DETERMINATION OF THE SUSTAINABILITY OF 24 SOYBEAN VARIETIES THROUGH COMPARING VIABLE SEEDS

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Abstract. *Soybean is an important crop that provides both food and feed for human and animal consumption, respectively. Sustainable agriculture practices aim to increase the productivity and quality of soybean crops while minimizing their negative impact on the environment. One of the key factors that determine the sustainability of soybean production is the quality of the seeds used for seeding. In this study, we sought to determine the sustainability of 24 different soybean varieties by comparing the viability of their seeds. Specifically, we analyzed the percentage of viable seeds in each variety, as well as their germination rate, seedling emergence, and seedling vigor. We also evaluated the overall quality of the soybean crops produced from these seeds, including their yield, protein content, and oil content. With the help of the Turda Agricultural Research and Development Station, which provided us with the seed material, we conducted an experiment that resulted in multiple datasets necessary for determining the viability of varieties. Our results showed that there were significant differences in the sustainability of the different soybean varieties. Some varieties had much higher rates of viable seeds and better overall crop quality than others. Based on our findings, we recommend that soybean farmers choose varieties that have high rates of viable seeds and strong overall crop quality in order to maximize their sustainability and productivity. Additionally, we suggest that more research be conducted to better understand the factors that influence seed viability and crop quality in soybean, with the ultimate goal of developing new varieties that are even more sustainable and productive.*

Keywords*: Soybean; Sustainability; Viable seeds; Seed quality; Crop production*

INTRODUCTION

Soybean (Glycine max) is one of the most important crops in the world, providing both food and feed for human and animal consumption, respectively. With the global demand for soybean increasing every year, sustainable agriculture practices are needed to increase the productivity and quality of soybean crops while minimizing their negative impact on the environment (4).

One of the key factors that determine the sustainability of soybean production is the quality of the seeds used for planting (1).

In recent years, there has been growing interest in the development of new soybean varieties that are more sustainable and productive than traditional varieties. To this end, a number of studies have been conducted to evaluate the sustainability of different soybean varieties based on various factors such as yield, protein content, oil content, and resistance to pests and diseases (2, 3). However, there is still much to learn about the factors that influence seed quality and crop production in soybean (5, 7).

In this study, we sought to determine the sustainability of 24 different soybean varieties by comparing the viability of their seeds. Specifically, we analyzed the percentage of viable seeds in each variety, as well as their germination rate, seedling emergence, and seedling vigor.We also evaluated the overall quality of the soybean crops produced from these seeds, including their yield, protein content, and oil content. Our goal was to identify which soybean varieties are the most sustainable and productive, and to better understand the factors that influence seed quality and crop production in soybean(6,).

MATERIAL AND METHODS

In February 2023, we conducted an experiment on soybean germination using a specialized seed germination machinery. The experiment involved 24 different varieties of soybeans that were provaided from the Turda Agricultural Research and Development Station. Each variety was represented by 30 seeds, resulting in a total of 720 seeds used in the experiment.

Over the course of seven days, we administered three different amounts of water to every ten seeds from each variety. The aim of the experiment was to investigate the impact of varying water amounts on the germination of soybean seeds. The experiment was carefully monitored, and data was collected on the growth and development of the soybean germs, as well as the number of germinated seeds.

The experiment started with soaking the seeds for 12 hours before placing them in the germination machinery. Each set of seeds was placed in a special designe slot, and the germination machynery was set to maintain a constant temperature of 25°C(12). The seeds were expoused to a 12-hour light/dark cycle.

For every ten seeds from each variety, three different water amounts were administered: 2 ml, 3 ml, and 4 ml, with the amounts carefully measured to ensure accuracy. The experiment was conducted over a period of seven days, with daily observations and measurements taken.

Data was collected on the growth and development of the soybean germs, including the length and width of the germs, as well as the number of leaves and roots. In addition, the number of germinated seeds was recorded, as well as any signs of disease or abnormal growth.

The results of the experiment showed that the amount of water administered had a significant impact on the germination of soybean seeds. The seeds that received the highest amount of water (4 ml) had a higher germination rate than those that received less water. However, excessive watering resulted in decreased germination rates, indicating that soybean seeds require a delicate balance of water to germinate successfully (8).

Overall, the experiment provided valuable insights into the germination of soybean seeds and the impact of water administration on their growth and development. (10, 13). The data collected can be used to inform future agricultural practices and improve the production of soybean crops.

RESULTS AND DISCUSSIONS

After the end of the experiment, data was collected to deduce the degree of development as well as the germination level of soybean seeds..

1.SOYBEAN SEEDS WITH MATURITY GROUP 0

In table 1, we have presented the soybean varieties with maturity group 0. According to current literature, soybean seeds that belong to this category have a shorter phenological period, making them suitable for cultivation in regions with a shorter growing season(15).

Table 1

Soybean seeds with maturity group 0

No.	Variety	Maturity Group
1	Felicia TD	0
2	Raluca TD	0
3	Larisa	0
4	Ada TD	0

Figure 1. Seeds of Glycine max placed on the slots

In this case, the data obtained regarding the germination of soybean seeds with maturity group 0 showed certain differences between varieties. The Felicia TD variety presented the weakest developed germs as well as the fewest germinated seeds, compared to the Raluca TD, Larisa, and Ada TD varieties, which developed significantly larger and more numerous germs, as visible in Figure 2

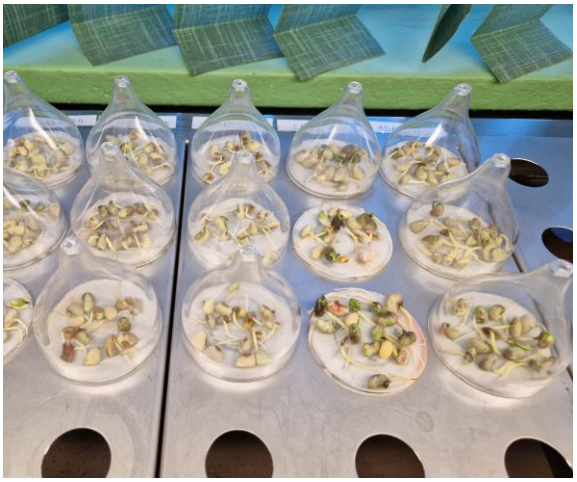
Figure 2. Seeds of Glycine max maturity group 0 after 7 days.

Regarding the way the amount of administered water influenced the level of germ development, we can state that soybean seeds that received a larger amount of water presented

better-developed germs. This leads us to the conclusion that the seeds in maturity group 0 have a germination power related to the amount of water administered

2. SOYBEAN SEEDS WITH MATURITY GROUPE 00

Soybean seeds with maturity group 00 are early-maturing varieties that can be grown in regions with a shorter growing season. They typically require fewer days to reach maturity than soybeans with higher maturity group numbers (15).

Table 2.

Soybean seeds with maturity group 00

No.	Variety	Maturity Group
1	Granat	00
2	Safir	00
3	Eugen	00
4	Onix	00
5	Felix	00
6	Darina TD	00
7	Cristina TD	00
8	Malina TD	00
9	Caro TD	00
10	Ilinca TD	00
11	Bia TD	00
12	Teo TD	00
13	Miruna TD	00
14	Nicola TD	00
15	Iris TD	00
16	Ziana TD	00

The seeds with maturity group 00, also presented in Table 2, were the majority in the conducted experiment and also provided us with the most useful results in differentiating between varieties.

Based on the results obtained from the germination of soybean seeds with maturity group 00, it was deduced that soybean germs showed staggered development, depending on the amount of water administered.

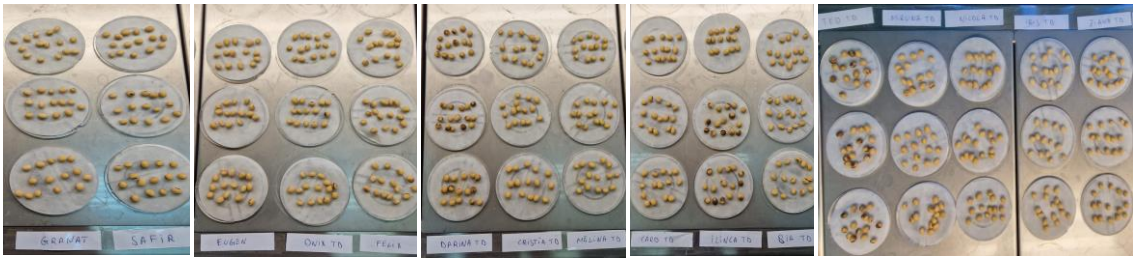

Figure 3. Seeds of Glycine max maturity group 00 placed on the slots.

So, after the 7 days required for the development of the germs, the varieties with the most developed germs were chosen. The results obtained reveal that the germs that received a larger

amount of water developed much better compared to the germs that received a smaller amount of water, 2 ml and 3 ml, respectively

Figure 4. Seeds of Glycine max maturity group 00 after 7 days.

The experiment conducted involved studying the germination process of soybean seeds with maturity group 00, with a focus on the impact of water quantity on the development of the germinated seeds. The seeds with maturity group 00 are early-maturing varieties that can be grown in regions with a shorter growing season. They typically require fewer days to reach maturity than soybeans with higher maturity group numbers(14).

The results of the experiment showed that the soybean seeds with maturity group 00 exhibited staggered development in relation to the quantity of water administered. The seeds were divided into different groups based on the quantity of water administered, and the germination process was studied for a period of seven days. The seeds that received a larger quantity of water demonstrated significantly better development of the germinated seeds in comparison to the seeds that received a smaller quantity of water.

The results also showed that certain soybean varieties with maturity group 00 had fewer and weaker viable germinated seeds in all three phases of water application. On the other hand, other soybean varieties with the same maturity group and receiving the same quantity of water in all three phases showed significantly better development of the germinated seeds. This led to the hypothesis that soybean varieties with maturity group 00 exhibit better germination results when they receive an optimal quantity of water.

3.SOYBEAN SEEDS WITH MATURITY GROUPE 000

Maturity group 000 soybeans are another variety of soybeans that have a longer growing season than maturity group 00 soybeans, usually taking around 120-130 days from seeding to maturity (15).

Table 3.

Soybean seeds with maturity group 000

No.	Variety	Maturity Group
1	Diamant	000
2	Perla	000
3	Carla TD	000
4	Isa TD	000

Diamant is a high-yielding soybean variety that is known for its adaptability to a range of growing conditions. It is also resistant to a number of common soybean diseases.

Perla is a popular soybean variety that is prized for its high protein content and good yield potential. It is also noted for its good resistance to lodging (falling over).

Carla TD is a triple-stacked genetically modified soybean variety that is resistant to multiple herbicides. This means that farmers can use a broader range of herbicides to control weeds in their fields.

Isa TD like Carla TD, Isa TD is a triple-stacked genetically modified soybean variety that is resistant to multiple herbicides. It is also noted for its high yield potential and good resistance to diseases like soybean cyst nematode.

The maturity group 000 soybean seeds have the longest development period, making the availability of water during the germination process crucial. Therefore, in our experiment, we aimed to determine the level of germination development based on the amount of water available.

Analyzing the evolution of germination for the maturity group 000 soybean seeds over the seven days of the experiment, we observed that the resulting germs exhibited well-defined physiological characteristics.

Figure 5. Seeds of Glycine max maturity group 000 placed on the slots.

It is important to note that even though there were no significant differences observed between the germination of soybean seeds with different water quantities in the case of maturity group 000, the Diamant variety showed some variations in germ development depending on the amount of water applied.

This finding suggests that the Diamant variety may require a specific amount of water to optimize its germination potential. Therefore, it is important to consider the specific needs of each variety when determining the optimal amount of water for soybean seed germination.

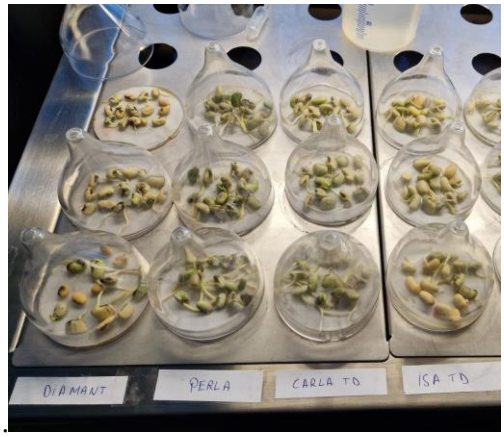

Figure 6. Seeds of Glycine max maturity group 000 after 7 days.

CONCLUSIONS

Based on the experiment conducted on soybean seeds with maturity group 00 and 000, it can be concluded that the availability of water plays a crucial role in the germination and development of soybean seeds. The results of the experiment showed that soybean seeds with maturity group 00 had better germination rates when provided with optimal water quantity.

Additionally, the experiment also revealed that the Diamant soybean variety showed significant differences in germination rates depending on the amount of water provided. This suggests that the Diamant variety requires a specific amount of water to develop properly.

Furthermore, it can be concluded that the Eugen, Caro TD, and Miruna TD soybean varieties had the least viable and weakest germination rates compared to other soybean varieties with the same maturity group. On the other hand, the Onix TD, Felix TD, Ilinca TD, and Bia TD varieties showed significantly better germination rates despite being provided with the same amount of water in all three stages of watering.

Overall, the results suggest that the optimal water quantity for soybean germination and development may vary depending on the soybean variety and maturity group(9, 11).

The experiment demonstrates the significance of water quantity in the germination process of soybean seeds, which can be used as a guide for optimizing the conditions for soybean cultivation. The results of this experiment can be useful for farmers and agricultural researchers in developing strategies for growing soybeans with better yield and quality.

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