



Anwendungsbericht/User Application Report

Produkt/Product:

penergetic b
penergetic p

Art. Nr.:

3000 penergetic b
4000 penergetic p

Fachberater/Consultant:

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Field Trials
Brazil

Datum/Date:

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Combined use of penergetic and cover crops in corn

Justification for evaluations

Agriculture faces a major problem in alleviating pressure on the environment and fulfilling future food demands as the world population is expected to reach 9 billion by 2050 (Kim et al., 2020).

Soil degradation from conventional agriculture is one of the critical factors in this pending problem. Much attention has been given to restoring and maintaining soil health and to researching and validating alternative practices, such as reduced tillage or crop rotations. These practices are essential. Not only to maintain and restore soil health, but also to minimize other agricultural side effects such as nutrient leaching, water pollution, and soil erosion. (Paustian et al., 2016). Cover crops are valued as a viable, sustainable agricultural practice that is expected to provide many benefits, such as prevention of soil erosion and nutrient leaching, weed suppression, and carbon capture (Thapa et al., 2018).

Cover crops may impact soil microbial functionality responsible for important soil ecosystem services, especially as the agricultural soil microbiome is sensitive due to its typically low diversity. The soil microbiome is a crucial component of soil health. So, the effects and response to cover cropping need to be surveyed to support its viability as a conservation practice.

The corn yield, as well as concentrations of sugar, starch, protein, lipids and other components of specialty corn varieties, can vary according to the production factors and management system used.

Penergetic technology has attracted attention among farmers and the scientific community, among products based on technological innovations with an effect on restoring balance in agricultural systems. Over the last few years, more and more new studies are demonstrating the effects of Penergetic in the most diverse crops (Kadziulienė et al. 2005; Jakiene et al., 2008; Jankauskiene and Surviliene 2009; Perkarskas et al. 2011; Pekarskas 2012a; Cobucci et al. 2015; Pekarskas and Sinkevičienė, 2015; Steffen et al., 2016; Pekarskas et al. 2017; Souza et al. 2017; Franco Júnior et al. 2018; Franco Júnior et al. 2019).

All the studies presented have the quality of plants as a common point. The authors describe the increase in productivity and plant development with Penergetic use. The root volume stands out among the observed factors.

The objective of this study was to evaluate the joint use of cover crops in the winter period and Penergetic in corn crops in the summer.

Methodology

The corn cultivation in a rotation system with winter cover crops was also evaluated in a field trial conducted in the Brazilian southern area. Pioneer P1225VYHR hybrid corn was seeded on three different cover crop treatments (Figure 1):

- Black oats
- Mix corn (RX110)
- Mix soybean (RX210)

The Mix corn was used for soil cover prior to corn planting and consists of vetch, rye, black oats, and forage radish.

Whereas Mix soybean was used for ground cover prior to soybean or bean seeding and consists of rye, black oat, and forage radish.

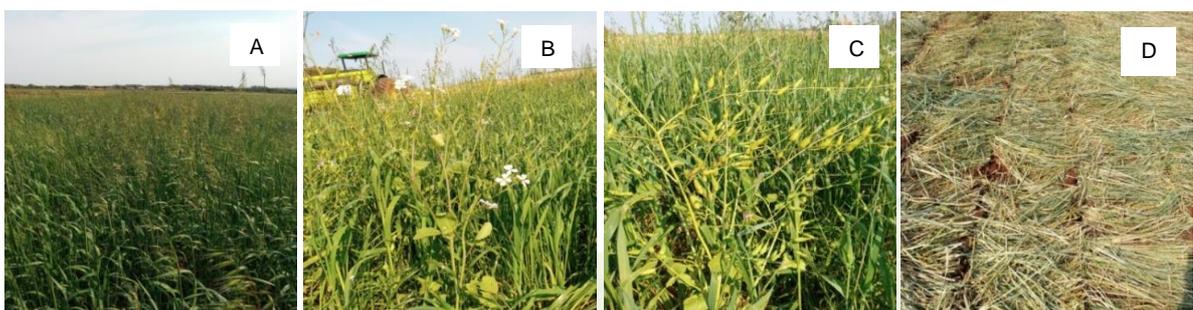


Figure 1. Cover Crop for corn evaluation: Black oat (A), Soy Mix (B), Corn Mix (C) and green mass of plants at the time of corn seeding (D).

The soil is classified as Nitisol. Corn seeding was carried out under the straw of various cover crops previously dried.

The three varieties were arranged in side-by-side blocks, each block consisting of 28 rows of corn 45 m long and 14 m wide with 0.5 m spacing. The seeding density was 3.3 seeds per linear meter, resulting in 66,000 plants per hectare. At the time of seeding, basal fertilization was applied with 373 kg ha⁻¹ NPK 5:20:20 formulation at a depth of 3.5 to 4 cm.

The Penergetic technology was applied only in corn cultivation. Penergetic b was applied one week before seeding at a dose of 500 grams per hectare. Penergetic p was applied in the 4-leaf stage (V4) at a dose of 500 grams per hectare.

Corn grain yield was harvested 140 days after seeding (Figure 2), by mechanized harvesting of four replicates per block, corresponding to a yield of five square meters (five linear meters and one meter wide).



Figure 2. Corn plants at harvest time 140 days after seeding.

Results

The use of cover crops in the winter period (between the periods of crops with higher economic interest) leads to a significant increase in soil quality. Cover crops help maintain soil biology and they are very important for the regeneration of agricultural systems. The application of cover crops during the winter period provides the release of root exudates which stimulates microbial activity. This maintenance of soil biology results in a greater diversity of organic compounds in the surface layers of the soil (up to 10-12 cm deep). The richness of exudates in the surface soil layer is fundamental for supporting highly fertile soils that can guarantee high yields.

The cover crops effect can be easily observed in the results presented.

The range of cover crops used (different winter mix) resulted in differences in corn yields (Figure 3). The right composition of the cover crop mixture is crucial for a significant increase in productivity. In this case, we can observe that the corn mixture (vetch, rye, oats, and fodder beet) can protect the soil, keep nutrients in circulation, and provide nitrogen in the soil.

Vetch is a legume species that fixes nitrogen from the air directly into the soil, making the nitrogen available for subsequent crops. The combination of properties and benefits offered by this mixture has led to an increase in crop productivity.

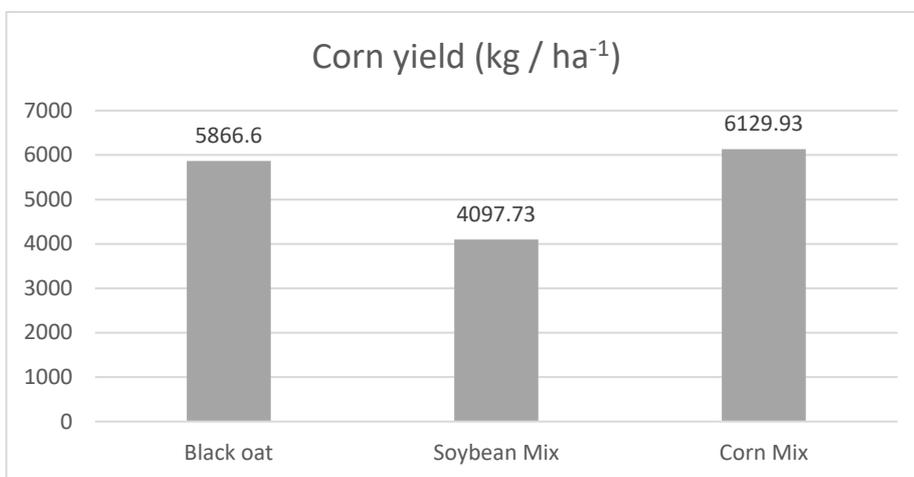


Figure 3. Corn (Pioneer P1225 VYHR hybrid) under different cover crops. Black Oats: only black oats. Soybean Mix: rye, oats and forage turnip. Corn Mix: common vetch, rye, oats and forage turnip.

The use of Penergetic technology provided a significant increase in corn productivity for each cover crop mixture evaluated (Figures 4, 5 and 6). The effect of using Penergetic resulted in increased root volume and higher nutrient concentration in the plants. The consequent greater grain filling was more evident with the cover crop and soil biostimulation (Penergetic) combination.

Global agriculture is constantly improving. That is a fact. All agricultural crops are managed intensively and with great competence. But we need to take care of the soils to enable these productivity advances. Penergetic represents a fundamental link in the overall regeneration process of the soil ecosystem.

There are few technologies that allow to increase the productivity of agricultural crops without damaging part of the complex structures that the soil presents. Penergetic is very efficient in this point. Penergetic can increase the quality, productivity and vitality of plants, and restore the quality of soils by increasing the biodiversity in the system and enhancing the interactions between microorganisms and plant roots.

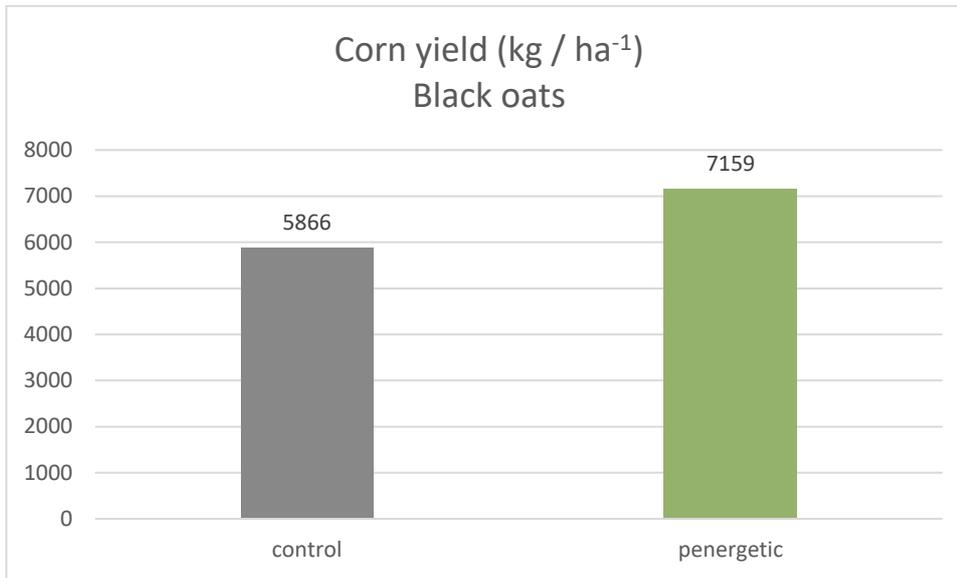


Figure 4. Corn (Pioneer P1225 VYHR hybrid) under different treatments. Cover crops in the winter period – Black oats: only black oats in the winter. Penergetic technology: penergetic b (500 g) + penergetic p (500 g).

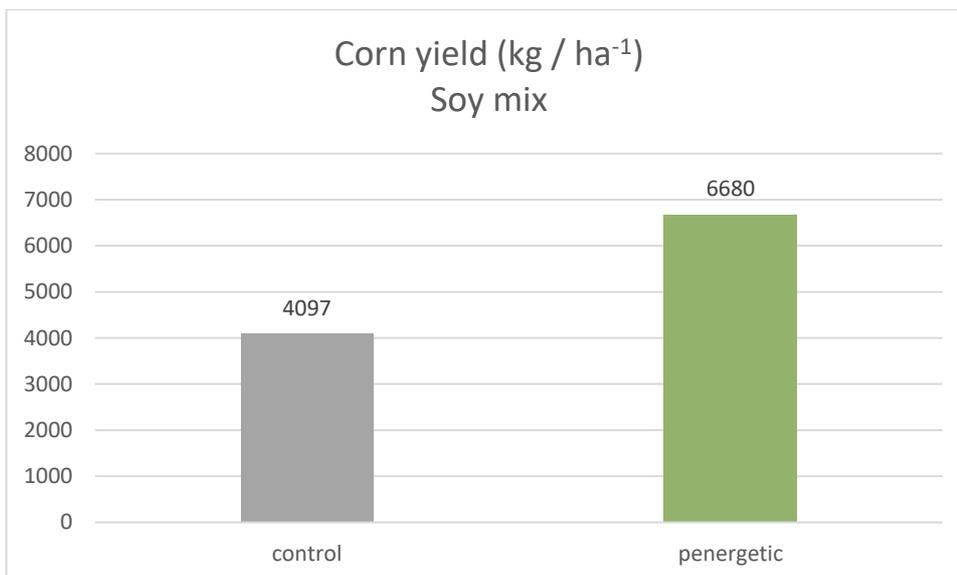


Figure 5. Corn (Pioneer P1225 VYHR hybrid) under different treatments. Cover crops in the winter period – Soy Mix: rye, oats and forage turnip. Penergetic technology: penergetic b (500 g) + penergetic p (500 g).

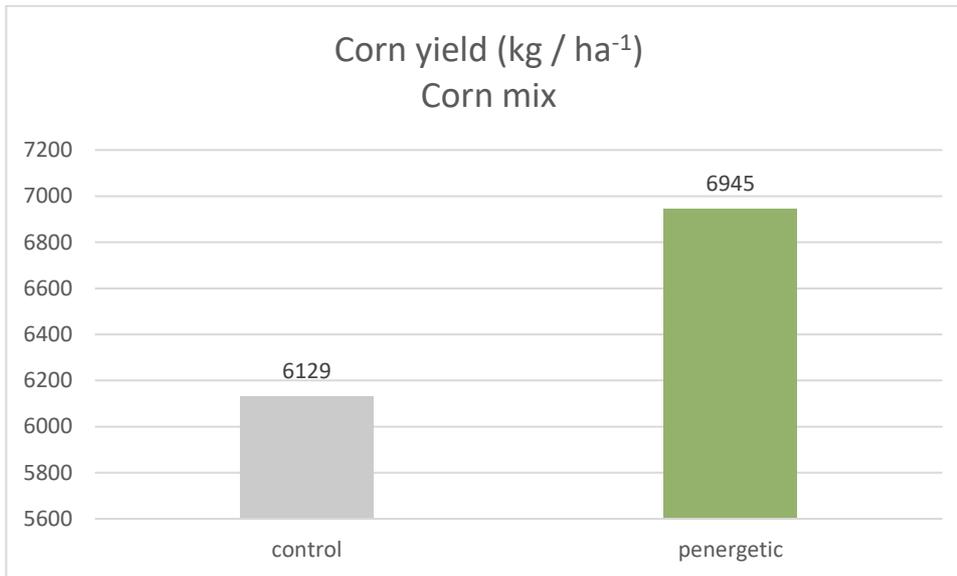
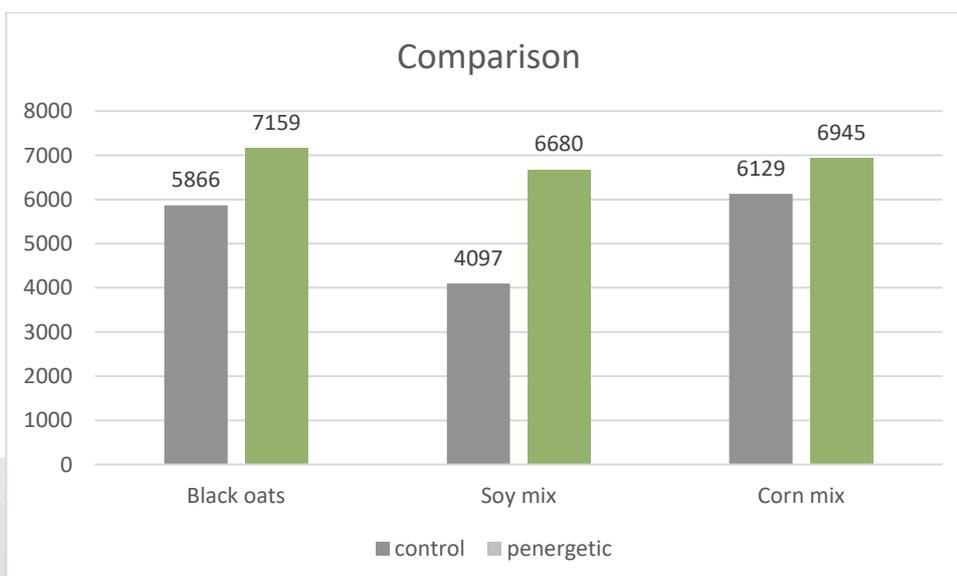


Figure 6. Corn (Pioneer P1225 VYHR hybrid) under different treatments. Cover crops in the winter period - Corn Mix: common vetch, rye, oats and forage turnip. Penergetic technology: penergetic b (500 g) + penergetic p (500 g).

It was observed that the Penergetic technology intensified the positive effect of the use of cover crops on the increase in corn yield. The Penergetic technology contributed 13 to 61% increases in corn yields compared to using cover crops without the use of Penergetic (Figure 7). These results demonstrate the importance of combining different technologies and management practices aimed at the regeneration of agricultural soils.

Increase of corn productivity provided by penergetic technology combined with cover crops (Figure 7).

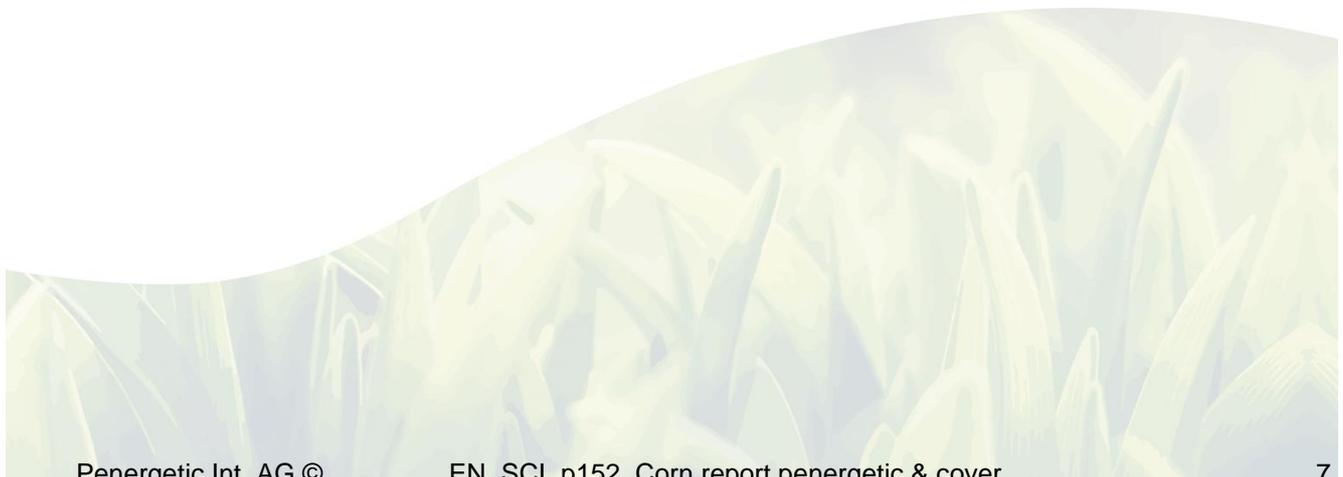


Considerations

The results of a more conscientious conservationist agriculture are reflected in economic, environmental, social and cultural sustainability, through a more balanced and efficient production system over time. There are numerous benefits provided by the introduction of cover crops as rotation alternatives in grain production systems.

The combination of cover crops and Penergetic was effective in increasing productivity. The effect of Penergetic on treatments (different mix of cover crops) was significant.

The success and longevity of productive systems depend on managements that provide for the maintenance of soil quality, which represents the fundamental basis for sustainable plant production.



References

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