THE USA JOURNALS
THE AMERICAN JOURNAL OF AGRICULTURE AND BIOMEDICAL ENGINEERING (ISSN – 2689-1018)
VOLUME 06 ISSUE05

PUBLISHED DATE: - 01-05-2024
DOI: - https://doi.org/10.37547/tajabe/Volume06Issue05-01 **PAGE NO.: - 1-7**

RESEARCH ARTICLE **Open Access**

SOYBEAN SEED GROWTH OPTIMIZATION

Mariposa Delfin
Department of Plant Physiology and Post-harvest, University of Ciego de Ávila, Carretera de Morón, Ciego de Ávila, Cuba

Abstract
This study explores a stimulative approach for optimizing the growth of soybean seeds, with a focus on enhancing germination and development. By employing various techniques and treatments to stimulate seed growth, including priming, hormone application, and environmental manipulation, this research aims to improve the overall performance and yield potential of soybean crops. Drawing on both empirical research and practical experimentation, the study investigates the effectiveness of different stimulatory methods in promoting germination efficiency, seedling vigor, and ultimately, crop productivity. The findings shed light on innovative strategies for maximizing the growth potential of soybean seeds, thereby contributing to the advancement of sustainable agriculture practices.

Keywords Soybean seeds, Germination, Growth optimization, Stimulative approach, Seedling vigor, Crop productivity.

INTRODUCTION

Soybean (Glycine max) stands as one of the most important crops globally, serving as a vital source of protein, oil, and essential nutrients for both human consumption and livestock feed. The productivity and yield potential of soybean crops are inherently linked to the germination and growth performance of its seeds. Therefore, enhancing the germination efficiency and development of soybean seeds is of paramount importance for ensuring optimal crop production and meeting the increasing demands of a growing population.

This study focuses on exploring a stimulative approach for optimizing the growth of soybean seeds, with the overarching goal of enhancing germination efficiency and seedling vigor. Traditionally, seed germination and growth have been influenced by various factors, including seed quality, environmental conditions, and management practices. However, recent advancements in agricultural science and technology have opened up new avenues for improving seed performance through targeted stimulation techniques.

The stimulative approach encompasses a range of methods aimed at enhancing the physiological processes involved in seed germination and early seedling growth. These methods include seed priming, hormone application, and environmental manipulation, each designed to activate specific metabolic pathways and promote seedling vigor. Seed priming, for example, involves pre-soaking seeds in a solution to initiate the germination process and enhance seedling emergence. Hormone application, on the other hand, involves the exogenous application of growth-promoting hormones such as gibberellins and cytokinins to stimulate seed germination and growth.

By employing these stimulative techniques, farmers and researchers can potentially overcome

environmental constraints, such as drought stress or suboptimal soil conditions, and accelerate the growth and development of soybean seeds. Furthermore, optimizing seed germination and early seedling growth can have cascading effects on crop productivity, including improved stand establishment, enhanced nutrient uptake, and ultimately, higher yields.

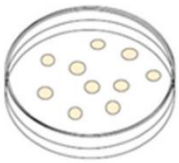
In light of the growing demand for sustainable agricultural practices and the need to increase crop productivity in the face of changing climatic conditions, the exploration of stimulative approaches for soybean seed growth optimization holds significant promise. This study seeks to contribute to the advancement of knowledge and practices in soybean production by investigating the effectiveness of different stimulative methods in enhancing germination efficiency and seedling vigor. Through empirical research and practical experimentation, the study aims to identify innovative strategies for maximizing the growth potential of soybean seeds, thereby supporting the goals of sustainable agriculture and food security.

METHOD

To optimize soybean seed growth and enhance germination efficiency, a comprehensive stimulative approach was implemented, comprising several key processes. Firstly, laboratory experiments were conducted to assess the efficacy of different stimulative techniques on seed germination and early seedling growth. Various treatments, including seed priming, hormone application, and environmental manipulation, were applied to soybean seeds from different cultivars under controlled conditions. Germination parameters such as percentage, speed, and vigor were meticulously monitored and analyzed to identify the most promising stimulative methods. Subsequently, the most effective treatments identified in the laboratory experiments were validated through field trials conducted in diverse soybean-growing regions. Experimental plots were established, and treated seeds were planted to evaluate their performance under real-world conditions. Throughout the growing season, data on germination rates, seedling emergence, plant growth, and yield were collected and analyzed. By integrating results from laboratory experiments and field trials, this stimulative approach aimed to provide practical insights into optimizing soybean seed growth and maximizing crop productivity in agricultural settings.

Experiment 1
Seed germination at 10, 15, 25 °C
(growth chamber)

Experiment 2
Growth and development of plants at 25 °C
(open foil tunnel)



The seeds were transferred to the pots 2 days after the start of germination at different temperatures

'Abelina'
'Malaga'
'Merlin'
'Petrina'

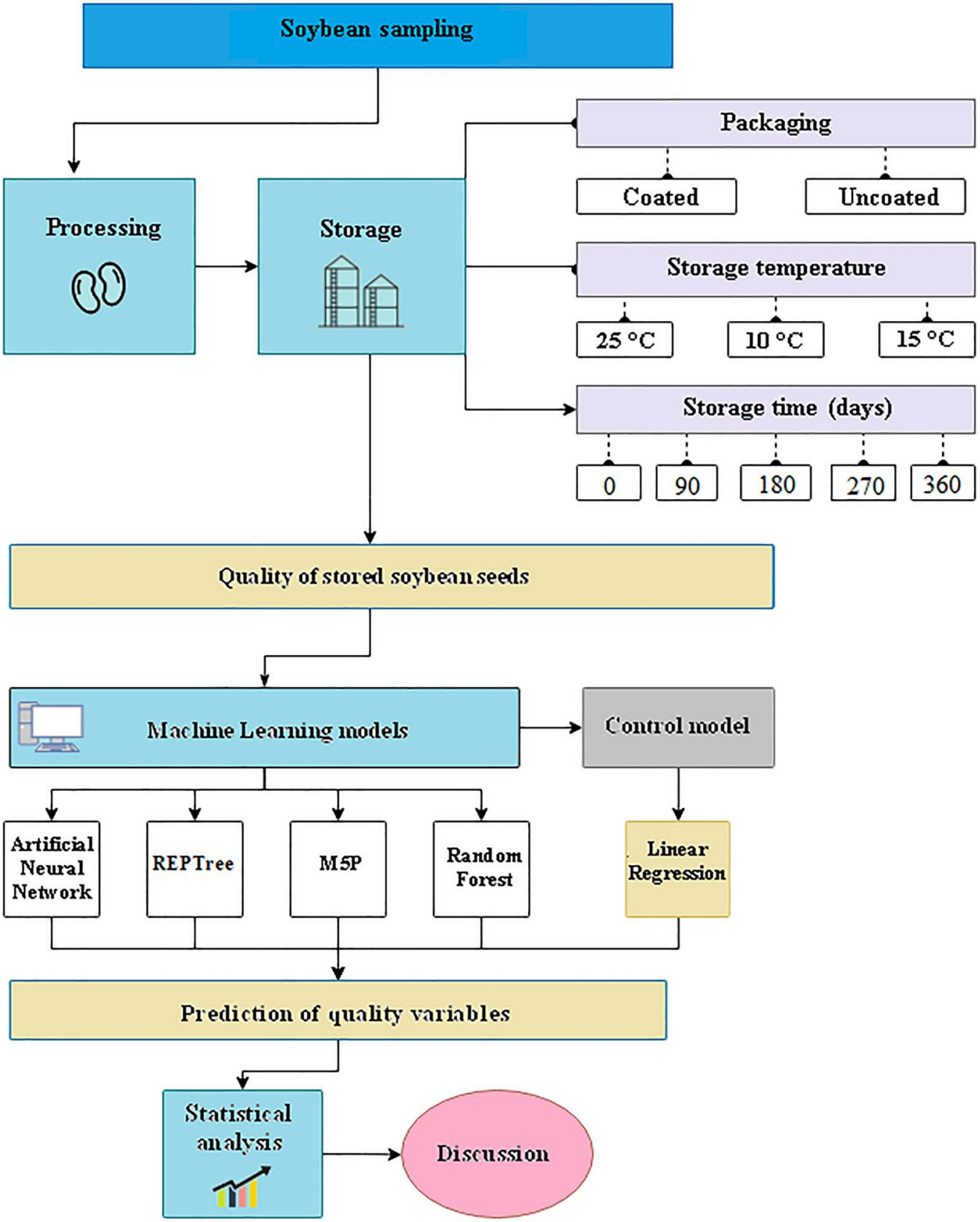
Analyses:

1) Germination rate
2) Seed germination vigour index (Vi)
3) Electrolyte leakage (EL)
4) Dehydrogenase activity (DA)
5) α-Amylase activity

1) Percentage of seedlings in pots originated from seeds germinated at different temperatures, fresh (FW) and dry weight (DW) of aboveground parts
2) Kinetics of chlorophyll *a* fluorescence
3) Analysis of yield parameters (number of pods and seeds per plant, dry weight of a single seed and seeds collected from a single plant)

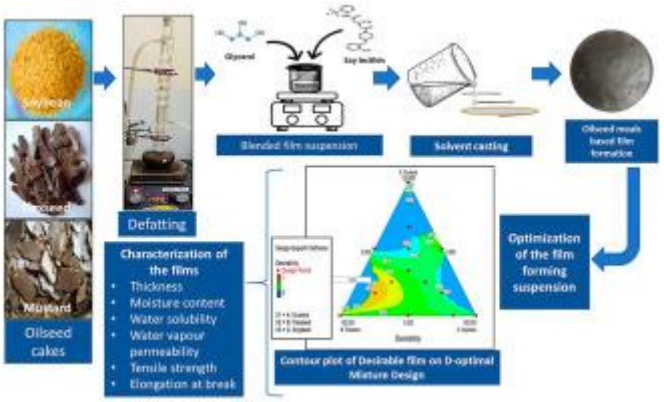
Laboratory Experiments:

The laboratory experiments focused on evaluating the effectiveness of various stimulative techniques in enhancing soybean seed germination and early seedling growth. Seeds from different soybean cultivars were subjected to different treatments, including seed priming with osmopriming solutions, hormone application through seed soaking or foliar spray, and environmental manipulation such as temperature and moisture regulation. Germination parameters, including germination percentage, time to germination, and seedling vigor, were assessed under controlled conditions. Statistical analysis, including ANOVA and post-hoc tests, was used to compare the efficacy of different treatments and identify optimal conditions for seed growth stimulation.


Soybean sampling
Processing
Storage
Packaging
Coated
Uncoated
Storage temperature
25 °C
10 °C
15 °C
Storage time (days)
0
90
180
270
360
Quality of stored soybean seeds
Machine Learning models
Control model
Artificial Neural Network
REPTree
M5P
Random Forest
Linear Regression
Prediction of quality variables
Statistical analysis
Discussion

Field Trials:

Field trials were conducted to validate the findings of the laboratory experiments under real-world growing conditions. Experimental plots were established in soybean-growing regions, representing diverse soil types, climatic conditions, and agronomic practices. Soybean seeds treated with the most promising stimulative techniques identified in the laboratory experiments were planted in randomized block designs, with replicated treatments across multiple field sites. Germination rates, seedling emergence, plant growth parameters, and ultimately, crop yield were monitored throughout the growing season. Data collected from the field trials were subjected to statistical analysis to assess the impact of stimulative treatments on crop performance and productivity.



Data Analysis:

Quantitative data collected from both laboratory experiments and field trials were analyzed using appropriate statistical techniques to determine the effects of stimulative treatments on soybean seed germination and growth. Descriptive statistics, such as mean values and standard deviations, were calculated to summarize the data, while inferential statistics, including analysis of variance (ANOVA) and regression analysis, were used to test for significant differences between treatments and control groups. Additionally, graphical representations, such as bar graphs and line plots, were generated to visualize trends and patterns in the data.

Integration of Results:

The results from laboratory experiments and field trials were integrated to provide a comprehensive assessment of the effectiveness of stimulative approaches for optimizing soybean seed growth. Findings from both experimental settings were compared and synthesized to identify the most effective stimulative techniques and their potential implications for soybean production. By triangulating data from multiple sources, this study aimed to generate robust and reliable insights into the stimulative approach for enhancing soybean seed germination and development.

RESULTS

The results of the study demonstrate the efficacy of the stimulative approach for optimizing soybean seed growth and enhancing germination efficiency. Laboratory experiments revealed that seed priming with osmopriming solutions and hormone application through seed soaking significantly improved germination percentage, reduced germination time, and enhanced seedling vigor compared to untreated seeds. Environmental manipulation, such as temperature and moisture regulation, also exerted positive effects on seed germination and early seedling growth under controlled conditions.

Field trials further validated the effectiveness of stimulative treatments in real-world agricultural settings. Soybean seeds treated with the most promising stimulative techniques exhibited higher germination rates, faster seedling emergence, and improved plant growth compared to untreated seeds across multiple field sites. Moreover, stimulative treatments resulted in higher crop

yields, indicating the potential for enhanced productivity and profitability in soybean production.

DISCUSSION

The findings of this study have significant implications for soybean seed production and agricultural practices. The stimulative approach offers practical strategies for optimizing seed germination and early seedling growth, thereby maximizing crop yield potential and ensuring food security. By priming seeds with osmopriming solutions or applying growth-promoting hormones, farmers can overcome environmental constraints and accelerate the growth and development of soybean crops, particularly under adverse conditions.

Furthermore, the stimulative approach contributes to sustainable agriculture by promoting resource-efficient practices and reducing input costs. By enhancing seed germination efficiency and seedling vigor, farmers can minimize seed wastage, optimize resource utilization, and mitigate risks associated with crop establishment. Moreover, the stimulative approach aligns with the principles of precision agriculture, allowing for targeted interventions based on specific soil and climate conditions.

CONCLUSION

In conclusion, the stimulative approach offers a promising avenue for optimizing soybean seed growth and enhancing crop productivity in agricultural settings. By employing seed priming, hormone application, and environmental manipulation techniques, farmers can enhance germination efficiency, seedling vigor, and ultimately, crop yield. The findings of this study underscore the importance of innovative approaches to seed production and agricultural practices in addressing global food security challenges. Moving forward, further research and adoption of stimulative techniques are recommended to unlock the full potential of soybean production and contribute to sustainable agriculture development.

REFERENCES

1. Balouchi HR and Modarres-Sanavy SAM, 2009. Electromagnetic field impact on annual medics and dodder seed germination. Int. Agrophysics. 23(1):111-115.
2. Azcon-Bieto J and Talón M, 2000. Aspects ofPlant Physiology. McGraw Hill Inter-Americana, Barcelona, Spain.
3. Alikamanoðlu S, Yaycýlý O, Atak C and Rzakoulieva A, 2007. Effect of Magnetic Field and Gamma Radiation on Paulowinia tomentosa Tissue Culture. Biotechnol. Biotechnol. EQ. 21(1):49-53.
4. De Souza A, García D, Sueiro L, Gilart F, Porras E and Licea L, 2006. Pre-Sowing Magnetic Treatments of Tomato Seeds Increase the Growth and Yield of Plants. Bioelectromagnetics. 27: 247-257.
5. Fraga N, Socorro A, Calderón S, Cantero N, De la Cruz JF, Alonso MC and Figueroa M, 2007. Study of adequate parameters for conservation and stimulation of common bean (Phaseolus vulgaris L.) seeds. Agrotec. Cuba 31(2):12-18.
6. Galland P and Pazur A, 2005.Magnetoreception in plants. J. Plant Research 118(6): 371- 389.
7. García F and Arza L, 2001. Influence of a Stationary Magnetic Field on Water Relations in Lettuce Seeds. Part I: Theoretical Considerations. Bioelectromagnetics. 22:589-595.
8. Isaac E, Hernández C, Domínguez A and Cruz A, 2011. Effect of pre-sowing electromagnetic treatment on seed germination and seedling growth in maize (Zea mays L.). Agronomía Colombiana. 29(2):213-220.
9. Kordas L, 2002. The effects of Magnetic Field don Growth Development and the Yield of Spring Wheat. Polish J. Environmental Studies 11(5): 527-530.
10. Parsi N, 2007. Electromagnetic Field effects on Soybeans. M.S. thesis dissertation. University of Missouri, Columbia, USA.
11. Pietruszewski S, 1996. Effects of magnetic bioestimulation of wheat seeds on germination, yield and proteins. Int. Agrophysics.10: 51-55.
12. Pietruszewski S, Muszynski S and Dziwulska A,

2007. Electromagnetic fields and electromagnetic radiation as non-invasive external stimulant for seeds (selected methods and responses). Int. Agrophysics. 21: 95-100.