Challenges of soybean production and its difficulties in the region of Tocantins/Bahia

Desafios da produção de soja e suas dificuldades na região do Tocantins/Bahia

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Bruno Henrique di Napoli Nunes
Master in Plant Production
Institution: Universidade Federal de Tocantins
Address: Gurupi - TO, Brasil
E-mail: bhdinapoli@gmail.com

Liomar Borges de Oliveira
PhD in Plant Production
Institution: Universidade Federal de Tocantins
Address: Gurupi - TO, Brasil
E-mail: liomarferaborges@gmail.com

Helber Veras Nunes
PhD in Plant Science
Institution: Instituto Federal de Tocantins
Address: Gurupi - TO, Brasil
E-mail: helberveras@ifto.edu.br

Daniella Inácio Barros
PhD in Plant Science
Institution: Instituto Federal de Tocantins
Address: Gurupi - TO, Brasil
E-mail: daniellabarros@ifto.edu.br

Ricardo Alencar Libório
Master in Tropical Animal Science
Institution: Instituto Federal de Tocantins
Address: Gurupi - TO, Brasil
E-mail: ricardo.liborio@ifto.edu.br

Sergio José da Costa
PhD in Plant Production
Institution: Instituto Federal de Tocantins
Address: Gurupi - TO, Brasil
E-mail: sergiojose@ifto.edu.br
ABSTRACT
The study refers to the activities developed in the soybean harvest period being carried out in an agricultural Farm, most of it is in the municipality of “Formosa do Rio Preto” - BA, and another part in the forests of Tocantins which borders the “Jalapão” and “Serra Gerais” state park. Throughout the study period, some practices related to soybean production were followed, such as the production of bioproducts (Trichoderma spp. and complex of bacteria of the genus Bacillus), plant stand evaluation, pest and disease monitoring, plant monitoring. The activities carried out helped to expand knowledge about the obstacles in soybean production, in addition to demonstrating the main problems of the region to seek ways to improve agricultural production. The knowledge passed on about the entire soybean production process was of great importance, showing how to obtain greater grain production potential.

Keywords: monitoring, landing, production.

RESUMO
O estudo refere-se às atividades desenvolvidas no período de colheita da soja em uma fazenda agrícola, a maior parte localizada no município de Formosa do Rio Preto - BA, e outra parte nas matas do Tocantins, que faz divisa com o Parque Estadual do Jalapão e Serra Gerais. Ao longo do período de estudo, foram acompanhadas algumas práticas relacionadas à produção de soja, como a produção de bioprodutos (Trichoderma spp. e complexo de bactérias do gênero Bacillus), avaliação do estande de plantas, monitoramento de pragas e doenças, monitoramento de plantas. As atividades realizadas ajudaram a ampliar o conhecimento sobre os entraves na produção de soja, além de demonstrar os principais problemas da região para buscar formas de melhorar a
produção agrícola. O conhecimento repassado sobre todo o processo de produção da soja foi de grande importância, mostrando como obter maior potencial de produção de grãos.

**Palavras-chave:** monitoramento, desembarque, produção.

1 INTRODUCTION

Brazil has been standing out for many years as one of the world's largest food producers and even occupies the first positions in several rankings of production and export (USDA, 2020). Among the most exported agricultural products in Brazil stands out soybeans, maize, and beef, with emphasis on soybean production, estimated at 133.7 million tons, and maintains Brazil as the world's largest producer of the oilseed. The total corn harvest is expected to reach 105.2 million tons, also the highest in the historical series – an increase of 2.6% over the previous one (CONAB, 2021).

The exploitation of the oilseed began in the south of the country and today is already found in the most different environments, portrayed by the advance of cultivation in areas of the Cerrado, establishing a new agricultural frontier called MATOPIBA – Maranhão, Tocantins, Piauí, and Bahia, in the North and Northeast of the country (FREITAS, 2011). The favorable characteristics of the Cerrado biome associated with the use of modern agricultural practices make the region a great attraction for producers mainly from other states, in search of extensive and cheap areas for the development of large-scale business agriculture (FREITAS, 2011).

Among the cerrado areas of the northeast, the west of Bahia is a highlight in the country's grain production, since it is the largest producer in the northeast region. The soybean crop was the most planted, with 1.6 million hectares planted, with a productivity of 3720kg ha\(^{-1}\), in the 2019/2020 harvest (CONAB, 2021). The locality has an average annual rainfall of 1044.48 mm and a standard deviation of 210.61 mm, an altitude around 700-900 m above sea level, flat and flat undulating topography, and soils mostly of sandy texture.

Studies are always necessary for Brazil to continue emerging as one of the largest producers in the world, especially about sustainable production with less damage to the environment. The example of the research with the *On-Farm* method that has been used in some countries, using different methods, to produce inoculant so that the producer has an economic gain with the inoculant produced, and also with the use or sale of the oleícola species (CZERNIAK; STÜRMER, 2015).
The cultivation of soybeans to be successful and have good production involves numerous processes, from the sowing that is necessary care for the quality of the seeds acquired, using fertilizers, and means of enhancing production, especially with the use of microorganisms. In addition, factors such as the time and density of sowing, use of cultivars adapted to the region, quality, and seed treatment should be of paramount importance in decision-making. During the conduct of the crop, it is essential to have efficient monitoring that allows to identify the pests and diseases at the right time of their control, thus avoiding unnecessary applications of pesticides.

Thus, this review aims to describe and analyze the activities developed in agriculture for soybean production and the main problems encountered in the states of Tocantins and Bahia.

2 PLACES OF ACCOMPANIMENT OF AGRICULTURAL HARVEST

The internship was carried out on an Agricultural Farm most of which is in the municipality of Formosa do Rio Preto, and another part in Mateiros do Tocantins which borders the Jalapão State Park, with Latitude -11.201556 South, Longitude -46.494194, in the period from December 19, 2020, to February 19, 2021.

Approximately 5700 ha were cultivated in the 2020/2021 crop, most planted with soybeans, and the remainder was grown with corn. In addition to farming, the property deals with livestock, and raising cattle. It is also made harvest followed by off-season (safrinha), with the predominant use of the no-tillage system.

3 ACTIVITIES DEVELOPED

Throughout the study period, the production of bioproducts (*Trichoderma* spp. and complex of bacteria of the genus *Bacillus*) and day-to-day activities of the farm were carried out. Such as plant stand evaluation, pest and disease monitoring, and plant monitoring.

3.1 CHARACTERIZATION OF THE FUNGUS *TRICHODERMA* SPP.

Fungi of the genus Trichoderma are organisms widely distributed in all terrestrial environments, capable of colonizing soil, substrates, and the root system of various types of plants and producing many substances, including enzymes that degrade the cell wall of other fungi, antibiotics and other compounds that interfere with the growth and defense of plants.
Trichoderma species are usually found as components of the microbiota of most soil types, especially organic ones, including the humus layer of forests, agricultural soils in the field and orchards, and can live saprofitically or parasitize other fungi (DRUZHININA et al., 2011).

The fungus Trichoderma in biological control is associated with its high reproductive capacity, ability to develop in unfavorable conditions, efficiency in the use of nutrients, capacity to modify the rhizosphere, high aggressiveness against phytopathogenic fungi and efficiency in promoting growth and induction of defense mechanisms in plants (HOWELL, 2003; BENÍTEZ et al., 2004).

The main mechanisms of action used by Trichoderma in the control of phytopathogens are antibiosis (antagonist produces one or more substances that inhibit the growth or reproduction of the pathogen), competition (antagonist disputes the same resources, food, and space with the pathogen), parasitism (antagonist feeds on the pathogen) and induction of resistance (the beneficial agent/antagonist activates the defense mechanisms of the plant that becomes more resistant to the entry of one or more pathogens).

The application of Trichoderma can be carried out directly in the soil; in substrates to produce seedlings; in seeds or other plant propagation material; in the aerial part of plants; in crop residues or other organic substrates; in fruits or even in plants used in crop rotation.

3.2 CHARACTERIZATION OF BACILLUS SPP. BACTERIA

The etymology that names the genus comes from the Latin Bacillus, a masculine word that designates the morphology of the cell, referring to the shape of a stick or rod, usually arranged in colonies (MADIGAN et al., 2016). In addition to the characteristic morphology, other taxonomic patterns are attributed to the genus. Thus, these microorganisms can be characterized as gram-positive, obligate, or facultative aerobes, producers of catalase enzyme, grow in various carbon sources, and form endospores as a survival structure in periods of environmental stress (MADIGAN et al., 2016).

Biological control by microorganisms is a promising alternative for the reduction or elimination of the use of agrochemicals in the control of phytopathogens. The diversity of microorganisms, as well as their antagonistic relationships, emerges as important tools for applied biological control (LANNA-FILHO; FERRO; PINHO, 2010).
The most prevalent genera of antagonistic bacteria are *Pseudomonas* of the fluorescent group (*P. putida* and *P. fluorescens*), *Bacillus* spp., *Streptomyces* spp., and representatives of the family Enterobacteriaceae (CAMPOS SILVA et al., 2008). In particular, the genus *Bacillus* spp. stands out for forming an endospore and presenting a multiplicity of antagonistic mechanisms. Thus, enabling its long maintenance and survival in specific ecological niches, with great versatility in the mechanisms of action to circumvent the defenses of phytopathogens (LANNA-FILHO; FERRO; PINHO, 2010).

Species of the genus *Bacillus* show rapid growth in various carbon sources. This metabolic adaptation is attributed to the great capacity to produce extracellular enzymes, responsible for the oxidation of polymers such as nucleic acids, polysaccharides, and lipids, which can be readily used as an energy source for the cell (MADIGAN et al., 2016).

Due to their peculiar characteristics, these microorganisms have been employed in agriculture, increasing the resistance of plants to various environmental stresses such as drought, heavy metals, and nutritional scarcity of the soil (CLEMENETE et al., 2016). However, in the agricultural sector, *Bacillus* species are more widely studied and used as growth promoters and biological control agents against pests and diseases (CLEMENETE et al., 2016).

### 3.3 ON-FARM PRODUCTION

The *Trichoderma* produced on the farm has the advantage of better management of the storage time of the spores, in addition, to greater ease for production from different inoculum, even native inoculum.

The fungus produced on the farm is multiplied in moist parboiled rice (culture medium), and the same is packed in polypropylene bags in an amount of 450g. Soon after, it is autoclaved for 20 min at 120 °C, so they are cooled in the inoculation room with the aid of air conditioning at 16 °C.

Soon after, the bags were inoculated in the flowing chapel with 20 mL of the fungus supplied by the company SoluBio. Ahead, they are taken to the growth container with a controlled environment of full light, temperature around 25 °C, and 80% humidity. They stay for eight days growing in the bag, on the 8th day the bags are opened completely, in a low humidity environment to be able to store the fungi with low humidity thus increasing the shelf life.
3.4 PLANT POPULATION ASSESSMENT

The plant population is defined according to the number of individuals distributed per unit area by combining row spacing and the density of plants in the row in a spatial arrangement. The number of plants established per meter of the row is defined as a plant stand.

The spacing and density of plants used for the soybean crop depend on the analysis of several factors that will define this choice and should consider mainly the characteristics of the cultivar, the season of sowing, altitude, and soil interferences (fertility, diseases, and nematodes) (CÂMARA, 2015). Soybeans can be grown in row spacing ranging from 40 to 70 cm, where the choice of this parameter is closely linked to the cultivar cycle.

Larger spacings are recommended for cultivars of longer cycles, due to their characteristic of longer vegetative periods, while smaller spacings are more indicated for cultivars of early cycle, of medium size, and resistant to lodging. In addition, line spacing can be used as a strategy to control Sclerotinia sclerotiorum since larger spacing can decrease the formation of apothecium in the fungus.

Considering the relevance of the population of high-productivity plants in the soybean crop, the actual stands of plants in the plots of the farm were evaluated. For this, a 5m tape was used stretched parallel to the planting row at its maximum capacity choosing 4 rows at random in various points of the area, being counting the number of plants germinated in this space. At the end of the count, the value obtained was added and divided by the number of rows analyzed to achieve the average result of a stand. Remembering that the spacing used in all areas of the farm was 50 cm.

3.5 PHYTOSANITARY MONITORING

The monitoring and phytosanitary management in soybean crops are extremely relevant for the success of the productivity of this crop. Soybeans can be attacked by pests from the emergence of plants to their physiological maturation phase, in the same way as the incidence of diseases. If the management is not carried out properly, the biological agents that cause stress in the crop (pests and diseases) can cause losses of up to 100% of the production (ÁVILA et al. 2013).
3.5.1 Pest monitoring

The main pests found in the soybean crop during this stage were the caterpillars: false gauge caterpillar (*Crysodeixis includens*); the soybean caterpillar (*Anticarsia gemmatalis*); and the complex *Spodoptera* spp. and *Helicoverpa armígera*. Pod and seed-sucking bedbugs, brown stink bugs (*Euschistus heros*), and green stink bugs (*Nezara viridula*). In addition to other secondary pests, such as gusty mites (*Tetranychus urticae*) and whitefly (*Bemisia tabaci* breed B).

3.5.1.1 False-meditéira - (*Chrysodeixis includens*)

The caterpillars are commonly called false gauges, because they move as if measuring palms, and are light green with white longitudinal stripes and black punctuation (Figure 1). The larval stage lasts between 14 to 20 days. In its last larval stage, it reaches 40 to 45 mm in length and the transformation to the pupa phase occurs under a web, usually on the ventral face of the leaves. This caterpillar can be confused with Rachiplusia which is more frequent in southern Brazil. However, *C. includens* presents the inner face of its jaws with two teeth (SOSA-GÓMEZ et al, 2014).

Since the harvest of the late 1990s, numerous outbreaks of caterpillars of the subfamily Plusiinae such as *C. includens* and *R. nu Guenée, 1852* (Lepidoptera: Noctuidae), known as false gauge caterpillars have been observed in many soybean-producing states in Brazil, including Goiás (OLIVEIRA, 2014).

The application of post-emergent herbicides on soybeans at the beginning of crop development, associated with insecticides of a broad spectrum of action, for example, affects the entire complex of natural enemies present in the area (ALEXANDRE, 2010).
3.5.1.2 - Soybean caterpillar - (*Anticarsia gemmatalis*)

The soybean caterpillar, in the larval stage, passes through six instars. The small caterpillar (up to 10 mm) is usually green in color and has four pairs of properties in the abdomen, two of them vestigial (Figure 2). With this, it moves around measuring palms and is often confused with small caterpillars of the false medideira. Caterpillars larger than 15 mm can be found in both green and dark forms and have three white longitudinal lines on the back and four pairs of abdominal prolegs, plus a terminal (SOSA-GÓMEZ et al, 2014).

The moths have a wingspan of 30 to 38 mm and a very variable coloration on the dorsal part (from light gray to dark brown) (MOSCARDI et al., 2012).

3.5.1.3 *Helicoverpa armigera*

The eggs of this caterpillar measure between 0.4 to 0.6 mm in length and 0.4 to 0.5 mm in width. They are yellowish white with a bright appearance changing to dark brown near hatching (Figure 3). The larvae in their first instars vary in coloration from yellowish white to reddish-brown. As the larva grows, it acquires different colorations, ranging from straw-yellow to green. The last instar can measure from 30 to 40 mm in length (KOPPERT, 2020).

The pupa is dark brown and measures 14–18 mm in length. In adults, females have yellowish forewings, and males have greenish-gray wings. The eggs are deposited preferentially in the abaxial part of the leaf, or the stalks, flowers, fruits, and terminal shoots and the incubation period lasts around 3.3 days. The larval period can last from 2 to 3 weeks depending on weather conditions. The caterpillar exhibits the behavior of curving the cephalic capsule when it is touched. The caterpillar migrates to the soil near the pupal stage. This phase lasts between 10 to 14 days. The adult stage can last according to food viability (nectar, sucrose), pupal weight, and temperature. The longevity of females lasts on average 11.7 days and of males 9.2 days. Each female can lay from 2,200 to 3,000 eggs (KOPPERT, 2020).

![Figure 3 - Helicoverpa armigera.](https://www.koppert.com.br/desafios/lagartas/helicoverpa-armigera/)

3.5.1.4 Brown bed bug – (*Euschistos heros*)

Adults measure approximately 1 cm in length and are brown, including on the abdômen (Figure 4). On the prothorax, there are two lateral spines and there is a white half-moon-shaped spot on the back, above the membranous part of the wings (MOREIRA; ARAGÃO, 2009).
The nymphs, newly hatched measure 1 mm and have an orange body and black head, go through five stages of development until they develop into adults (SOSA-GÓMEZ et al, 2014).

Damage: Adults and nymphs feed on the pods and grains causing yield losses and affecting seed quality. This species causes fewer symptoms of leaf retention, compared to the green stink bug and the small green stink bug (SOSA-GÓMEZ et al, 2014).

Figure 4 - Brown Bed Bug – *(Euschistos heros).*


3.5.1.5 Green bed bug - *(Nezara viridula)*

The eggs are yellowish-white and turn pink near hatching. The laying of the eggs is done on the underside of the leaves or in more protected places inside the canopy (Figure 5). They are placed in groups that form like a hexagon (MOREIRA; ARAGÃO, 2009).

The nymph of the green bed bug presents green or black coloration, with different white circular spots and small black dots distributed throughout the body, goes through five nymphal phases, and completes its development in about 25 days (SOSA-GÓMEZ et al, 2014).
3.5.1.6 Cracked mite - (*Tetranychus urticae*)

The mite *Tetranychus urticae* is considered a highly polyphagous agricultural pest, with the ability to attack a wide range of hosts (more than 1100 plant species from 140 distinct families) (Figure 6), including the main crops in Brazil, such as soybeans, corn, cotton, tomatoes, apples, grapes, citrus, among others. Its incidence and potential for harm occur in all producing regions of the country (BAYER, 2021).

The main management strategy has been the use of specific insecticides/acaricides registered for mite control. For greater effectiveness, the applications must be at the right time, at the beginning of the infestations, at the dose recommended by the manufacturer. The use of broad-spectrum, non-selective products reduces the populations of natural enemies in the area and may favor an increase in mite infestation (BAYER, 2021).
3.5.1.7 Whitefly - (*Bemisia tabaci*)

Whiteflies are insects about 1 mm long and white, resulting from the wax that covers their wings. They live in colonies on the underside of leaves (Figure 7). The biological cycle of the whitefly is divided into the egg phase, four nymphal instars, and adults. The eggs are pear-shaped, and yellow and are laid singly or in groups with hatching in approximately seven days (SUEKANE et al, 2013).

The nymphal phase, depending on weather conditions and the host plant, can last only five days. The nymphs are yellowish and translucent and move only at the first instar, as they soon attach themselves to the leaves becoming immobile. The dispersal of colonies to other leaves and plants is done by adults, developing annually from 11 to 15 generations. The hot and humid climate favors its development. They cause damage by the withdrawal of nutrients and water and by the transmission of diseases such as the transmission of the virus that causes the black stem of soybeans or necrosis of the stem. Infested plants are weakened, leaves fall, and fruits become wilted, and ripen irregularly (GRIGOLLI, 2014).
Yano, Husch e Sosa-Gómez (2015), For pest management, some key points should be considered, such as the correct identification of the pest, since the susceptibility to products for control differs between species; the determination of the density of the pest in which control measures will be applied and apply the recommended dose, verifying if the chemical pesticide has harmful side effects on natural enemies, because in this way pest upwelling may occur.

The monitoring of pests in the stage was carried out by walking, using sampling using the beat cloth, where a cloth approximately one meter wide by one and a half meters long was extended between the soybean lines and then "shake" the plants and observe how many and which insects fell, for identification.

The points were georeferenced with the help of the Syngenta Digital system, which allowed the population balance in the plot and the preparation of graphs of the evolution or involution of the pest during the crop cycle, thus allowing the evaluation of the efficiency of the applications.

3.5.2 Disease monitoring

The soybean crop can be affected by diseases from the moment of plant emergence to the filling of grains. Under favorable conditions, the occurrence of diseases in the initial phase of cultivation can lead to significant losses of the stand and consequently, in the grain yield, and certain cases it is necessary to carry out the replanting. In addition, it is important to be aware that the time of occurrence of the main diseases is not the same, and it is necessary to identify these to be successful in controlling them (ÁVILA et al., 2013).
The main diseases occurring in the soybean crop found on the farm were: powdery mildew, white mold, target spot, anthracnose, and downy mildew, in addition to nematodes (gall nematodes, cyst nematodes, and root lesion nematodes). Integrated disease management is one of the pillars of modern agriculture, and for it to be efficient, professionals who are in the field must know the etiology and epidemiology of the main diseases and the technologies available for their control.

3.5.2.1 Oidio - *Microsphaera difusa*

*Microsphaera difusa* is an obligate parasite that can infect the aerial part of the soybean plant (Figure 8), including stems, petiole, and pod, however, its occurrence is more common in the leaves (SILVA et al. 2013, YULIA et al. 2017). Its pathogenesis begins with the deposition of its conidia on the leaf, which germinate and infect the cells of the epidermis and later the mycelium colonizes the leaf surface, resulting in a layer of white and powdery mycelium. With the advance of colonization and the aging of the colony, the coloration of the fungal structure’s changes from white to grayish-brown (YULIA et al. 2017).

The fungus *M. difusa* survives in voluntary soybean plants and is easily spread by the wind, which makes crop rotation, as a management practice, unfeasible or unsatisfactory for pathogen control. The main control measure is the use of resistant cultivars, but there is a certain lack of cultivars with complete resistance (BRASIL et al. 2018). Thus, the chemical control with fungicide performed in a curative way has become an alternative adopted by soybean growers, however, in recent years has increased the search for more economical and environmentally friendly control alternatives (SILVA et al. 2013).
3.5.2.2 White Mold - (*Sclerotinia sclerotiorum*)

One of the most important diseases affecting the soybean crop, white mold, caused by the fungus *Sclerotinia sclerotiorum*, promotes losses that can reach a 70% reduction in productivity and are present in about 28% of the soybean production area in Brazil (Figure 9) (MEYER et al., 2020).

In soybean the first symptoms of *S. sclerotiorum* are generalized soaked spots, which evolve to light brown coloration and soon develop the abundant formation of white and dense mycelium, in a few days, the mycelium turns into a black and rigid mass, and the sclerotium formed both on the surface and inside the infected stems and pods, the fungus can interfere with the germination of seeds, in the development and establishment of seedlings and also attack the entire aerial part, at any stage of development. Symptoms usually occur in the middle third of plants reaching the main stem, petioles, leaves, and pods (ALMEIDA et al., 2005).
3.5.2.3 Spot – target - (*Corynespora cassiicola*)

The fungus is necrotrophic and presents a parasitic phase on the host plant and another saprophytic phase on the cultural remains, in addition to surviving on volunteer plants, seeds, and alternative hosts, which allows its survival from one crop to another (Figure 10).

The lesions begin with brown punctuations, with a yellowish halo, evolving to large circular spots, light brown to dark brown, reaching up to 2 cm in diameter. Usually, the spots have dark punctuation in the center, like a target. Susceptible cultivars may suffer severe defoliation, with reddish-brown spots on the stem and pods. The fungus also infects roots (HENNING et al, 2014).

The fungus is found in virtually all soybean-growing regions of Brazil. It is native and infects many native and cultivated plants. It can survive on crop remnants and infected seeds. The relative humidity is favorable to infection in the leaf (HENNING et al, 2014).
3.5.2.4 Antracnose (*Colletotrichum truncatum*)

The anthracnose caused by the fungus *Colletotrichum truncatum* is one of the main diseases of the Brazilian Cerrado, which has been standing out in Brazil, causing a reduction in plant population, seed quality, and grain yield (Figure 11). The reduction in yield is closely related to infection in legumes or under conditions of severe infection in the leaves during the stage of grain filling, being one of the main diseases affecting the initial phase of vegetable formation (STEFANELLO et al, 2017).

Antracnose is a disease that affects the initial stage of pod formation and occurs more frequently in the Cerrado region, because of the high precipitation and high temperatures. In rainy years, it can cause total loss of production, but more often it causes a reduction in the number of pods, inducing the plant to leaf retention and green stem (HENNING et al, 2014).
3.5.2.5 Mildew - *Perenospora manshurica* (Naumov) Syd

Downy mildew caused by the fungus *Perenospora manshurica* (Naumov) Syd., is considered a secondary disease in soybean crops (Figure 12). Its etiological agent is an obligate parasite because it needs its host to survive, keeping itself in the living plant or the seeds (KOWATA et al., 2008).

It originates in the unifoliolate leaves and can progress to almost all the leaves of the plant. Its symptom is characterized by the presence of light green spots 3-5 mm in diameter, evolving to irregular spots of yellowish tone on the upper part of the leaf, until necrosis. On the back of the yellowish spot appear fruiting structures that have a cottonous aspect, slightly pinkish to gray (HENNING et al., 2014).

Figure 12 - Mildew - *Perenospora manshurica* (Naumov) Syd.
3.5.2.6 Nematoses

Nematodes are a major threat to commercial vegetable growers around the world, causing severe root damage and production losses (JONES et al., 2013). Some of the obligate genera of plant parasites Meloidogyne (gall nematodes) and Heterodera (cyst nematode) have a wide range of hosts and infect most plants of economic importance, the main symptoms being in the root, which ultimately affects the plant's ability to absorb water and nutrients (Figure 13). The symptoms of above-ground plants are not distinct from other root damage, and therefore plant-parasitic nematodes are often neglected until the population settles down and causes economic losses (DAHLIN et al., 2019).

Figure 13 - Gall nematode (Meloidogyne); Cysts nematode (Heterodera).

The inspections were carried out every 3 days, going through the whole area and collecting leaves at points of the cultivation area to evaluate the presence of diseases through visual diagnosis.

The control was done with the use of a mix of bacteria mostly bacteria of the genus Bacillus produced on the farm, Bokashi Solubio and Bacsol, they were submitted to a culture medium of their formulation developed on the farm and placed in fermenting biofactories. In addition to biological control, applications were made with the use of chemical fungicides, with the active ingredients tebuconazole, ciproconazole, trifloxystrobin, prothioconazole, mancozeb, chlorothalonil.
3.6 MONITORING OF THE SOYBEAN HARVEST

The soybean harvest is the last operation still carried out in the crop, being an operation of great importance, you should always be attentive to avoid losses, making good regulations of the machines, among other important care.

Desiccation is the first step towards soybean harvesting, where it is used to anticipate the harvest from 3 days to up to a week. The benefits of early desiccation of the soybean crop go beyond harvesting, enabling uniformity of maturation, planting of corn with reduction of weeds, greater use of soil moisture and rainfall, desiccation of adult invasive plants, and elimination of young weeds, transport of grains with fewer impurities, among others.

After the removal of the soybean from the field these were transported to warehouses and the transport was carried out by trucks, the harvest on the assisted property, began on February 26, 2021, and is expected to end on March 30, 2021, with an estimated average productivity of 4000 kg/ha of soybeans in 5300 thousand hectares of the planted area.

4 FINAL CONSIDERATIONS

During the study, it was possible to monitor the activities such as the production of bioproducts (Trichoderma spp. and complex of bacteria of the genus Bacillus spp.) in addition to seeing the results of soybean production. Thus, the study provided the opportunity to evaluate the main problems found in a soybean crop in the region of Tocantins/Bahia.

Monitoring the entire production process is of great importance, to map the production processes, organize the planning for crop improvement, and possible obstacles and solutions to be followed. The knowledge passed on about the entire soybean production process was of great importance, showing how to obtain greater grain production potential.
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