Influence of Nitragin utilization on nodosity formation at soybean (*Glycine max* L.) culture

Neag Paula-Narcisa¹, Duda M.M.¹, Rózsa S.¹*, Gocan Tincuța-Marta¹

¹University of Agricultural Sciences and Veterinary Medicine, Faculty of Horticulture 3-5 Mănăștur St., 400372, Cluj-Napoca, România

*Corresponding author e-mail: drd.rozsa.sandor@gmail.com

**Abstract** Soybean seeds contain a high protein percentage of about 35-40%, and require a high amount of nitrogen compared to other crops. Soybean plants make nodules on the roots and can fix atmospheric nitrogen. Soybeans can absorb nitrogen, usually from soil or fertilizers. The total amount of the assimilated nitrogen is proportional to the yield of soybean seeds either from nitrogen fixation or nitrogen uptake, and the availability of nitrogen is very important for soybean cultivation. Maintaining long-term nitrogen fixation is very important for high soybean production. Nitrates that come in direct contact with a root part of the root cause severe inhibition of nodule growth and nitrogen fixation, although a distal portion of nitrate nodules has no effect or low effect. It has been tried to see this in three varieties: Onix, Selix and Cristina under Transylvania plateau conditions, where the seeds were treated with Nitragin before sowing.

**Key words** nitrogen, soybean, seeds, yield, fertilization

The world population is constantly growing, while the agricultural area is limited. Therefore, the increase of the surface crop production is very important. Soybean (*Glycine max* L.) originates from East Asia. Annual production of soybean (262 million tons in 2010) is the fourth most important crop of cereals, including corn (844 million tonnes), paddy rice (672 million tonnes) and wheat [1].

For the best seed production, it is necessary to use both the nitrogen fixation and the nitrogen absorption from the roots [2-3]. When only planting nitrogen is available, vigorous vegetative growth does not occur, resulting in reduced seed yield. On the other hand, a large amount of nitrogen often decreases node development and nitrogen fixation activity and induces senescence of the nodule, which also leads to reduced seed yield (figures 1 and 2). In addition, a large amount of nitrogen fertilizer in soil causes a lush increase in vegetative mass, which results in inadequate deposition and formation of pastes.

Figure no. 1. Characteristics of the soybean plant grown at 2 plants on 2 m² density [4].

Figure no. 2. The three sources of nitrogen in soybean plants [3].
Symbiotic nitrogen fixation in soybeans can provide 65 to over 160 kg of fixed nitrogen per hectare [6] in soybean crop, accounting for approximately 40-70% of the nitrogen requirement. Maintaining this significant contribution to nitrogen can be important for cost-effective soy yields and sustain long-term soil productivity, especially in poor soil-containing nitrogen-containing soils. The symbiotic nitrogen fixation can be affected by herbicides due to direct effects on the rhizobitic symbiotic, as well as indirect effects on the physiology of the host plant [5].

Material and Method

Thanks to Nitragin, rich crops with significant increases in production of soy, peas, vetch, beans, alfalfa, clover, lupine with Rhizobium symbiotic bacteria are obtained. Using Nitragin, it is no longer necessary to apply nitrogen-based chemical fertilizers. The product ensures, through symbiosis with the plant, quantities of 100-125 kg nitrogen, respectively 90-95% of the nitrogen requirements of the plant.

Factor A (variety)  
- a1. Onyx  
- a2. Felix  
- a3. Cristina

Factor B (seed distance)  
- b1. 25 cm  
- b2. 45 cm

Results and Discussions

Soybean can fix atmospheric nitrogen through their root nodules associated with soil bacteria, *Bradyrhizobium* sp. In addition, soybeans can absorb inorganic nitrogen, such as nitrate and ammonia from soil or fertilizer. Typically, a high yield of soy was obtained in a high fertility field of the soil. By providing a steady but low concentration of nitrogen, either from soil or from organic manure, soybean growth will occur without depressing nodulation and nitrogen fixation. However, it is well known that the high concentration of nitrogen and minerals decreases the formation of the nodule and the activity of nitrogen fixation. In particular, nitrate, the most abundant inorganic nitrogen in the upper fields, severely inhibits the nodulation and fixation of soybean nitrogen when the nodulated roots are in direct contact with the nitrate-containing soil solution [7-9].

The influence of Nitragin application on the number of nodosites on the 2015-year crop (figure no. 1), in the three studied varieties, illustrates the increase in the number of nodosities regardless of the variety compared to those that did not receive Nitragin.

In the 2016-year crop, the situation is the same for the three varieties when treating the seeds with Nitragin only as the number of nodosites on the plant is slightly higher (Figure 2).
Fig. 2. The influence of Nitragin application on the number of nodosites on the 2015-year crop

Figure no. 3 shows the situation of the nitrogen in the soil after the dissolution of the soybean culture according to the experimental factors. It can be seen that the Onix variety in 2016 at the same crop distance (25 cm) has higher values in 2016, just like the Cristina variety. The Felix variety records in 2015 the highest values at the same seeding distance (25 cm).

Fig. 3. The influence of the sowing distance on the amount of nitrogen left in the soil. Sowing distance = 25cm, + with Nitragin, - without Nitragin.

With regard to the 45cm seed distance shown in Figure no. 4, the highest nitrogen values in soil, in year-2016, are between 0.458 and 0.524 recorded of the Onix variety. It can be said that the application of Nitragin was beneficial, the plants synthesizing better the atmospheric nitrogen.
Conclusions

The results of studies conducted in the experimental field, under Transylvanian plateau conditions, entitles us to say that both the pedological and climatic conditions specific to the experimental framework are favorable for the establishment of efficient soybean cultures.

To maintain agricultural production and protect the environment, effective use of nitrogen fertilizer is crucial.

In order to obtain a high yield of seeds, soybean plants need to assimilate sufficient nitrogen, not only during the vegetative stages but also during the breeding stages.

References