the Danube and Lake Neusiedl, together with the clay, sand, gravel and loess-soil, create the conditions that give the wines their uniqueness. The wine is in the truest sense of the word a natural product and the noblest embodiment of the spirit of nature. Through careful, selective harvesting of the grapes and a natural integrated management, we try to treat the wine respectfully in order to maintain its lightness and grandeur.

**Our assortment**

The focus of our company is on the local Austrian grape variety Zweigelt, which has long since made a name for itself well beyond Austria. But we also produce the internationally known wines of the burgundy group, such as Pinot blanc, Chardonnay, Pinot gris and Pinot noir, Merlot and Cabernet Sauvignon. Of course, we also have THE Austrian variety: the Grüner Veltliner, which is experiencing a renaissance at the moment and is also making an international breakthrough. We vinify our wines traditionally (large wood and steel) and internationally (barriques).

**penergetic applications since 2006**

- In 2006, some penergetic products were added to the conventional synthetic chemical pesticides. The conventional pesticides were reduced by approximately 10%.
- In 2007, a special spray schedule was developed together with Mr. Christof Weber, and the conventional spray quantities could be reduced by 15 – 20%.
- In 2008, more attention was paid to soil vitalization. The penergetic spray schedule was adapted accordingly. Conventional pesticides were already reduced between 30 – 40%.
- In 2009, soil vitality was taken even more into account and the reduction of pesticides was increased to 50%.
- In 2010, despite a very wet year, the conventional spray amount was reduced by 55%.
- In 2011, soil vitalization and development of mycorrhiza were even more in focus. A 60% reduction of the conventional pesticides was planned. In 2011, partly even a 65% reduction took place – with the very best results and savings!

## Cost-neutral applications

Since application of the special spray schedule for viticulture in 2007, the treatments have always been cost-neutral. That is, the cost of the penergetic products was covered by the reduction of conventional pesticides. In the meantime, there is even an extra profit of 190 Euros per hectare due to the substantial reduction of pesticides.

## No additional work for penergetic applications

No additional work is needed for the penergetic applications, as the products are simply added to conventional sprayings with the exception of the area composting, i.e. soil treatment in autumn. Here a separate spraying is done after the harvest. Normally leaf pulling is done one week after flowering with a device producing a pulsating airflow. Due to the permanent plant coverage, one can always drive in the vineyards.

Like that, diseases can be counteracted in time even with very wet conditions. Also soil erosion through wind and water can be kept at a minimum – on the contrary; actually, a build-up of humus is taking place.

## No nitrogen applied for about 10 years

Since 2003 no more spraying of acaricides (against mites). Since 2009 no more spraying against Botrytis. No nitrogen fertilization was applied for about ten years. For 2011, an application was planned. However, for the purpose of comparison some acres were treated not conventionally, but only with the addition of penergetic p molasses. However, due to the good development, no nitrogen fertilization took place in 2011 after all.

## Better soil structure

Over the years, the soil has become looser with better crumbling structure. A greater diversity of species, such as vetch, has developed. Insect pests like the rust mite have declined. The vines became more vigorous and above all more resistant to stress related diseases and rapidly changing weather conditions.

## Decreased pesticide use

The wine quality and also the sales increased generally in recent years. Especially the white series have gained in fruitiness and fullness. Generally speaking, pesticides were decreased annually by about 10% since we started applying the Penergetic technology (2006 minus 10% – 2011 minus 65%).

In 2010, we leased an additional ca. 3 acres. Here the pesticides were reduced by 50% immediately without any loss of quality or quantity.

## Increasing annual profit

Besides all the positive effects regarding to vitality of the vines, aeration of the soil and increasing quality of the wines produced, there is extra annual profit of 190 Euros per ha. And I think the end is not yet in sight.

Christian Grassl

**Our Awards**

- Rubin Carnuntum 2006
  Falstaff 90 points
  (Falstaff is an Austrian magazine: www.falstaff.at)
- Rubin Carnuntum 2007
  NÖ WEIN 2008 (North East Wine): among the best
- Merlot 2006
  NÖ WEIN 2009: among the best.
  Falstaff 91 points
- Exor 2007 (Zweigelt Reserve)
  NÖ WEIN 2009: among the best.
  Falstaff 91 points Salon Austria Wine 2010
- Exor 2008 (Zweigelt Reserve)
  Falstaff 91 points
- Cuvée Nepomuk 2005
  Falstaff 91 points
- Cuvée Nepomuk 2006
  Falstaff 90 points
- Cuvée Nepomuk 2007
  Falstaff 90 points
- Cuvée Nepomuk 2008
  Falstaff 92 points
- Grüner Veltliner Selektion 2008
  Salon Austria Wine 2009
- Grüner Veltliner Selektion 2009
  Salon Austria Wine 2010



# Diploma thesis to compare penergetic effects versus standard treatments

**Effect of stone meals (penergetic) on the sensory parameters of wine carried out at Federal College and Federal Office for Viticulture and Fruit-Growing Klosterneuburg.**

**Diploma Thesis submitted by Marius Pimpel**
On the subjects of

- plant protection (with exercises)
- Wine and fruit growing technological laboratory (viticulture)

Variety: Green Veltliner

## Effect of plant tonics / fortifiers

Plant tonics have no direct effect on harmful pathogens, but simply strengthen the resistance of the plant against pathogens (Harms and Walter, 2008). The main modes of action of plant tonics are increased plant resistance, promotion of rooting, growth and flowering, increase of yield, promotion of soil organisms and activation of existing nutrients and components. By judicious use of plant tonics, a prevalence of pathogens is prevented (Hofman, 1995). If used properly, the result should be healthier and better-growing plants, reduced losses and increased flower formation (Hall Mann, 2007) (Mohr, 2005). The resistive power of the plants is based either on the activation of plant defense mechanisms or on the hardening of tissue (Harms and Walter, 2008). Plant tonics must be used preventively in several applications, since they have no direct effect against pathogens (Hall Mann, 2007). The plant-strengthening effect is difficult to verify scientifically in most cases (Harm, 2010). In the fight against decay plant tonics achieve similar results as unilateral leaf removal in the grape zone or like fungicides with additional Botrytis effect. There is currently no reliable evidence of a strengthening of the grape skin through treatment with plant tonics (Harms and Walter, 2008). In addition to resistance-inducing properties, a direct effect against certain stages of fungi development has been observed with some plant tonics (Harm, 2008).

## Sprayings in the vineyard

**Test design** / Location: W. Glatzer, Göttlesbrunn (Carnuntum area) / Size: 2 plots – each with 3 rows and 30 vines. The rows are labeled at the upper end to separate from the rest of the vineyard. Then Michael Pimpel of Bayer Cropscience and Christof Weber of Weber Agrartechnik (penergetic products) made a spraying plan for each plot. The trial area was on a slight southern slope with sandy loess and subsoil of gravelly loam. Variant 1 (V1): The rows are treated with standard (100%) amounts of pesticides. Variant 2 (V2): The rows are treated with 30% less pesticides + penergetic p. When pesticides were reduced due to favourable weather conditions, etc., the reduction was done equally in both lots. The amounts of penergetic p were per plot 7gr per treatment except for the spraying were 9gr per plot at the at the time of budding.

**above:** V1 *(left)* and V2 *(right)*

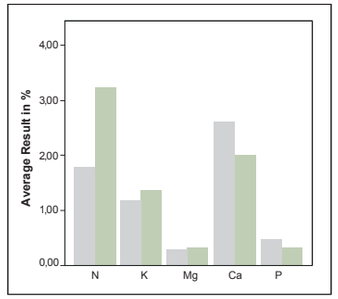
**below:** Spraying plan 2013 Marius Pimpel, Göttlesbrunn. Application was done using a motorized sprayer (petrol), provided by the trial farm. The objective was to apply the products directly and make them stick to the leaves as well as possible.


## **Spraying scheme 2013** Marius Pimpel, Göttlesbrunn

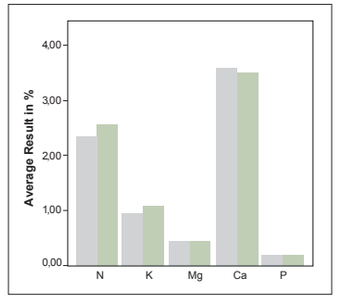
| Spraying | Pesticide | V1, Amount Standard IP | V2, Amount penergetic | Reason | Date |
|---|---|---|---|---|---|
| 1 | Netzschwefel Stulln | 4kg/ha – 75gr/plot | 3kg/ha – 50gr + 9gr penergetic p/plot | Leaf curl & mites | 27/04/13 |
| 2 | Netzschwefel Stulln | 4kg/ha – 45gr/plot | 30gr/plot + 7gr penergetic p | Oidium | 09/05/13 |
| | Ortho Phaltan 500 SC | 1lt/ha – 30ml/plot | 20ml/plot | Peronospora | 09/05/13 |
| | Envidor | 9ml/plot | 6ml/plot | Mites | 09/05/13 |
| 3 | Collis | 0.4lt/ha – 9ml/plot | 6ml/plot + 7gr penergetic p | Oidium/Botrytis | 24/05/13 |
| | Profiler | 1,5kg/ha – 40gr/plot | 30gr/plot | Peronospora | 24/05/13 |
| | PH-Opti | 0.2ml/100lt 10ml/5ml | 0.2ml/100lt 10ml/5ml | Miscibility | 24/05/13 |
| 4 | Collis | 0.4lt/ha – 9ml/plot | 6ml/plot + 7gr penergetic p | Oidium/Botrytis | 08/06/13 |
| | Profiler | 1,5kg/ha – 40gr/plot | 30g/plot | Peronospora | 08/06/13 |
| | PH-Opti | 0.2ml/100lt 10ml/5ml | 0.2ml/100lt 10ml/5ml | Miscibility | 08/06/13 |
| 5 | Luna Experience | 0.2lt/ha – 8ml/plot | 6ml/plot + 7gr penergetic p | Oidium | 21/06/13 |
| | Melody Combi | 2.0kg/ha – 50gr/plot | 2.0kg/ha – 35gr/plot | Peronospora | 21/06/13 |
| 6 | Runner | 0.4lt/ha – 9ml/plot | 0.4lt/ha – 6ml/plot + 7gr penergetic p | Tortrix, moth | 05/07/13 |
| | Prosper | 0.8lt/ha – 18ml/plot | 0.8lt/ha – 12ml/plot | Oidium | 05/07/13 |
| | Melody Combi | 2.0kg/ha – 50gr/plot | 2kg/ha – 35gr/plot | Peronospora | 05/07/13 |
| 7 | Prosper | 0.8lt/ha – 18ml/plot | 0.8lt/ha – 12ml/plot + 7gr penergetic p | Oidium | 18/07/13 |
| | Ortho Phaltan 500 SC | 1lt/ha – 30 ml/plot | 20ml/plot | Peronospora | 18/07/13 |
| | Runner | 0.4lt/ha – 9ml/plot | 0.4lt/ha – 6ml/plot + 7gr penergetic p | Tortrix, moth | 18/07/13 |
| 8 | Prosper | 0.8lt/ha – 18ml/plot | **0.8lt/ha – 12ml/plot** | Oidium | 05/08/13 |
| | Melody Combi | 2.4kg/ha – 50gr/plot | 2kg/ha – 35gr/plot | Peronospora | 05/08/13 |
| 9 | Prosper | 0.8lt/ha – 18ml/plot | 0.8lt/ha – 12ml/plot | Oidium | 16/08/13 |
| | Melody Combi | 2.4kg/ha – 50gr/plot | 2kg/ha – 35gr/plot | Peronospora | 16/08/13 |

## *Evaluation of measurement of nutrient content and face elements*

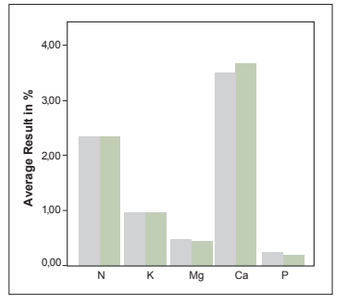
### Nutrients




**June 21/2013**
At the first time of leaf sampling (outgoing blossom) it is striking that the nitrogen content of the plant in variant 2 is clearly higher than in variant 1. Potassium is slightly higher in variant 2. Calcium could have been more in version 2 before the rainfall. Otherwise there is no significant difference in other nutrients.

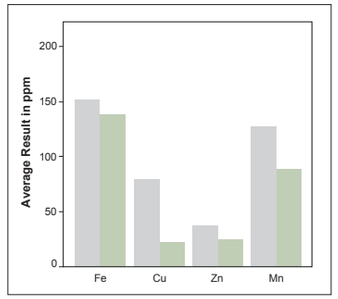



**August 17/2013**
The second leaf sampling shows a high, but equivalent amount of calcium in both variants. Nitrogen was used for chlorophyll synthesis. Potassium, magnesium and phosphorous are balanced.

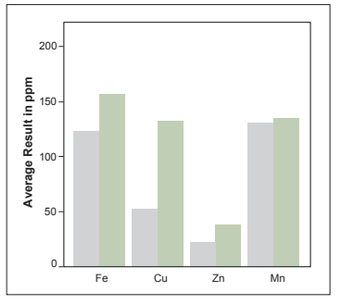



**September 01/2013**
The third leaf sampling that took place around the start of full ripening, did not show any greater changes. The calcium content rose and was even a bit higher in variant 1 than in variant 2. One could see that the grapes in variant 2 appeared riper.

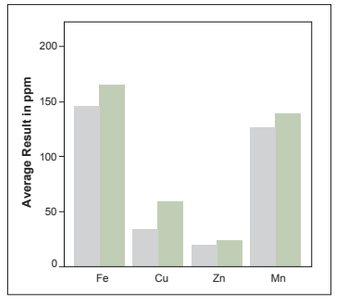
### Trace elements




**June 21/2013**
The values of iron and manganese are significantly higher in variant 1 than in variant 2. A big difference between the variants can be seen in copper. In this phase the values of the standard variant generally dominate. Since a lot of nitrogen was used for building chlorophyll in variant 2, it can be assumed that the trace elements were also consumed in the process.




**August 17/2013**
This looks different, though. Here variant 2 dominates again, in particular regarding copper. Trace elements are replenished for the formation of chlorophyll.




**September 01/2013**
The values of copper and zinc decreased in variant 2. Otherwise the values remained rather the same.

**Variants**
Standard
penergetic

## Discussion

Sustainability in crop protection is becoming a more and more important subject. Pesticides should be reduced and the environment should be protected, but at the same time high quality, healthy vine should end up in the wine glass of the consumer.

Great numbers of plant protection strategies are continuously being developed in order to not pollute the environment too much. Pesticides are reduced, sprays are skipped, but also weather stations and sophisticated programs like Vitimeteo are used to calculate the severity of attacks in order to achieve targeted applications. Unfortunately, as it was the case in 2013 with Oidium, with varying degrees of success.

In this thesis, the attempt was made to compare a normal plant protection variant, treated as per normal IP praxis, to a variant that was treated with 30 percent less pesticides and strengthened by penergetic p.

The first major objective, support for maintaining the health of the vines, could be achieved as the grapes of the special variant were very healthy all the way till harvesting. It even went so far that the special version without Botrytis could be harvested in good condition whereas some rotting berries had to be removed in the IP variant.

The penergetic p has a similar effect as potassium silicate of hardening the skin of the berries and therefore less occurrence of Botrytis. This was already confirmed by “Harms and Walter 2008”.

The second major objective (according to “Weber 2005”) was the propagated effect of penergetic p: increase of chlorophyll and photosynthesis performance for which increased nitrogen, but also trace elements are needed, could be demonstrated impressively by leaf sample measurements. Equally important in this comparison, according to “Walter Harms and 2008”, is better health of the “informed” grapes over the IP grapes.

As determined at the multiple tastings of the separately vinified batches, there were no differences between the wines except for small nuances. But the wine is young and the wines of 2013 generally develop rather slowly. So one would have to await the further development with age and then compare again.

At any rate, this plant protection comparison trial – including vinification – is a pointer in the direction of developing sustainable plant protection and an option to strengthen plant health and inherent resistance of the plants against fungi as well as reducing chemical pesticides considerably.

**Viticulture will not be able to do completely without chemical products – especially in difficult years – but with the plant fortifying effect of penergetic p a new direction can be taken.**

## Summary

In modern plant protection various strategies have been tried and tested over and over again to protect plants successfully against a number of diseases. Moreover, it is a further challenge to use as small quantities of plant protection agents as possible, which is partly facilitated by the use of fungus-resistant varieties, which require far less plant protection. Thus, with questions of sustainability arising, this topic is gaining importance.

This diploma paper has investigated if lower amounts of chemical plant protection agents could be used, if their effect is enhanced by the use of penergetic p, which affect the plant similarly to plant fortifiers. The question arising is, if the plant can thus be protected as well against common diseases as with an ordinary IP concept.

A further consideration was if this more sustainable variant would enable the producer to receive an equally good or even fruitier product. A rating for diseases and nutrient analysis of the leaves should reveal any differences between the variants. Especially a testing for nitrogen contents, which play a crucial role in photosynthesis showed clear results.

**At harvest it was striking that with the IP variant some diseased berries had to be removed from the clusters, whereas this was not necessary in the variant treated with penergetic p and lower amounts of synthetic spraying agents.**

Apart from that, there were no significant differences between the variants, which can be judged as positive, since it reveals that lower expenditures regarding synthetic spraying agents combined with biological strengthening of the plants can lead to a healthy crop and consequently good wine.

If spraying passes are not reduced, but the amounts of spraying agents used per pass can be reduced by the support of the penergetic p, it is possible to not only boost photosynthesis, leading to healthy and vital plants, but also to tread new ways of sustainability in viticulture.

Penergetic U.K.
Penergetic UK Ltd.

# penergetic b and penergetic p helps to compensate damages from slugs

**Trials on wheat, oats and oil seed rape have been conducted over three years at Sudbury Park Farm Derbyshire. The fields show a good level of production with the Penergetic plots returning increased yield and crops that are better able to withstand challenges than the control plots.**

The trials were all carried out at Sudbury Park Farm Derbyshire U.K. Two fields (Fischpond and Top Park) were selected, each with a defined control area and a testing area.

## Wheat

**Varieties**
Crusoe milling wheat and Skyfall milling wheat

**Size of fields**

- Fishpond
  penergetic: 4.77ha
  Control: 1.79ha
- Top Park
  penergetic: 8.84ha
  Control: 15.72ha

**Doses of penergetic used**

- 450gr/ha of penergetic b
  in October (2016/10/21)
- 200gr/ha of penergetic p
  in March (2017/03/16)
- 200gr/ha of penergetic p
  5 weeks later (2017/04/20)
- 200gr/ha of penergetic p
  5 weeks later (2017/05/22)
- 150gr/ha of penergetic p
  3 weeks later (2017/06/09)
- All other inputs remained the same, the only difference between the treated and control plots was the addition of penergetic products

## Yield Fishpond 2017

| Fishpond | Harvest in tonnes / ha | Increase in tonnes | Increase in % |
|---|---|---|---|
| penergetic | 10.380 | 0.550 | 5.5 |
| Control | 9.830 | | |

penergetic: + 5.5%

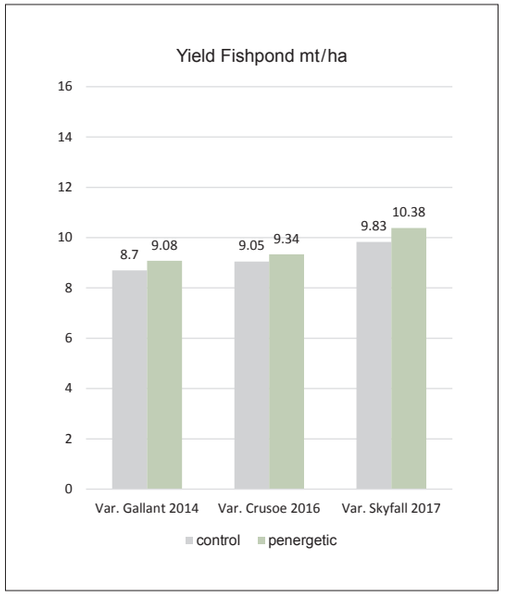
## Yield Top Park 2017

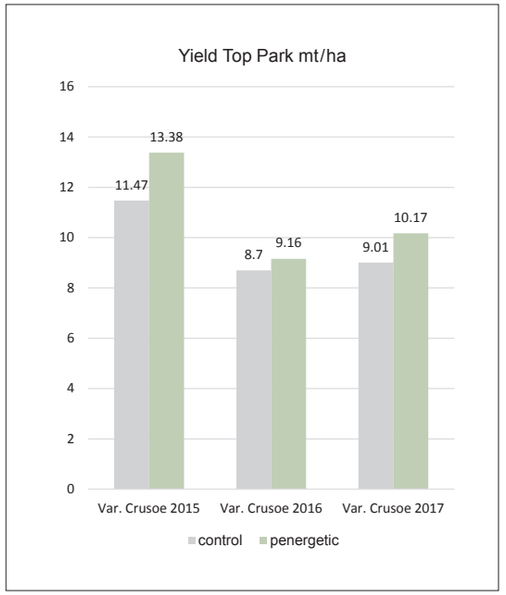
| Top Park | Harvest in tonnes / ha | Increase in tonnes | Increase in % |
|---|---|---|---|
| penergetic | 10.170 | 1.160 | 12.9 |
| Control | 9.010 | | |

penergetic: + 12.9%

Due to difficult weather conditions harvest of Fishpond had to take place in two steps:
The control plot was harvested on 15th August. A small part of the Penergetic plot was harvested on 16th August, the reminder on 27th August due to prolonged rain showers. The yields per hectare listed above refer only to the part of penergetic harvested on 16th August. However, the obtained samples should not be reliably used as a comparison.

## Yield comparison



## Winter oats

The trial was carried out at Sudbury Park Farm Derbyshire on the Kennel Park Field following the previous years crop of oil seed rape OSR variety Holl316.

**Variety**
Winter Oats, 1st year

**Doses of Penergetic used**

- 450gr/ha of penergetic b in October (2016/10/21)
- 200gr/ha of penergetic p in March (2017/03/16)
- 200gr/ha of penergetic p 5 weeks later (2017/04/20)
- 200gr/ha of penergetic p 5 weeks later (2017/05/22)
- 150gr/ha of penergetic p 3 weeks later (2017/06/09)
- All other inputs remained the same, the only difference between the treated and control plots was the addition of penergetic products

| Kennel Park | Harvest in tonnes/ha | Increase in tonnes | Increase in % |
|---|---|---|---|
| penergetic | 8.680 | + 0.400 | + 4.8 |
| Control | 8.280 | | |

penergetic: + 4.8%

### Analysis

| Kennel Park | kg/hl | Moisture in % |
|---|---|---|
| penergetic | 48.80 | 15.10 |
| Control | 48.70 | 15.10 |

**Conclusion**
The oats treated with penergetic b and p show an increase in yield towards the test field. Moisture stayed the same. Just before harvest was due to start there was a day of heavy rainfall with strong wind on the crop. It was noticed that the penergetic treated plot was able to withstand this better than the untreated with less plants falling due to the wet conditions.

**Yield results for 2018 for the oats**
penergetic plot yielding 8.040mt/ha and the control at 7.2mt/ha.That's an increase of 840kg per hectare.

## Winter oil seed rape, 1

The trial was carried out on Knoll field. This was the first year of OSR after six years of cereals.

**Variety**
Elgar

**Doses of penergetic used**

- 450gr/ha of penergetic b in September (2016/09/20)
- 225gr/ha of penergetic p 6 weeks later (2016/10/31)
- 150gr/ha of penergetic p in March (2017/03/15)
- 200gr/ha of penergetic p 5 weeks later (2017/04/19)
- 100gr/ha of penergetic p 4 weeks later (2017/05/10)
- All other inputs remained the same, the only difference between the treated and control plots was the addition of penergetic products

### Analysis

| Knoll | Moisture in % | Oil content in % |
|---|---|---|
| penergetic | 8.19 | 45.3 |
| Control | 7.97 | 45.2 |

The crop in the penergetic plot suffered serious slug damage leading to a reduction in plant numbers, however the plants developed a deeper canopy and increased seed per plant to maintain a yield level of 4.44 tonnes per hectare equal to the control as shown on the pictures.

**Conclusion**
The use of penergetic b and p helped to compensate for the damage caused by the slugs. The farm owner and staff at the farm commented that based on previous experience they expected greater losses where the slugs had been active.

**Comparison**
Control (*above*) and penergetic (*below*)

## Winter oil seed rape, 2

We also conducted another trial in a field which had never previously received any penergetic products at all. We noticed that the crop was developing with uneven plant growth due to compaction of heavy low lying soil. Both areas had been sown at the same time and rate but as shown on the photograph taken on 12 April 2017 the area to left of the picture was flowering well ahead of that on the right. We decided to use penergetic p molasses as a spray at 200ml per hectare to see if we could help rectify the situation. The second photograph taken on 4 May 2017 shows just how rapid the plants were able to catch up following the application of penergetic p on 13 April. The final yield was comparable to other OSR grown elsewhere on the farm at 3.8 tonnes per hectare.

**12 April *(above)* and 4 May *(below)***
The penergetic plot developes very well after an additional spray



# Advantages in coffee planting when using cover crops and penergetic products

**Dr. Ademir Calegari**
Soil Scientist Researcher
Senior Agronomist IAPAR
Londrina, PR Brazil

**Studying the effect of penergetic (PNG) and cover crops (CC) with different doses of PNG and chemical fertilizers on coffee plantation**

**Fernandes et al. (2018) in an experiment conducted in:**

- Experimental Station Izidoro Bronzi, Araguari, Minas Gerais State, Brazil
- Coffee farmers Association of Araguari (ACA)
- Procafé Foundation

**Variety**

Catuaí Vermelho IAC 15, planted in a clay soil with a drip irrigation system, (2.3lt/h water), 3.7m x 0.7m of space between the plants and same between the drip irrigators.

**Treatments**

- **1** Control
- **2** Control + cover crop (CC) mix
- **3** 100% fertilizer* + PNG
- **4** 100% fertilizer + PNG + CC mix
- **5** 50% fertilizer + PNG
- **6** 50% fertilizer + PNG + CC mix
- **7** 100% fertilizer
- **8** 100% fertilizer + CC mix
- **9** 75% fertilizer + PNG
- **10** 75% fertilizer + PNG + CC mix

* 450kg/ha of N, 85kg/ha of $P_2O_5$, 400kg/ha of $K_2O$ (fertilizers applied per year).

**left:** Coffee intercropped by mix cover crops
**right:** Coffee intercropped by mix cover crops after slashing

## Cover crop mix

The cover crops Fagopirum esculentum (buckwheat), Crotalaria breviflora, Crotalaria ochroleuca, Mucuna prupriens (dwarf mucuna), Cajanus cajan (dwarf pigeon pea), pear millet and Vigna unguiculata (cowpea) were sowed broadcast between the coffee rows in a spring season, and after around 85–90 days they were slashed and the residues left covering the soil surface.

## Results

The results showed important benefits of nutrients cycling by the cover crops, weed control between the coffee rows, and among others improving soil moisture and soil biology (biodiversity).

In table 2, the data comprising effects of penergetic and penergetic combined with cover crops, including or not chemical fertilizers, show significate differences in dry grain yield when compared with control plot. Very good results are obtained when penergetic is involved. Using cover crops + penergetic + 50% fertilizer (treatment 6), it was possible to achieve 65.6 bags of coffee (1 bag = 60kg of dry bean coffee grain) per hectare. That is an increase of 33% compared with treatment 2 (control + cover crops) and of 22% compared with treatment 7 (100% fertilizer).

With the Penergetic Technology and cover crops species intercropped and slashed in the flowering stage (when the soil contains reasonable nutrient levels), it is possible to reduce the dosis of chemical fertilizer and still have an increase in yield. Comparing treatment 7 (100% fertilizer) and treatment 10 (75% fertilizer + PNG + CC), treatment 10 realized 33% more yield.

Table 3 is presenting the ranking achieved and compared among all treatments. Comparing treatment 10 (75% fertilizer + PNG + CC mix) and treatment 6 (50% fertilizer + PNG + CC mix), probably the costs of fertilizer are quite similar to the grain coffee improvement. This leads to conclude that with 50% fertilizer + PNG + CC mix, it´s possible to achieve high coffee grain yield with profitability, and almost 23% higher yield when compared to treatment 7 with just 100% chemical fertilizer.

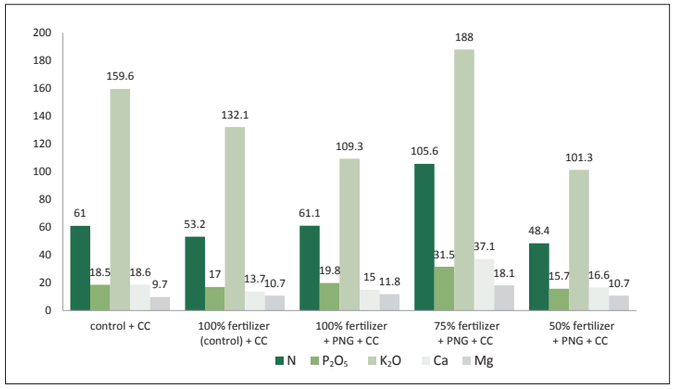



**Table 1:** Nutrients cycling by the cover crops

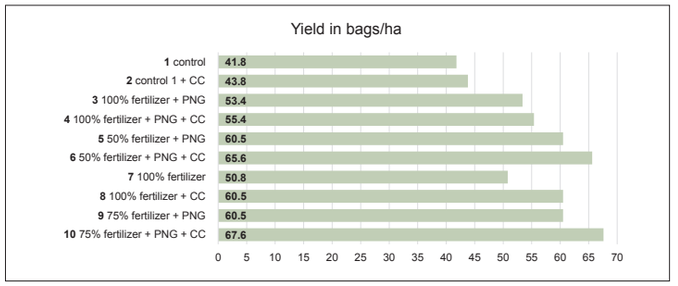



**Table 2:** Productivity of the treatments in the 2nd year of the trial

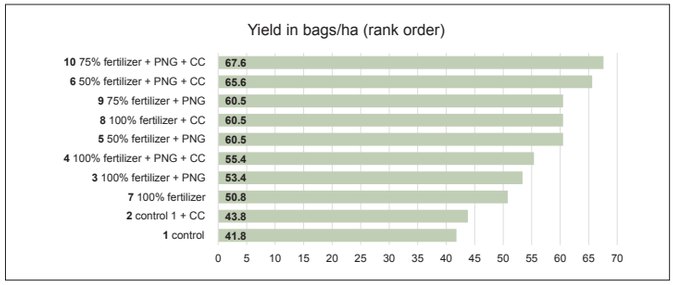



**Table 3:** Ranking productivity results

## Conclusions

It may be preliminarily concluded that:

- The use of Penergetic Technology for soil and plants is beneficial for the nutrition of the coffee plant, especially when it is combined with CC mix
- With CC mix, the productivity was higher in all the treatments, compared to the treatments without CC mix
- The inclusion of CC mix in the coffee production system in the Minas Gerais is promising, because it allows the increase of the biomass produced, in addition to signaling potential gains in coffee productivity over a period of several seasons
- The use of Penergetic Technology in all chemical fertilizer dosis tested, when CC mix is included, occur like a synergism, and in all treatments coffee dry grain yield was increased

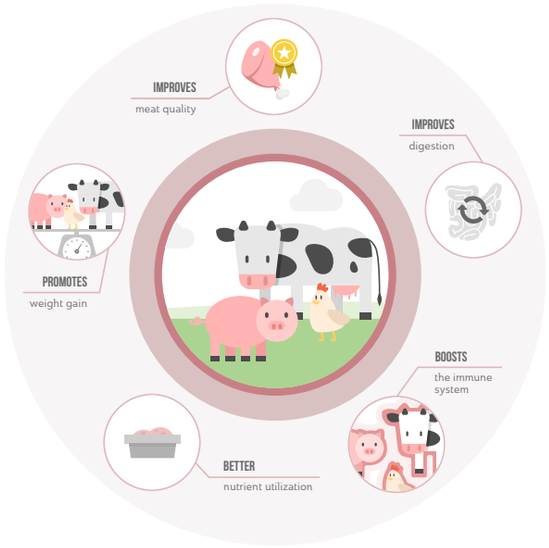
# Livestock
# penergetic t

*penergetic t is a feed supplement, which improves the quality in livestock farming. The product promotes a better feed efficiency and regulates the animals' immune system and regenerative capacities. It also has a positive effect on the entire organism.*

**A further advantage is the improved climate in stables, which results from the positive changes with regard to excretion.**

***Benefits***

- Better conditions for livestock
- Single feedstuff
- Less stress and improved well-being of the animals
- Improves digestion
- Boosts the immune system
- Promotes better feed conversion
- Stabilized quality and production
- Greater weight gain
- Improved meat quality



# Practical experience reports





# Test in organic goat rearing and production of cheese for direct sales

**The farm was taken over by Ms. Alexandra Dupont on January 1, 2011. It was in the process of being converted to organic methods. The entire farm was awarded organic certification on October 1, 2011. Since March 3, 2014 the farm is also home to wethers and “retired” nannies.**

## Situation

Since the farm has commenced operations, it comprises 20 hectares of land. As a sole farmer, Ms. Dupont breeds goats and produces cheese that she sells directly. Volunteers of WWOOF France and other helpers, friends and temporary trainees support her in her work, totaling the equivalent of one part-time employee working half days. Depending on the year and hay quality, the farm produces 16,000 to 20,000 liters of goats’ milk annually.

Livestock at the farm comprises:

- 4 generative bucks, in a separate enclosure
- 49 dairy goats
- dry goats
- young female goats are approved for milking by Ms. Dupont from three years of age. In this way they have sufficient time to mature and grow to their full size.

The animal sanctuary is also home to 90 castrated bucks and ten old nanny goats, both in their own enclosures and buildings.

**Building**

From March to October the dairy goats are kept in a 13 hectare enclosure next to a building of 100 square meters. During the winter they stay in this building.

**Feed rations**

Water is available to the animals freely. Throughout the entire year they can feed freely on hay from fodder grass/clover (mostly fodder grass) and are also fed an individual ration of concentrates at the time of milking (one milking in the morning, one in the evening). This daily ration, fed in two equal portions, comprises a total of 800 grams during the summer, 1 kilogram in the winter.

- Despite the hay from the 2017 harvest being of very poor quality, milk production appeared to be higher than during the same period of the previous year, and higher than forecast by Ms. Dupont before the trial.
- In addition, an obvious and easily measurable result was observed and measured: two days after penergetic t was introduced, the curd was of much better quality and more homogeneous, it kept better on the draining table, resulting in less waste in cheese production.

## *Trial*

The trial commenced on October 8, 2017, the set-up was quite simple: the goats were given 1gr penergetic t each with their morning ration; it was sprinkled over the concentrate. The goats readily accepted the feed mix with penergetic t. On December 18, 2017, Ms. Dupont had used up the 3kg standard bucket of penergetic t.

**Observations**

Ms. Dupont observed several positive effects. However, since no weighings, detailed analyses or other controls were carried out, she does not want to comment because a direct relationship between the observed effects and penergetic t has thus not be proven. Nonetheless, three examples of observed effects should be mentioned:

- From December 28, ten days after penergetic t was fed to the animals for the last time, the herd was affected by conjunctivitis, while it had been in perfect health when the last dose of penergetic t was taken.

14 days after the trial commenced, the farm switched to winter mode: the animals were kept inside the building and thus had no access to grass, but hay was freely available to them. This change in their diet had no effect whatsoever on milk quality, which was consistently better than before, significantly higher than before the trial. This obvious improvement of milk quality could thus only have been the result of adding penergetic t to the feed.

**Measurements**

- Before the trial she produced around 1.3 Crottin* goats cheeses from 1 liter of milk.
- During the trial she produced around 1.7 Crottin goats cheeses from 1 liter of milk.
- After the bucket of penergetic t was used up, the quality declined again.

**Commercial aspects**

With annual milk yield of 18,000 liters, the following cost-benefit ratio applies, calculated for a full test year:

**Photo from January 20, 2018. Right with penergetic t left without:** the cheese is less firm, loses more water and cheese in shapes and is slightly yellower with penergetic t.

| Parameter | Without penergetic | With penergetic |
|---|---|---|
| Annual milk yield | 18,000 lt | 18,000 lt minimum |
| Conversion rate | 1.3 FCR | 1.7 FCR |
| Number of cheeses per year | 23,400 pieces | 30,600 pieces |
| Selling price per cheese | € 2.50 | € 2.50 |
| Annual turnover | € 58,500 | € 76,500 |
| Annual costs of penergetic t | 0 | € 456.10 |
| Additional annual net profit, generated by penergetic t | | € 17,543.90 |
| Return on investment with penergetic t | | 38.5 times the purchase price |

When the Tocrop consultant, who was asked by the Penergetic importers to carry out the trial, visited on January 14, 2018, Ms. Dupont bought a bucket of penergetic t and agreed to share her experiences with people contacting her.

**Period December 18, 2017 – January 14, 2018**

- Since her supply of penergetic t was used up, Ms. Dupont bought a feed supplement on a calcium carbonate base instead; the result was rather disappointing. Compared to penergetic t the amount of cheese produced from 1 liter of milk was reduced; although the curd was better with that feed additive than before using penergetic t, the quality was not as good as during the period penergetic t was fed to the animals.
- The goat herd was affected by conjunctivitis.

**Period January 14, – January 22, 2018**

On the evening of January 14, Ms. Dupont started to use penergetic t again and returned to the same feed cycle as before: 1gr of penergetic t per goat and day, at the time of the morning milking. On January 21, she then noticed the curd having returned to the high quality levels and achieved the one liter of milk to 1.7 Crottins conversion rate again.

* Crottin: name of the goat cheese

**Penergetic**
**Penergetic de Costa Rica S.A.**

# *Four years test on reproduction and performance in dairy cows*

**The combinded reproductive and productive performances of six dairx herds (Holstein/ Jersey) were analized over four years.**

This retrospective analysis was made by Dr. Jaime Murillo Herrera, MSC teacher from Universidad Nacional de Costa Rica and private consultant of Cooperativa de productores de leche Dos Pinos in cooperation with ING. Fabricio Alfaro Jaikel, MBA as CEO of Penergetic de Costa Rica.

**Benefits**

- Less semen doses
- Less costs
- Less time to pregnancy
- More milk

The management of the 6 dairy farms was 100% grazing, with two milkings daily. They were additionally fed twice a day with a concentrate, according to milk production. The farms are located at a height of 400 meters over sea level, with temperatures ranging between 25°C and 33°C, with a good humidity average ratio above 70% throughout the year.

Four periods between 2010 and 2014 were analyzed, each from September to September. The only change in the management of these herds was the feed supplementation with penergetic t since November 2012. These two years are highlighted in colour.

From table 1 it can be deduced that the detected percentage of heats is quite consistent in the last 4 years, but we can see a decrease in services by conception; going from 2.46 in the time period of 2010–2011 to 2.10 in the time period of 2013–2014 (less semen doses, less costs, less months to pregnancy).

In the analyzed four years period, the percentage of pregnancy at first service improved from 33.7% to 39.1%, the interval between calving decreased by 17 days and the age of the heifers at first calving was reduced by 5 months.

**Table 1:** Four years comparison in six dairy herds

| Lapse of time | Sept 2010 – Sept 2011 | Sept 2011 – Sept 2012 | Sept 2012 – Sept 2013 | Sept 2013 – Sept 2014 |
|---|---|---|---|---|
| Evaluated animals | 607 | 708 | 763 | 703 |
| % heat detection | 52.5 | 51.0 | 52.2 | 51 |
| I/A services by conception | 2.46 | 2.27 | 2.16 | 2.10 |
| % pregnant at first service | 33.7 | 38.2 | 33.5 | 39.1 |
| Interval between calving in days | 404 | 408 | 388 | 387 |
| Age at first calving in months | 32.7 | 27.4 | 28.3 | 27.3 |

**Table 2:** Comparison of the total milk production of the analyzed six dairy herds during the test period

| Year | Total of cows milking in 6 herds | Average of milk in liters in finished lactations | Total of liters produced in 6 herds annually |
|---|---|---|---|
| 2011 | 505 | 14.0 | 2,596,694 |
| 2012 | 560 | 12.8 | 2,634,065 |
| 2013 | 576 | 15.8 | 3,320,733 |
| 2014 | 597 | 15.8 | 3,433,997 |

It is important to consider that even though the data are not statistically significant their economic weight for the observed herds is significant because of the quantity of represented animals.

As for the production indicators, it can be deduced from table 2 that the average of milk production improved by 1.8 liters of milk per cow per day, which means an increase of 12.9%.

Finally, it was observed that despite increasing the number of lactating animals in the herds in a year by only 92 animals (18.2%), there was an increase of 837,303 liters of milk produced (32.2%) in 2014 compared to 2011.

Again it is important to emphasize that the only change in management was the additional feeding with penergetic t since November 2012. The increase of 837,303 liters of milk with the same area and only with 92 more animals is a figure with a high economic importance.

# *What could penergetic t do for your dairy herd?*

## *My farm story ...*

**The Minnesota Dairyman: We run a tie-stall AI-herd dairy operation, and we were running into waxing and waning (coming and going) periods of mastitis, somatic cell counts over 400,000 SCC frequent DA's*, lameness issues and struggling with cow comfort and stress. We would modify one management practice as encouraged by our veterinary team, yet another challenge would take the forefront. We were juggling multiple regimes and variables, and we were watching our cows miss their genetic potential … does this sound like your farm?**

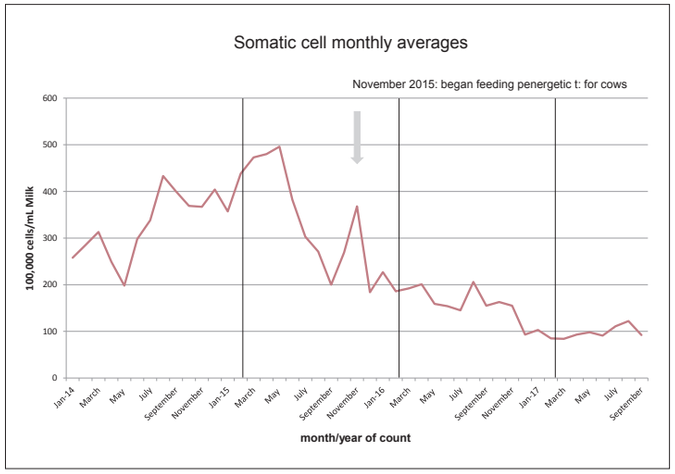
**From our experience, using penergetic t for cows avoids costs of:**

- Veterinary bills
- Retreating conditions
- Loss of production and throwing out treated milk
- Farrier costs

## Changes observed

| Increased | Decreased |
|---|---|
| Appetites and consistency in eating | Time between calving an return to feed |
| Number of healty, thifty and heavy calves born | Somatic cell average from 326,000 (2014) to 191,000 (Sept. 2017) |
| Hair coat shine and overall bright appearance | Incidences of DA's, septic mastitis cases and veterinary required calving issues |
| | Farrier required lameness evaluations and hoof issues |
| Cow comfort noticed by increased resting times | Poor appetites and inconsistencies in eating |

## Decreased somatic cell averages




**Return on investment**
The somatic cell count (SCC) premium we now receive from maintaining a consistently lower SCC, pays for the cost of penergetic t (for cows) for our herd.

**Application Rate**
5 grams per cow per day as a top-dressing to a TMR**.

* DA: displaced abomasums
** TMR: total mixed rotation

**Penergetic Thailand**
**Behn Meyer Chemicals (T) Co.Ltd.**

# Study on carcass quality in the last four fattening weeks

**Margins in animal husbandry are very low. For this reason, alternatives are searched for a better fattening result.**

## The effect of penergetic t fattening on carcass quality in swine fattening phase

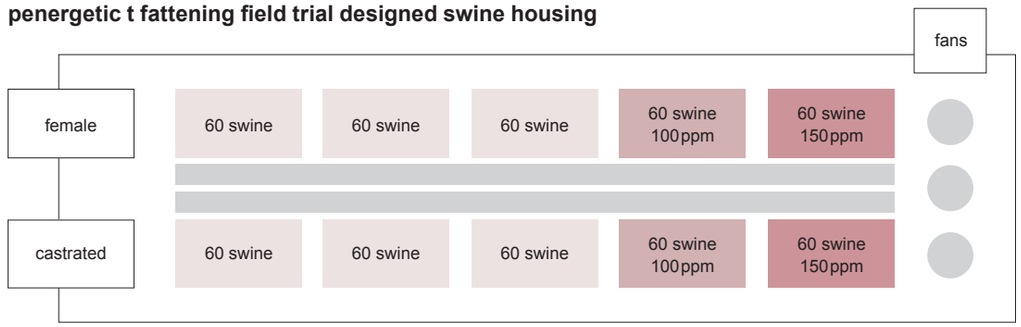
This study was carried out about the effect of penergetic t fattening on swine carcass one month before slaughtering.

**Material and method**

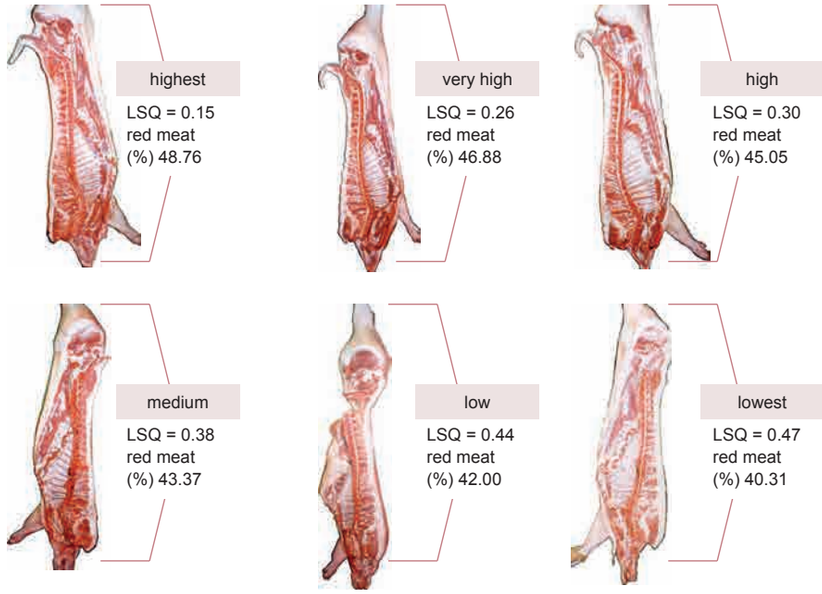
600 fattening pigs in one house, average 80kg weight separated and divided by sex into 3 groups:

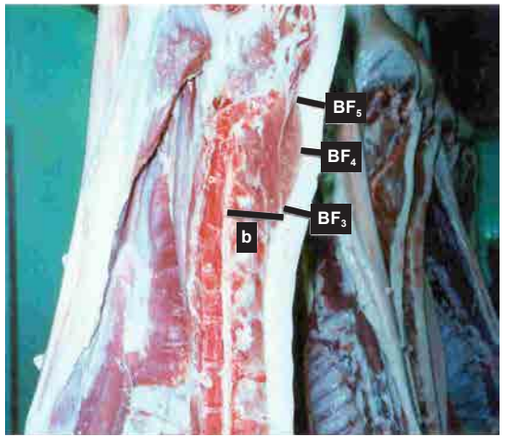
- **Control:** 360 fattening pigs (castrated and female separated) were separated in 3 pens with 60 pigs per pen. The control groups were fed normal feed without penergetic t fattening
- **Treatment 1:** 120 fattening pigs (castrated and female separated) were allocated in 2 pens with 60 pigs per pen. 100ppm penergetic t fattening mixed into feed during 1 month of production period
- **Treatment 2:** 120 fattening pigs (castrated and female separated) were allocated in 2 pens with 60 pigs per pen. 150ppm penergetic t fattening mixed into feed during one month of production period
- The fattening pigs were fed 2 times per day by automatic feeder

**penergetic t fattening field trial designed swine housing**




## Carcass LSQ Standard




**Collect data**

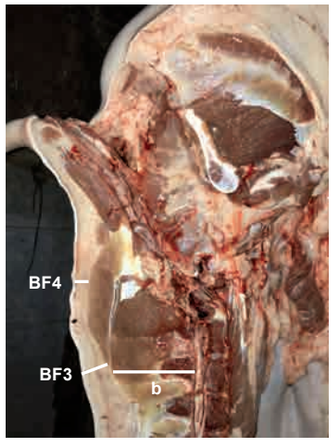
The pigs in all groups were tested during one month or weight avg. 110kg – 125kg before slaughtering. The carcass quality was checked in each group by LSQ standard by Pfeiffer & Falkenberg (1972)

**Control group**


**Test 1:** 100ppm penergetic t fattening



**Test 2:** 150ppm penergetic t fattening




$$LSQ = \frac{BF_3 + BF_4}{2b}$$

**LSQ data**
**left:** 100 ppm penergetic t (weight < 120kg)
**right:** control

## Results

| Group | BF3 | BF4 | b | LSQ | LSQ avg. |
|---|---|---|---|---|---|
| **Control** | 35 | 30 | 90 | 0.36 | |
| | 30 | 30 | 90 | 0.33 | 0.35 |
| **100ppm penergetic t** | 25 | 15 | 80 | 0.25 | |
| | 20 | 10 | 90 | 0.16 | |
| | 25 | 15 | 100 | 0.20 | |
| | 20 | 10 | 80 | 0.18 | 0.20 |
| **150ppm penergetic t** | 25 | 20 | 85 | 0.26 | |
| | 25 | 10 | 80 | 0.21 | |
| | 15 | 15 | 70 | 0.21 | |
| | 20 | 10 | 70 | 0.21 | 0.22 |

### Conclusion

- Both, 100ppm and 150ppm penergetic t groups showed the benefit on carcass quality, as the deposit of back fat was more reduced in test, recorded data followed by LSQ standard when compared with control group (0.20>0.22>0.35 LSQ)
- In the treatment of penergetic t fattening, in both 100ppm and 150ppm groups the response of sex to carcass quality was shown. The results showed that female pigs had trend to increase carcass quality more than castrated pigs.
- The effect of penergetic t fattening both of 100ppm and 150ppm to the pigs' final weight showed that the pigs lower than 120kg weight had trend to respond better to the product than the pigs over 120kg weight

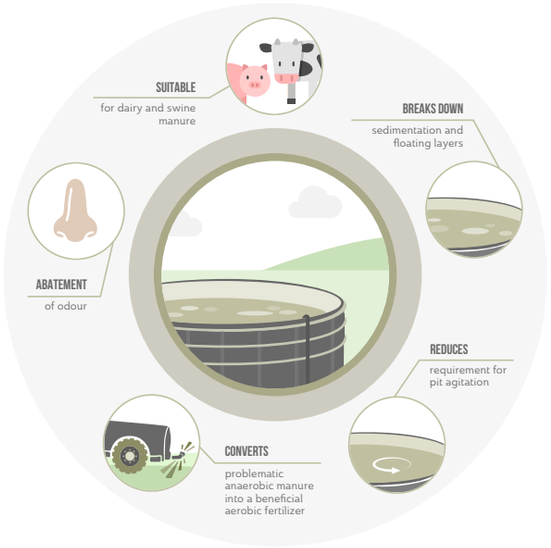
### Conclusion concentrate

- The results showed that there was no effect on carcass quality by increasing dosage rate from 100ppm to 150ppm
- There was no interaction between control and penergetic treatments, if the pigs are kept in the same house.

# Manure
# penergetic g

*Farmyard manure (liquid manure, slurry). One or more of these valuable fertilizers are produced on all farms. Careful and good preparation ensures sustainability on the soil.*

**penergetic g is used as a rotting aid in liquid manure. As a result, the consistency of the liquid manure is optimized and becomes homogeneous and flowable. Aerobic activation reduces floating and sinking layers and leads to a reduction of odour emissions. The liquid manure becomes a valuable fertilizer and causes less chemical burns.**

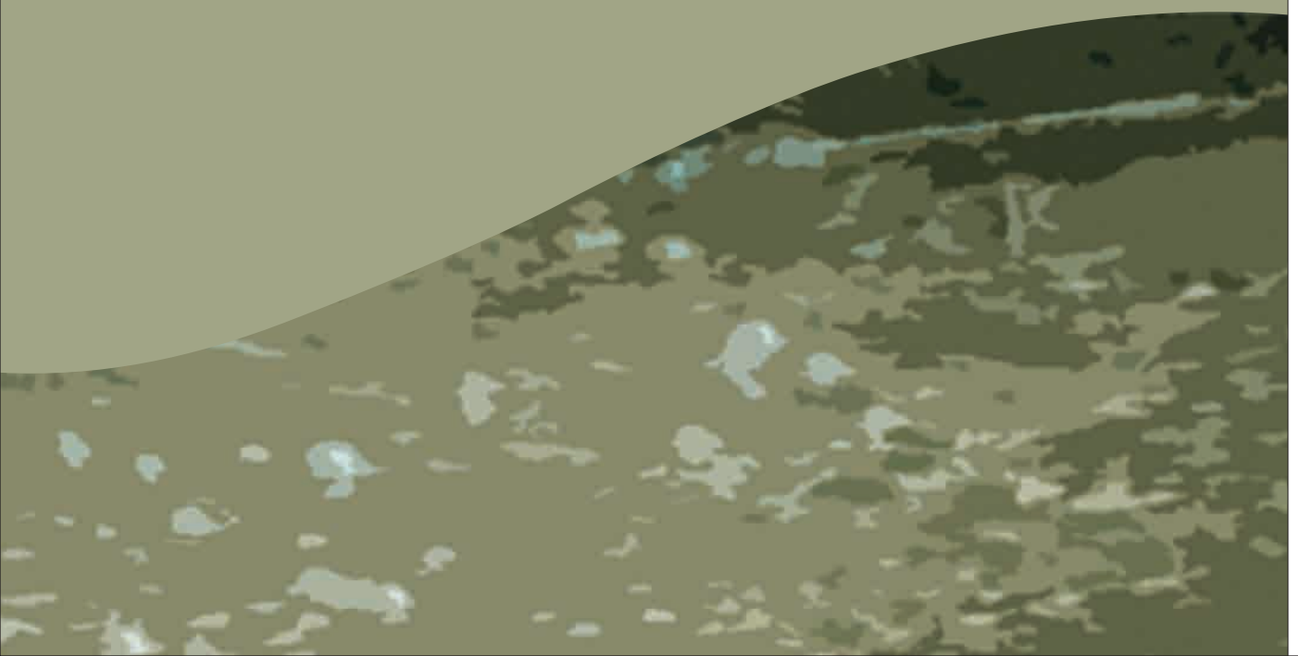



***Benefits***

- Homogenisation of slurry and liquid manure
- Converts problematic anaerobic manure into a beneficial aerobic fertilizer
- Odour abatement
- Improved plant compatibility
- Improved stable climate
- Reduced requirement of pit agitation
- Less scorching of plants
- Easier assimilation of nutrients
- The nozzles of drag hoses clog up less
- Suitable for dairy and swine manure

## Practical experience reports







# Application of penergetic g in pig slurry and its effect in various crops

**This study on slurry, was carried out regarding effects of penergetic g and penergetic t in stables and on field applications.**

## Case 1. Pig slurry

**Test Site: Hanul Farm**

- Pig fattening farm with over 3,000 pigs
- Run by Young-tae Kim for over 20 years
- Located in Ham-An in Korea (about 380km south of Seoul)

**Test Overview**

- Period: Oct. 22, 2011 – Feb. 15, 2012 (4 months)
- Control / penergetic group: 500 pigs each with an average weight of ca. 18kgs
- All barns are above a slurry cistern/tank (slurry pig pen)

**Test Products**

- penergetic t: fed with fodder (60gr/mt)
- penergetic g: applied into slurry cistern/ tank (once a week, 2gr/pig)

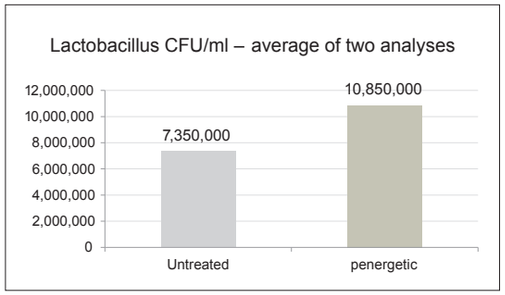
**Results**

- Free-flowing slurry, no sediments,
- Floating layers of slurry dissolved, more homogeneous
- Increased microbial activity
- Much less cough
- Less hyperemia (red eye): control group (80% – 90%), test group (10% – 20%)
- Reduced unpleasant odors by 80%
- Better meat quality
- Decreased pig mortality
- Improved working conditions of farmers

### Slurry in cistern

Control group and penergetic group

## More beneficial microorganism (Lactobacillus) in pigs' intestine



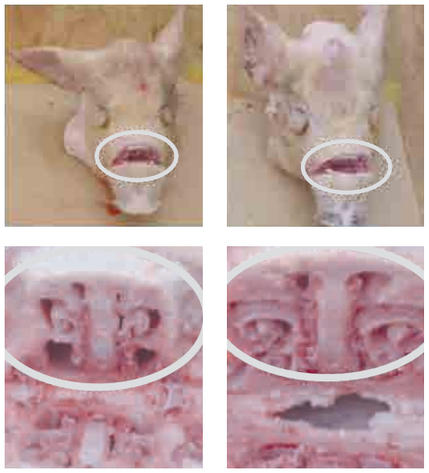

No pathogenic microorganisms detected in any of the analyses.

## Less nitrate, phosphate and potassium excreted due to improved feed conversion

| Parameter | Reduction in % |
|---|---|
| Nitrogen | 12.4% |
| Phosphate | 45.0% |
| Potassium | 72.0% |

All analyses by FACT, The Foundation of Agricultural Technology Commercialization and Transfer.

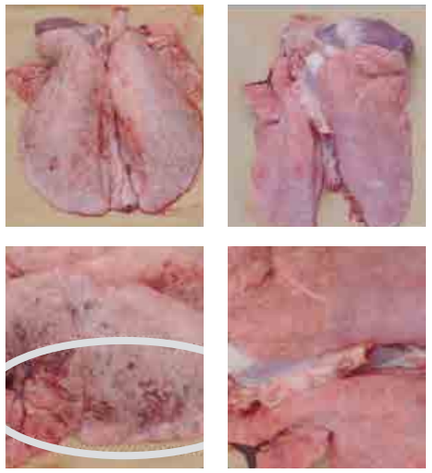
## Nasal cavity



Control and penergetic group

Control group: more closed and blocked with mucous
penergetic group: clear and normal

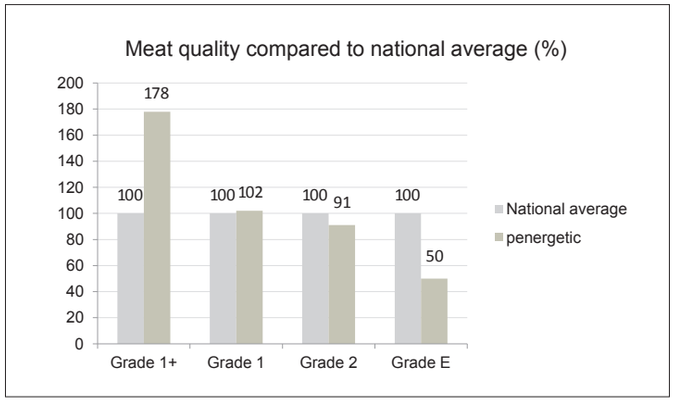
## Condition of lungs



Control and penergetic group

Control group versus penergetic group: clear difference

## Meat quality




* [ ] : Premium quality = % of Grade 1+ & Grade 1

National average based on 950,018 pigs.
penergetic farm 360 pigs.

## Thickness of intestines (health of internal organs)

Control

penergetic farm

More than twice as thick.

## Condition of hind leg (overall health)

Control

penergetic farm

The meat is firmer and grayish pink in penergetic group.

## Analyses hind leg

| | Protein | Saturated fat | Unsaturated fat | Potassium |
|---|---|---|---|---|
| Control (A) | 14.73% | 37.92% | 62.08% | 2,344[16] mg/kg |
| penergetic (B) | 18.18% | 35.57% | 64.43% | 2,795[60] mg/kg |
| Comparison (B/A %) | 123.4%<br>(3.45%↑) | 94%<br>(2.35%↓) | 103.8%<br>(2.35%↑) | 119.2%<br>(451[44] mg/kg↑) |

# Case 2. Applications of liquid fertilizer from pig slurry

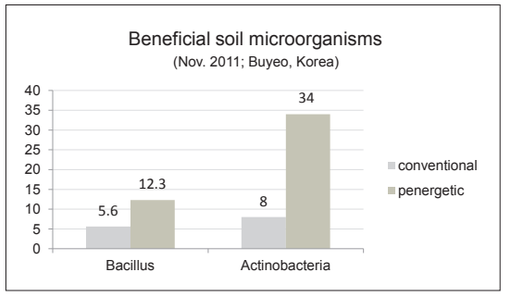
## Liquid fertilizer from pig slurry using penergetic products.

| Product | Usage | Dosage |
|---|---|---|
| penergetic t | Feed additive | 6kg/100mt fodder |
| penergetic g | Slurry treatment | 10gr/LSU/week |
| penergetic k | Compost and soil treatment | 3gr/m² on the barn floor after mucking out.<br>Repeat each time after bedding. |

Best results are obtained by using the products in combination if feasible.

**Benefits (with combined use of penergetic products)**

- Reduce unpleasant odors and the occurrence of harmful insects and their larvae
- Significantly lower mortality rate and reduction of respiratory diseases
- Economical; reduce or eliminate the use of chemical additives
- Minimize groundwater pollution




Bacillus promotes plant growth. Actinobacteria speeds up decomposition of organic matter.

## Application cases

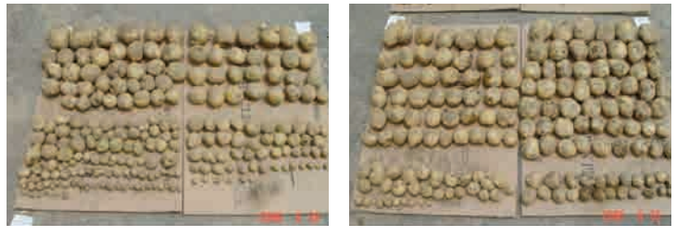
### 1 Rice cultivation
### Mar–Aug, 2006 / Dangjin, Korea


Cultivated by Min-Hyung Cho; 10 hectare
(used 25lt of liquid fertilizer per 3.3m²)

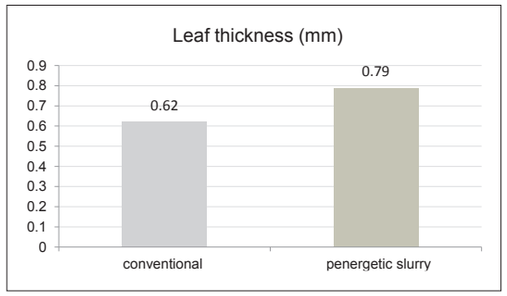
**Numer of stems (Aug 22, 2006)**
**left:** Traditional cultivation / number of stems: 16.7
**right:** penergetic treated slurry (replaced chemical fertilizer by 90%) / numer of stems: 24.7 (+148%)

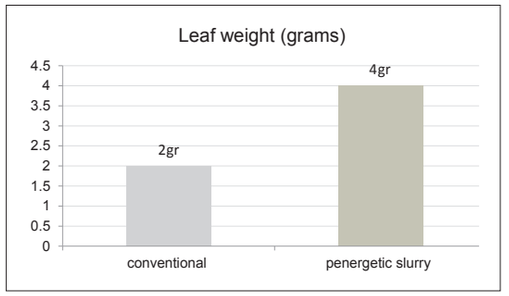
### 2 Potato cultivation
### July 28, 2006 / Chuncheon, Korea

Cultivated by Jong-Sung Hong;
1lt hectare (used 50lt of liquid fertilizer per 3.3m²)



**Potato crop (10 stems)**
**left:** Conventional
**right:** Larger protatoes with penergetic treated slurry



## Nutritional values of the potatoes

| Parameter | Conventional (A) | penergetic Slurry (B) | Comparison B/A % |
|---|---|---|---|
| Fiber | 0.51% | 0.77% | 151.0% |
| Starch | 16.55% | 20.45% | 123.6% |
| Vitamin C | 96.3ppm | 125.3ppm | 130.1% |

Tested by Gangwon-do Agricultural Research & Extensions Services.

## 3 Spinach cultivation
## Nov, 2010 – Mar 2011 / Buyeo, Korea

**Fertilizers used in greenhouses**
**A:** Liquid = treated slurry with penergetic g / chemical / organic
**B:** Chemical / organic / liquid = treated slurry with penergetic g
**C:** Organic / liquid = treated slurry with penergetic g / chemical

Cultivated by Baek-Je Agricultural Association; used 40lt of liquid fertilizer per 3.3m².

**Weight of spinach (based on 12 plants)**
**A:** Liquid fertilizer (penergetic g) 430gr
**B:** Organic fertilizer 320gr
**C:** Chemical fertilizer 280gr

Certificate of Results



# Problems of heavy crusts on manure lagoons solved by penergetic products

**Liquid manure – waste or natural fertilizer? This is a recurring question. If the liquid manure has sedimentation or floating layers, this means a lot of work for the farmer. penergetic g is the solution!**

**Lagoon Treatment with penergetic g/k**
Treatment of a 400,000 gal lagoon (1,600m³)
Location: Bow Area, Skagit County, WA
400 dairy cows

### Protocol used

- 72lbs (33kg) of penergetic g/k added to lagoon as shock treatment
- 6.5lbs (3kg) of penergetic g/k per week for 12 weeks
- Then 3.25lbs (1.5kg) of penergetic g/k per week = regular/maintenance application rate

**A**

**B**

**C**

**A: December 23, 2013**
Prior to treatment, there was a heavy crust on the lagoon surface.

**B: January 3, 2014**
11 days after treatment: The lagoon's liquid manure was bubbling, the previous crust submerged and dissolved already partially. There was no mechanical agitation involved!

**C: January 3, 2014**
16 days after treatment:
Further improvement in lagoon quality is evident.

# Various results and observations from five farmers using penergetic g

## Statements from farmers in Finland about their many years of experience with penergetic g

First of all a short introduction about the use of Penergetic in various areas and the respective results of five customers.

**The product**
Formerly known as penergetic g/k – it concerns penergetic art.no. 2010 and art.no. 2210. These products were mainly applied when a large amount of straw was within the manure/slurry. In Finland, the beddings are generally put into the pits. Therefore, these products are optimal for our market.

**Cow and pig slurry**
Recommendation:
1st week: 2 kg/100 m³ weekly
2nd – 5th week: 1.5 – 2 kg/100 m³ weekly
Subsequent: 1 kg/100 m³ additional new slurry
Blocked canals and bottom layers: 2 kg/100 m³ until slurry is free flowting

**Pig slurry**
Empty canals: 1 kg/100 m³
Repeat after drained out.

**Information about some prices in Finland**
- Diesel fuel costs about € 0.80/liter excluding taxes. When stirring a slurry tank with e.g. a 100 horsepower tractor, they spend about 15 – 20 liters fuel per hour. When farmers can save working hours with slurry stirring it also means spending less money; 1 hour is 15 x € 0.80 = € 12 minimum.
- For instance NPK 27-3-5 (N = 27 %, P = 3 %, K = 5 % including) fertilizer costs about € 310 per 1,000 kg without taxes. When farmers are able to decrease every year some 10 kg/ha fertilizers that means savings! E.g. 50 kg/ha less is € 0,31 x 50 = € 15,50. Farmers spread 25 – 30 m³ per hectare slurry. With a 1,000 m³ slurry tank, they need 40 ha of fields. 40 x € 15,50 = € 620. This we experience every year. Savings are increasing and use of chemical fertilizer diminishes.

With these two facts in the "slurry handling"; farmers realize continuously very good results and have a considerable advantage when using penergetic g.

**Farmer who uses penergetic since 2016**
**Jussi Kinnunen, Keihärinkoski**
- *No need to stir canals. Works incredibly well.*
- *We spread slurry in springtime. First to one block only, where the grass grows very strongly. Even though we had a cold weather period.*
- *Reduction of fertilizer: 30%!*

**Total amount: about 700 m³ slurry per year.**

**Farmer who uses penergetic since 2013**
**Olli Ervasti, Sotkajärvi**
- *Yes, it works well. Before we needed a machine to stir the canals, but not anymore.*
- *There is less ammonia in the stable.*
- *Much less flies in the stable.*
- *There were oxygen bubbles in the outside tank. Slurry is homogenous and has a dark green color. Much, much better than before!*

**Total amount: about 600 m³ slurry per year.**

**Farmer who uses penergetic since 2007**
**Veijo Saarikoski, Teuva**
- *The slurry is good. No top layer in the slurry tank.*
- *For the 'third grass crop' we spread only slurry and it grows well.*
- *We can also use 'the third grass crop' for silage. Still good quality for the cows.*

**Total amount: about 1,000 m³ slurry per year.**

**Farmer who uses penergetic since January 2013**
**Tero Tirkkonen, Nilsiä**
- *August 2014: "Now I have to believe that it works. There was no layer in the outside slurry tank. It was easy to stir. The slurry does not make any dregs to the bottom as earlier. Grass is growing well."*
- *August 2016: "This is great. I have seen that there is no need to make extra work with the slurry. We notice more effective fertilizing effect. We have grass fields and it seems to work very, very well. I appreciate that we can get good crop and plenty of grass silage to our dairy cows from our nearest fields."*
- *August 2017: "I have decreased fertilizers of the second grass crop (the first one was conventional). We can see a remarkably good effect in the fields. There are many many worms in the field. I can see them when I am ploughing. The soil is also fluffier than before."*

**Total amount: about 800 m³ slurry per year.**

**Farmer who uses penergetic since 2015**
**Harri Pakarinen, Rautalampi**
- *In grass silage, D-values are good. They have been 750 and 650.*
- *The consultant of the slaughterhouse calculates how much more protein has to be added to the silage. This has to be very little.*
- *In the winter, 2017/2018 we even didn't need to add protein to the silage at all.*
- *The slurry runs/moves better in the canals.*
- *There is no need to stir the slurry tank as much as before.*

**Total amount: about 300 m³ slurry per year.**

# Three analysis to evaluate the quality of manure

**Suckler cow liquid manure is very viscous and tends to have floating layers. Futhermore this is associated with odour emissions. penergetic g was applied to improve the entire situation.**

An average 15 – 25 suckler cows are kept at the farm on Lake Zurich. The slurry tank is underground and covered. At the time of the first sampling, the tank was about ¾ full. The first sample was taken without prior treatment. Immediately after sampling, penergetic g molasses was stirred once into the slurry tank 10 weeks before second sampling. After second sampling, follow-up treatment was performed weekly for one year until the third sampling.

## Analysis liquid organic fertilizers

| Parameters | 09.02.2017 without penergetic | 28.04.2017 once penergetic | 26.04.2018 weekly penergetic | Unit | Method |
|---|---|---|---|---|---|
| Dry Matter TS 105°C | 1.50 | 1.70 | 5.70 | % | D-TS-lbu |
| Ash residue 500°C | 38.40 | 35.90 | 30.70 | % | D-AS-lbu |
| Ash loss 500°C | 61.60 | 64.10 | 69.30 | % | D-AS-lbu |
| Carbon Corg | 357.30 | 371.90 | 401.70 | gr/kg TS | D-AS-lbu |
| pH-value | 7.58 | 7.67 | 7.00 | | pH-orgDüngerflüssig-lbu |
| Entire N after Kjeldahl | 71.30 | 63.80 | 37.00 | gr/kg TS | NKjeldahl-Büchi-lbu |
| Ammonium-nigrogen N-NH4 | 38.40 | 38.00 | 14.30 | gr/kg TS | N-NH4-Büchi-lbu |
| C/N-ratio | 5.01 | 5.83 | 10.85 | | Calculation |
| Phosphorus P | 8.62 | 9.45 | 7.89 | kg/mt TS | AD-KW-ICP-lbu |
| Phosphorpentoxyd $P_2O_5$ | 19.75 | 21.65 | 18.07 | kg/mt TS | Calculation |
| Potassium K | 137.00 | 120.00 | 53.90 | kg/mt TS | AD-KW-ICP-lbu |
| Potassiumdioxyd $K_2O$ | 164.68 | 144.61 | 64.99 | kg/mt TS | Calculation |
| Calcium Ca | 21.20 | 23.80 | 19.50 | kg/mt TS | AD-KW-ICP-lbu |
| Magnesium Mg | 7.47 | 7.13 | 5.97 | kg/mt TS | AD-KW-ICP-lbu |
| Sulfur S | 5.59 | 5.55 | 4.51 | kg/mt TS | AD-KW-ICP-lbu |

**Chemical analysis of three slurry samplings with and without penergetic g**

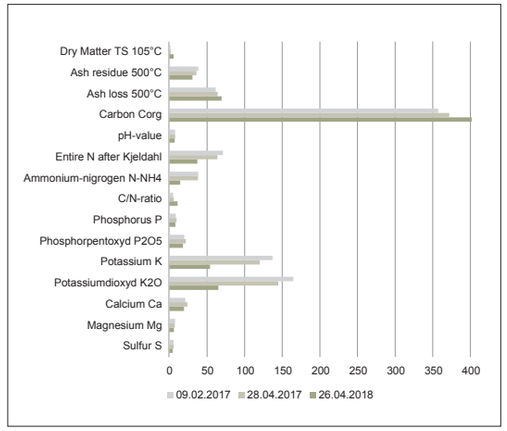
The purpose of this experiment was to analyse the chemical composition of the manure and to determine changes due to the influence of penergetic g. The analyses were carried out by the Laboratory for Soil and Environmental Analysis lbu in Thun/CH.

- No treatment before first sampling in February
- One treatment of 2lt/100m³ ten weeks before second sampling end of April
- Weekly 2lt/100m³ for new manure during one year until third sampling

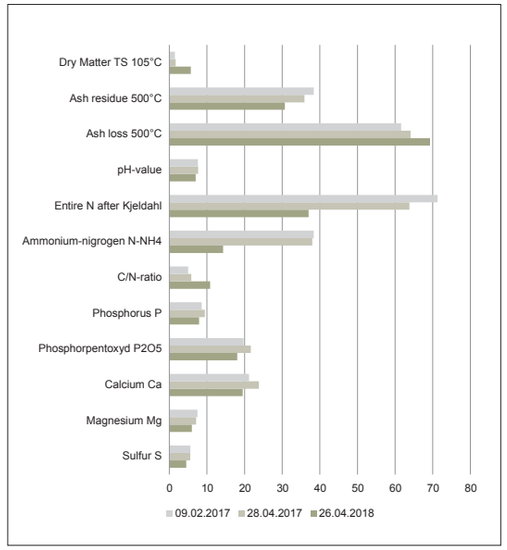
### Observable changes

The farmer noticed that the slurry was less smelly and more fluid. This has reduced the stirring effort. The floating layers have been reduced.

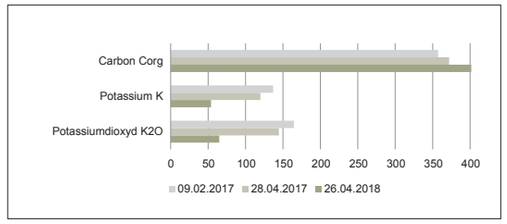
## Graphic view of the analysis, entire and divided




A




B




C

**Graphic view of the analysis, entire and divided**
**A:** The respective units
**B+C:** To make the differences between the samples easier to see, the parameters are divided into two graphs below.

# *Persistent floating layer are dissolved with penergetic g/k*

**Floating layers causes additional agitating costs for farmers. The layer on this farm was 1.5m thick and didnt  dissolve any more.**

**Farm details**
The Schlunegger family produces goat's and Tomme cheese. The farm is 50 hectares in size and is located approximately 800m above sea level.

**Animal stock**
- Approx. 200 goats
- Approx. 80 fattening pigs
- Approx. 20 cattle

**The problem**
- Strong floating layers
- Strong odour

The slurry consists of 90% pig slurry and 10% cattle slurry. Three years before we treated the slurry with penergetic g, which resulted in reduced odour but did not solve the main problem of the floating layer. After analysing the slurry and related factors in detail, we decided to use penergetic g (pig slurry). Even though odour was reduced even more, the floating layer remained.

We were very surprised about how persistent the floating layer was. Measures that would usually lead to perfectly homogeneous slurry were only partially successful, so we needed to take stronger action: penergetic k! The rotting process had to be the solution to this problem. In May we scattered additionally to penergetic g – 2kg of penergetic k across the floating layer. At our next visit at the start of August, we noticed that the floating layer was already half dissolved. At that point in time we scattered another 1kg of penergetic k and arranged to visit again in early November.

In early November we saw bubbles coming up where the surface was liquid. This showed that the microorganisms were working hard.

Condition of the slurry without penergetic

Condition of the slurry after penergetic g was applied

Condition of the slurry after penergetic g was applied. Supplemented by penergetic k (the bubbles that are forming show that the microorganisms are extremely active).

Photographs by Jürg Beerhalter

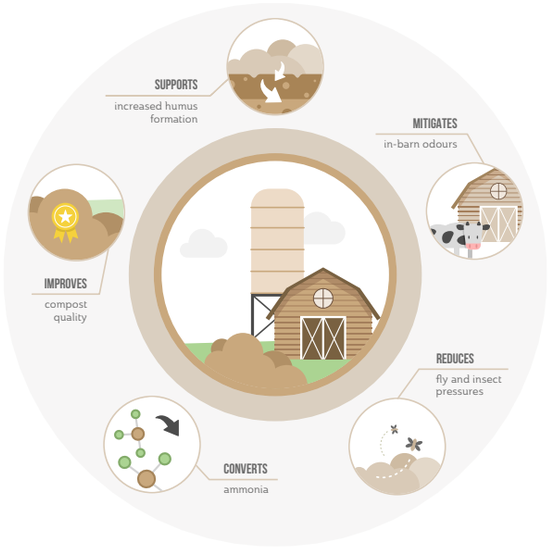
# Compost
# penergetic k

*penergetic k is a rotting agent for compost and bedding. The product promotes the degradation of organic matter and accelerates the rotting process. In barns it improves the sanitation and climate.*

**The product reduces the unpleasant odour from compost or manure to a natural level. The composting process itself is accelerated and optimized, the final product (humus) becomes enriched by the aerobic rotting processes.**

***Benefits***

- Stimulates the composting process
- Stabilizes rotting processes
- Improves stable climate
- Reduces ammonia emissions
- Supports increased humus formation
- Mitigates in-barn odours
- Reduces fly and insect pressures
- Accelerated development
- Less machinery work needed
- Reduced environmental pollution



# Practical experience reports





# Better and faster rotting of manure and higher valued fertilizer for plants

**In this comparison of manure with and without penergetic k, the advantage of faster decomposition and significantly less odour is clearly demonstrated.**

**Dosage recommendation**
40gr/m³ penergetic k

## Results

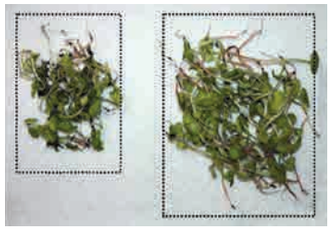
**Characteristics of manure treated with penergetic k**

- Lighter, drier texture
- Brown colour with white fungi evident
- Dryer and less clumpy
- Practically no odour

**Characteristics of untreated manure**

- compact, heavy texture
- Brown, greenish colour
- Pasty and humid
- Emits a slightly nauseous odour

**above:** Characteristics of manure treated with penergetic k (22°C)
**below:** Characteristics of untreated manure (13°C)

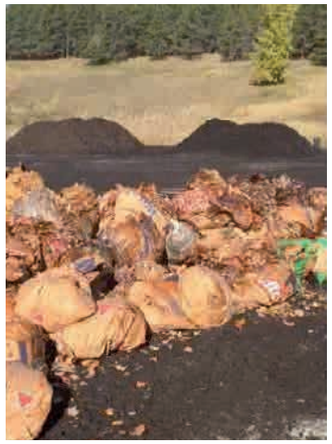


**left:** Control
**right:** with penergetic k

**Germinating radish seed with and without penergetic k treated cow manure**

- longer roots (+13%)
- larger root mass (+34%)
- more uniform growth (+37%)
- larger vegetable mass (+61%)
- improved germination (+4.2%)
- less evidence of water stress
- a continuation of rapid root growth

# Foliage waste transformed into valuable fertilizer within 21 days



**left:** Compostable material in works yard. No decomposition after 1+ year.
**right:** Same raw material now 21 days after composted with penergetic k.

**The City of Sherbrooke (population 250,000) decided to initiate a city-wide composting operation. The problem was that, after two years of collecting leaves and other raw materials from householders, their municipal works yard was full of compostable material which was not breaking down / decomposing properly (and they were running out of storage room).**

Seeking a solutions, the City approached Eric Schaffner of Solutions Penergetic. The mandate from the City of Sherbrooke was clear: “to compost the material they were collecting as fast as possible to create space for new raw materials to arrival.”

A test was conducted with 2,000 tons of leaves that had been stored for one year. The compacted leaf material was put in windrow, half of which penergetic k was applied on, at a rate of 50 grams per $m^3$. The windrows were mixed with a Bacchus windrow and turned again after 15 days.

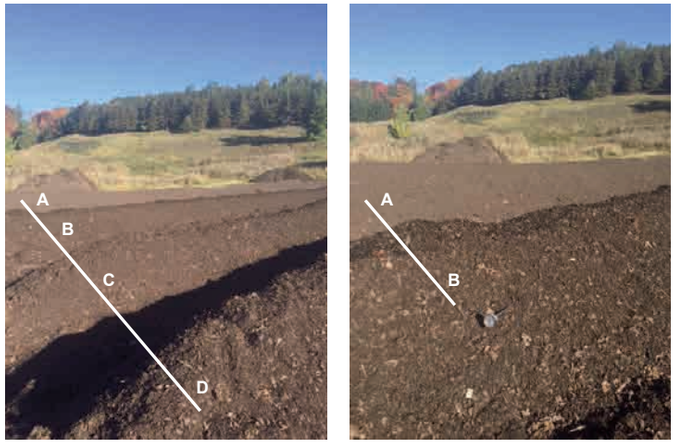
**Temperature after one week**
**left:** penergetic 60°C
**right:** Control 40°C

## Result

**The penergetic k treated compacted leaves composted successfully in 21 days!** Besides noticing “no odour from penergetic-treated compost”, the City has undertaken no further technical analysis as for them the most important thing was increasing the “through put” of compostable material through their municipal works composting yard. This, the penergetic k did very successfully and, as a result, now all material to be composed gets treated with penergetic k. The finished compost, so created by the City of Sherbrooke, is used for their own purposes – for flower pots, urban landscaping, etc.

Subsequently, they have observed that: provided the ambient air temperature was suitable when penergetic k was added, the composting process got underway quickly. Furthermore, once the process was started, even if the exterior of the pile became much colder, the composting process continued inside the piles (windrows) – as the temperature there remains higher.

“Before treating with penergetic k, the material after more than one year of storage was only at the beginning of the composting process. We found large blocks of compact leaves still almost fully intact.”

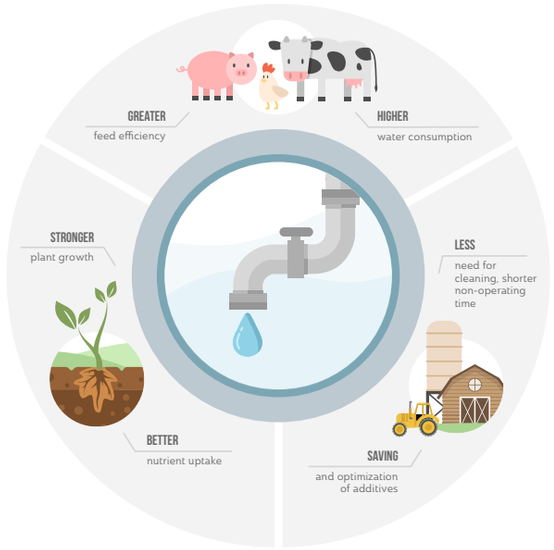



**A:** Control
**B-D:** penergetic

# Water vitalisation AquaKat

## *Take advantage of biostimulation with the Penergetic technology for vitalized and structured water.*

**The AquaKat is a physical device, which forwards a previously programmed frequency pattern to the water. The water responds to frequencies and gets through this restructured and vitalized. The vitalized water transports the ingredients better into the metabolic system of an organism, which makes e.g. chemical agents even more effective. This could lead to a considerable reduction of spraying agents.**




***Benefits***

- Beneficial to humans, animals and plants
- Better assimilation of water
- Lime and other deposits are easier to remove
- No installation costs & maintenance-free
- No energy consumption – neither magnetic nor electric

**In livestock**

- Increased water intake
- Increased performance
- Additives dissolve better
- Supports sustainability

**In plant cultivation**

- Better nutrient uptake
- Stronger plant growth
- Contribution to increased yield
- Reduced fertilizer use
- Supports sustainability

# Practical experience reports





# Problems solved of water quality in the tank for drinking water supply in dairy

**The water used for watering dairy cows has a large influence on milk quantities. If the cows don't drink enough, the amount of milk is lower. This can be improved by fitting an AquaKat.**

## Dairy farm, 180 cows

- Improve water quality
- Avoid harsh chemicals
- Achieve better health and performance

There has been great success at reducing the hardness of water using the AquaKat. It can be used to address iron in the water and eliminate hydrogen sulphide. Since animals like the better taste of the water, they drink more. Based on tests, an average 1.5 litres increase in milk production per cow per day and reduced use of detergents in the milk parlour has been observed.
The AquaKat XL has a capacity of 6,000 litres per day, means one AquaKat XL per 60 cows. This usage calculation is based on 100 litres per cow per day (more for regular milk cows and less for cows during gestation). A difference was noticeable after one month, but it achieved its maximum effectiveness after three months.
With respect to wash water in the milk parlour, it is much easier to clean up after milking with the AquaKat water. There was one farmer who forgot to use detergent one day and he noticed that it was just as effective (with just the AquaKat water) as when he used soap.

In the case of water from a groundwater source, we recommend that some penergetic w (for groundwater) be used – at a rate of 2.5kg every 3 months – suspended in the well or storage tank in a flow through filter cloth bag (so the product slowly dissipates to the water supply).

## Alberta Organic dairy farm, 400 cows

- Algae problem in water tank solved.
  The iron-derived algae bacteria sludge in a water tank could be resolved simply by installing an AquaKat XXL.

Water tank (inside) before using AquaKat

# 30% less herbicide spray agent with AquaKat

**The AquaKat is a device that can be easily fitted to the sprayer. Due to its effect on the water structure, spray agent can be better dissolved in the spray liquid and the amount of spray agent required can be reduced. An active and simple contribution to nature protection.**

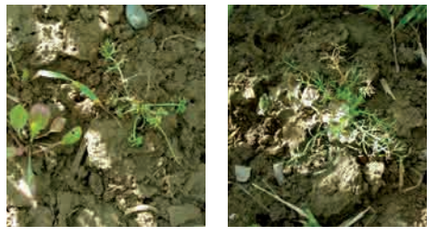
## Dates

Herbicide spraying (Atlantis) in winter wheat with AquaKat. A hitch sprayer with 2,000 liter filling volume and 21 m spray width was used for spraying. From the herbicide (Atlantis) 350 ml/ha were sprayed.

**In the experiment were compared**

- Herbicide 30% reduced with AquaKat and without AquaKat
- Herbicide at full cost with and without AquaKat

**22.04.15** reduced without AquaKat *(left)*
reduced with AquaKat *(right)*



**28.04.15** reduced without AquaKat *(left)*
reduced with AquaKat *(right)*

**22.04.15** full herbizide without AquaKat *(left)*
full herbizide with AquaKat *(right)*

**28.04.15** full herbizide without AquaKat *(left)*
full herbizide with AquaKat *(right)*



# Less odour and easier cleaning of filters aswell calmer animals with AquaKat

## Swine Farm, Minnesota 1

- Less water filter cleaning
- Less smell in the barn
- Improved feed conversion

The operator tells that before installing an AquaKat he would have to clean the water filter on the main water line every two weeks as the filter filled with sediment shutting off the flow to the barns. Since the AquaKat has been installed there has been no build-up of sediment even after more than 6 weeks. He also noticed that the swine drank more water, that they were calmer and that feed conversion was improved. Another noticeable result was the reduced smell in the barn. The operator himself now drinks water from the barn supply, as it tastes better than the one he has in his house, which is on the same water source.

## Swine Farm, Minnesota 2

- Noticeably calmer / healthfulness pigs
- Less smell in the barn
- Bubbling in the liquid manure
- Visibly better conditions

The property contains 3 barns with swine close to market weight. The barns are identical in terms of genetics and age of animals, feed rations and water. One barn was equipped with two AquaKat XL on the water line. As shown in the table below there were big differences noticeable simply by changing the water.

**Comparison between barns at Swine Farm, Minnesota 2**

| Observations | Control Barn | AquaKat Barn |
|---|---|---|
| Disposition / Demeanour | Nervous, irritated, jumping up on one another | Calm, appeared relaxed |
| Hide Coloration | Grey | Pink |
| Tail biting / scratches | Yes, easy to spot evidence of both | No tail biting evident, one scratch |
| Coughing | High incidence, various animals | one coughing animal |
| Odour | Strong, pervasive pig house odour | Noticeably fresher smelling |
| Slurry condition (through slats) | Still, nothing evident | Bubbling, active |

# Penergetic Technology

*The Penergetic Technology is based on physical principles. All of life, including growth, actions and thoughts are not possible without electrical impulses and magnetic waves. The Realization that every atom, molecule, compound and substance has its own electro-magnetic frequency led to the development of the Penergetic Technology.*

**We have been able to transmit selected frequencies to suitable material under controlled conditions of electromagnetic induction. This leads to a modified electron status of the material, which was treated with the Penergetic Technology. The penergetic products emit the selected electro-magnetic frequencies to the area of application and generate the desired effect.**

**Electrical impulses and magnetic waves make life possible**
Utilizing the potential in agriculture: principles that have been successfully used in the treatment of humans for decades can now also be utilized in agriculture with penergetic products.

## *Application of frequencies. And properties.*

**Programming selected properties**
The programming is not limited to single frequencies or characteristics. Several frequencies can be combined simultaneously on one product. Thanks to many years of experience, a selection of frequencies in combination with one another can be chosen today, which have already proven to be effective, to achieve more optimal results.

In agriculture, desired improvements such as better growth or resistance, can be stimulated with penergetic products. This biostimulation strengthens the whole organism and leads to an optimal use of the available resources and to an increase in quantity and quality of the products.

*"The application of penergetic products showed interesting trends in the development of plants. This should be further reviewed for a new approach in agriculture."*

Prof. Dr. Maria R. Finckh
Ecological plant protection, University Kassel

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