penergetic b

penergetic
the natural biotechnology

Anwendungsbericht/User Application Report

Produkt/Product:
penergetic b
Art. Nr. 3000
penergetic p
Art. Nr. 4000

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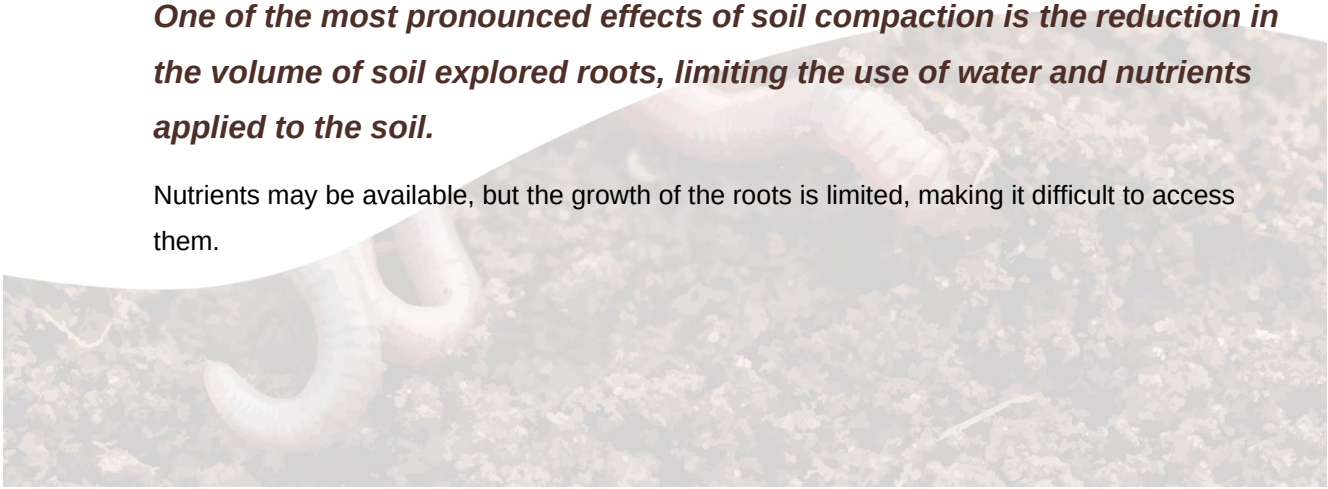
Effects of Penergetic technology on reducing soil compaction and increasing crop productivity

The reduced soil mobilization under the no-tillage system, associated with the use of heavy agricultural machinery, especially under conditions of high soil moisture, has caused the compacting of the surface layer soil. Compaction is considered to be one of the main causes of physical soil degradation caused by the reduction of soil volume when external pressure is applied, resulting in the increased soil resistance to penetration, decreased porosity and changes in the size distribution of pores.

One of the most pronounced effects of soil compaction is the reduction in the volume of soil explored roots, limiting the use of water and nutrients applied to the soil.

Nutrients may be available, but the growth of the roots is limited, making it difficult to access them.



Soil quality

Soil quality is generally considered taking into account physical, chemical and biological aspects. It is a way of assessing the degree of soil degradation and also to distinguish between management practices. The physical quality of the soil is poor when there is one or more of the following parameters in the area: low water infiltration in the soil, runoff, high density, reduced aeration and little root development.

reasons for the loss of productivity

One of the main reasons for the loss of productivity in crops is compaction. The more compacted the soil, the greater the difficulty of retaining water, thus influencing the plant productivity. Limiting the soil's ability to retain water is detrimental to irrigated or rainfed crops. However, the irrigated areas suffer the greatest impact. Generally, soil with high moisture suffers more from the intensive use of machines and the soil has less capacity to retain water than planned. All this results in excess water in the superficial layers and a lack of water in the lower layers of the compacted zone.

In areas with soil compaction, it is important to look for alternatives to minimize reductions in crop productivity. In soybean crop, short or medium cycle cultivars can respond differently to the effects of soil compaction depending on the time spent in the field. Given the above considerations, this study hypothesizes that soil compaction can be corrected by stimulating soil biology and the development of plant roots. Thus, the objective of the study was to evaluate the effects of Penergetic technology in reducing the resistance to penetration of soybean and wheat crops under the no-tillage system.

Methodology

The experiments were carried out in soil classified as Oxisol with 54% clay. Areas were selected, where there was no history of use of technologies for biological stimulation and there was no use of cover crops as a routine management practice. In these areas, a succession of soybean - wheat - soybean crops, was utilized using a no-till system.

For the analysis of the Penetration resistance (PR), the Electronic Meter of soil compaction by pressure was used as analyzing method. For the determination of the water content in the soil undisturbed soil, samples were collected at random areas, for each treatment, simultaneously with the measurement of PR. The data from the penetrometer were tabulated in the computer program, provided by the manufacturer of the penetrometer, called "Soil Falker Compaction". Penetration resistance evaluations were carried out before soybean planting (start of evaluations) and after harvesting the second soybean crop (Figure 1)

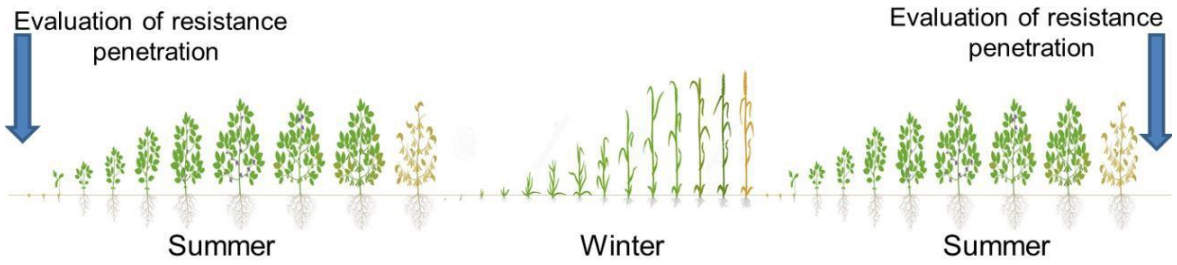


Figure 1: Evaluation times of soil compaction using penetration resistance analysis.

The evaluations were carried out in cultivation bands with dimensions of 30 meters wide and 120 meters long. Two ranges were used, called "treatment without Penergetic" and "treatment with Penergetic". In these ranges, soybean and wheat crops were grown, in the succession called soybean 1 - wheat - soybean 2. Crop management was carried out according to regional technical recommendations. Fertilization and phytosanitary management were identical for the two cultivation ranges.

Penergetic treatments

In the range called "with penergetic", dosages of 300 grams per hectare of Penergetic b were used 15 days before sowing and 300 grams per hectare of Penergetic p during the fourth leaf stage. Dosages and application times were the same for soybeans and wheat.

Table 1: Penergetic Treatment

Penergetic	***Soil treatment***	***Foliar application***
penergetic b *art. nr. 3000*	**300g/ ha** 15 days before sowing	
penergetic p *art. nr. 4000*		**300g/ ha** during the fourth leaf stage

Results

It was observed that in the treatment without Penergetic there were no apparent changes in resistance to penetration from the soil surface to a depth of 25 cm. It was observed that at depths of 15 to 18 cm the resistance to penetration was close to 2400 KPa. The succession of soybean - wheat - soybean did not provide significant changes between crops (Figure 2).

In the treatment with Penergetic, there was a significant reduction in resistance to penetration at depths of 11 to 22 cm. At depths of 14 to 20 centimeters, the greatest reductions in soil compaction occurred. Before the cultivation of soybean 1, the resistance to penetration at these depths was close to 2400 KPa. After the cultivation of soybean 2, the resistance to penetration at these depths was less than 1900 KPa.

It is important to note that the reduction of soil compaction in the subsurface layers was achieved in just 1.5 years of soil management using the system's biostimulation.

The main negative effects of soil compaction are related to the increase of the mechanical resistance in the root growth, the reduction of the aeration, in the availability of water and nutrients, and consequently, decrease in the soybean productivity. Under conditions of soil compaction, the growth of the side roots of soybeans is limited, forcing the highest concentration of roots to remain in the topsoil.

In recent years, research results have intensified demonstrating that the increase in biological activity in soils has the potential to reduce resistance to penetration. This effect is directly related to the accumulation of organic compounds in the soil, resulting from biological activity. Some of these compounds act directly in stimulating the increase in the emission of roots by plants. In the short and medium-term, this greater biological stimulus provides greater root volume for plants that can break up compacted soil layers. It is important to remember that 3500 KPa is the maximum resistance supported by the root system of most grain crops.

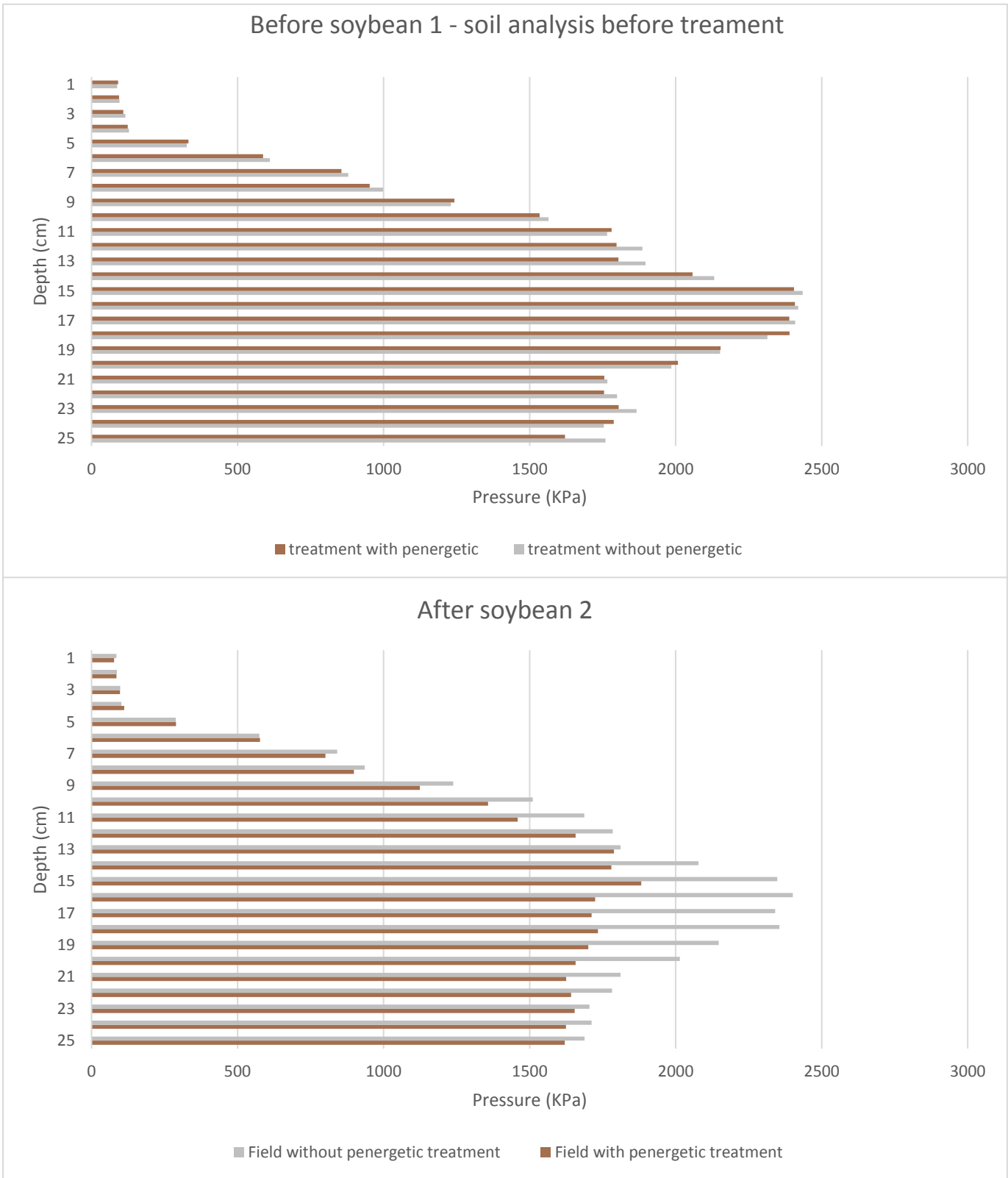


Figure 2: : Evaluation of soil compaction through the analysis of resistance to penetration at different depths in treatments

This effect was clearly seen in this work. The treatment with Penergetic in the soybean - wheat - soybean succession resulted in a decreased resistance to penetration (Figure 2) and increased productivity of the evaluated crops (Figure 3).

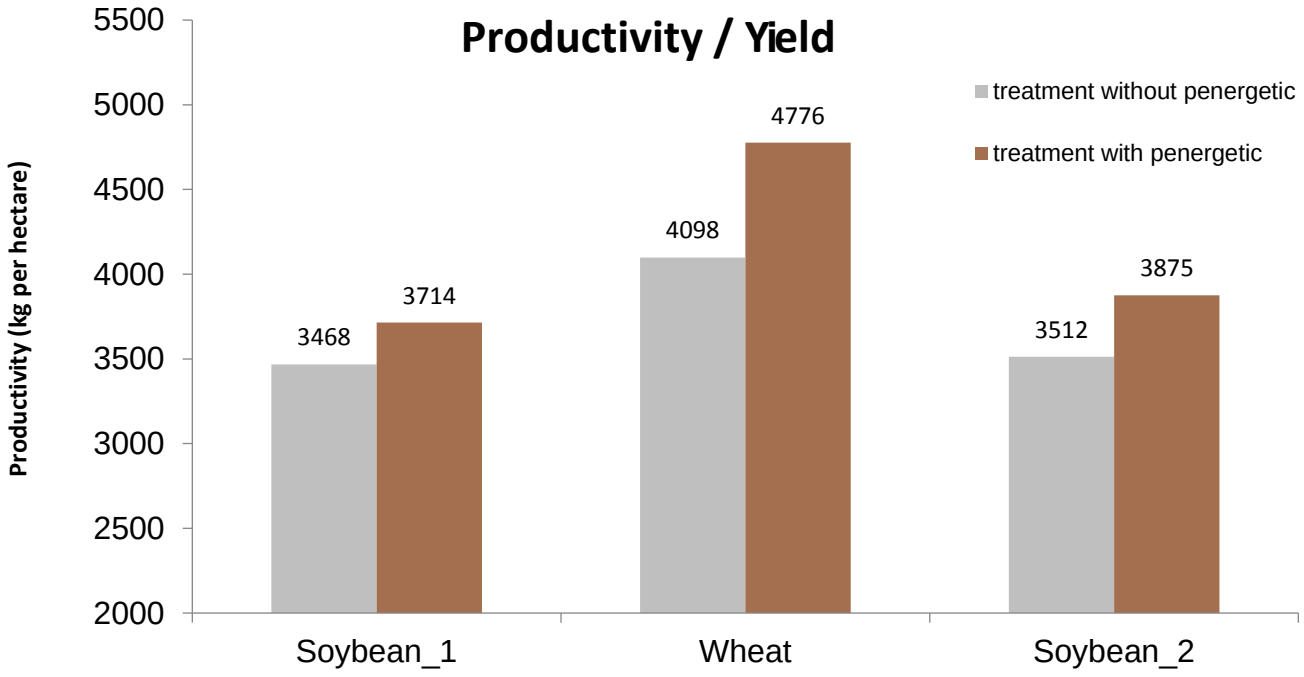


Figure 3: Productivity of soybean and wheat in treatments without Penergetic and with Penergetic, in the succession soybean - wheat - soybean.

Average comparison

In the first year of assessment (first cycle of biostimulation), the soybean crop showed an increase of 7.09% in productivity, compared to the treatment where Penergetic was not used. In the second year of cultivation, the increase in productivity in the soybean crop was 10.33% (Figure 3). These results demonstrate that there is a continuous improvement in the production system, improving soil conditions and increasing benefits over time.

The wheat crop in succession to soybean showed a productivity increase of 16.54% in relation to the treatment where Penergetic was not used.

Conclusions

The results obtained in this study demonstrated that the use of Penergetic technology reduced the compaction zone of the evaluated soil and resulted in an increase in the productivity of soybean and wheat crops.

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