Sirte University Scientific Journal (SUSJ)

Journal home page: http://journal.su.edu.ly/index.php/SUSJ/index

DOI: 10.37375/susj.v15i1.3395

Evaluation of the effectiveness of treating broad bean seeds with fungicides on germination and plant growth

Ali Abdulla Emhemmed[1]

[1]*Botany Dept., Fac. of Science Univ. Sirte, Libya*

DOI: 10.37375/susj.v15i1.3395

ARTICLE INFO:

Received 01 May 2025.
Accepted 07 June 2025.
Available online 24 June2025..

Keywords: (*Faba bean, fungicides, germination percentage- morphological traits)*

A B S T R A C T

The current study was carried out in a laboratory and a greenhouse at the Department of Botany, Faculty of Science, University of Sirte, during the 2024/2025 season, to determine the effects of soaking faba beans in four different fungicides (Moncerin 25%, Topsin–M70, Rizolex-T50%, and Vitavax-200) on germination percentage and some morphological traits of faba beans under laboratory and greenhouse conditions. These treatments were distributed in a randomized complete block design (RCBD) with three replicates. The laboratory results showed that the Moncerin 25% fungicide achieved the highest values of faba bean germination percentage after 3, 5, 7, and 10 days, followed by Topsin–M70, while the control treatment had the lowest germination percentage values. Furthermore, compared to the control, which recorded lower values of seed dressing germination percentage, Vitavax-200 recorded the highest dressing germination percentage after 3, 5, 7, and 10 days, followed by Moncerin 25% and Rizolex -T50%. This was true for all fungicides tested. However, in a greenhouse, seed soaking with 25% Moncerin, Rizolex T50%, and Topsin-M70 had a highly significant impact on shoot length, number of leaves, and fresh weight. Furthermore, compared to Rizolex T50% and Moncerin 25%, the germination percentage of faba bean seed soaking was greater with Vitavax-200, Topsin-M70 (83%), and control.

1 Introduction

According to the **United Nations (2019),** by 2050, there may be 9.7 billion people on the planet. To guarantee global food security in sustainable ways, global agriculture will have to increase production by at least 50% **(Searchinger *et al.,* 2019).** Approximately 90% of the world's food crops are grown from seeds, making them crucial to maintaining food security **(Dongyu, 2021).**

Faba beans (*Vicia faba*, L.), a winter-season crop in the Fabaceae family **(Badjona *et al.,* 2023),** are considered one of the most important crops in the legume family because only the seeds are used for human consumption, with the rest of the crop being used for animal feed. It also among the world's oldest legume crops and are grown primarily for their high protein content, which is beneficial for both human and animal use **(Vasić *et al.,* 2019).**

The faba bean is one of the most important food legumes in the world because of its great nutritional value, which includes high protein content (24–30%) and calories. Additionally, it is an excellent fixer of nitrogen **(Bogale *et al.,* 2022).** Despite being one of the oldest and third most important pulse crops in the world, broad beans may be grown in a variety of climates and soil types, but their overall cultivated area is decreasing because of their vulnerability to pests and diseases. The main causes of diseases in broad beans are nematodes, bacteria, viruses, and fungi. Integrated pest management, which promotes sustainable pest control, is the most efficient way to control these diseases **(Alananbeh *et al.*, 2024).** For the majority of crops grown worldwide, pre-sowing seed treatment with systemic fungicides is a tried-and-true technique. The therapy's goal is to shield the crop from illnesses that are spread by seeds and the soil **(Ayesha *et al.*, 2021).** One common integrated crop management technique for crops is the application of systemic fungicides to seeds. Fungicide seed treatment has been shown to improve plant vigor, seed emergence, and protection against soil-borne and seed-borne fungal infections **(Lamichhane *et al.*, 2020).** Particularly concerning are the treatment's off-target effects on the seed-borne microbiota, particularly on fungus **(Prior *et al.*, 2017).** Both independent and culture-dependent techniques have been used to identify a variety of fungus in seeds Through defense against seedborne and soilborne diseases, fungicide seed treatment (FST) FST improves seedling emergence, plant height, plant vigor, and plant and root biomass **(Da Silva *et al.*, 2017).** Correct implementation of the FST is necessary to optimize the net benefit. Fungicide seed treatment, or FST, is a commonly used method worldwide. Because of the supposed effectiveness of many fungicides in providing broad-spectrum and systemic control of key diseases, as well as the idea that FST reduces overall pesticide use, hence minimizing environmental implications, the use of FST has expanded dramatically over the past 50 years. The available data on the primary fungicides used to treat seeds, the benefits and drawbacks of FST, and we make recommendations to optimize the benefits and minimize the risks related to its use **(Lamichhane *et al.*, 2020).**

The goal of the current experiment was to assess how various fungicide treatments affected faba bean seed germination and growth

2 .Materials and Methods

Provide sufficient details to allow the work to be During the 2024–2025 seasons, the current study was carried out in a greenhouse and laboratory at the Department of Botany, Faculty of Science, University of Sirte. Four fungicides (Moncerin 25%, Topsin M70, Rizolex T50%, and Vitavax 200) were soaked in faba bean seeds to ascertain the germination percentage of faba beans in both laboratory and greenhouse settings. Three replicates of each treatment were used in a randomized complete block design (RCBD).

(Kinge *et al.*, 2019; Chun *et al.*, 2021). When systemic fungicides like carbobin and thiabendazole were initially released in the early 1970s, they were utilized to treat seeds because they inhibited infections that were both soil-borne and seed-borne. Systemic fungicide treatment of seeds is an essential disease control technique for a variety of vegetable and agricultural crops worldwide **(Lamichhane *et al.*, 2020).** According to **Pedrini *et al*. (2017),** seeds are usually treated as seed dressing, coating, or pelleting prior to being sowed. Coating seeds with dry or liquid fungicide and pesticide mixes is the most popular method of seed treatment. Natural bio-formulations like Pseudomonas, Trichoderma, and Rhizobia are also employed to increase the seeds' efficacy in the field. While seed pelleting is used for crops with tiny seeds, such carrots and onions, industries usually apply seed coating to huge batches of seeds **(Tamil Nadu Agritech web, 2020).**

- ### Samples collection

1. Broad bean seeds

The seeds of the native Libyan bean variety were used in these tests. The experiment was conducted using sandy soil. *Vicia faba* L. seeds were purchased from the Sirte municipal seed market in the 2024–2025 growing season. Using a ruler, the seeds were manually separated into three groups according to their length and width: 20 large seeds, 20 medium seeds, and 20 little seeds. The large seeds varied in size from 2.5 to 2.3 cm, the medium seeds from 2.0 to 2.2 cm, and the small seeds from 1.7 to 1.9 cm. For twenty-four hours, each group was submerged in tap water. They then germinated on filter paper that had been soaked with water in sterile Petri plates. During the seven days when they were left in the dark at 25˚C, petri dishes were soaked with water.

- ### Fungicides

In the 2024–2025 season The fungicides utilized in the tests were Vitavax-200, Topsin-M70, Rizolex-T50%, and Cererin 25%. The fungicides were purchased from commercial solutions for agricultural holdings in order to assess the efficacy of certain systemic and non-systemic fungicides.

Germination faba bean seeds

<u>Under laboratory tests</u>:

In the Botany Department's lab at Sirte University's Faculty of Science. The necessary materials for these experiments (seed dressing and seed soaking) were prepared, including petri dishes and filter papers. A wet filter paper was put in each dish, and the dishes were split into two groups: one group held seeds treated with the fungicides that were tested for this study, and the other group was used as a control and did not receive any treatment. Every group employed seven 9 cm-diameter petri plates, and each experiment used a comparison and a number of duplicates. There are five bean seeds in each serving. Two weeks after the experiment was carried out, the results were documented. Wash out any remaining filter paper after removing the seedlings from the Perti-dishes. To eliminate any excess moisture from the seedlings' surfaces, gently pat them dry with a soft paper towel. Weigh as soon as possible because plants contain a lot of water; waiting to weigh them could cause some drying and result in erroneous statistics.

Green house experiments:

In order to assess the four fungicides that were tested Moncerin 25%, Topsin M70, Rizolex T50%, and Vitavax 200 faba bean seeds were mixed with the fungicide individually (2g/kg) in a greenhouse setting. Furthermore, the same cultivar's seeds were immersed in the required dosage of the fungicides described above for 12 hours. Soil was added to sterilized containers, and treated seeds were placed inside. In these trials, any treatment was replicated four times, while the control pots contained three seeds and were not treated: The percentages of germination were calculated using the formula outlined by **El-Helaly *et al.* (1970)** 20 days after seeding. Two and four weeks after seeding, pre- and post-emergence damping-off disease were evaluated, and the number of surviving plants was determined using the formula below **(Ragab *et al.*, 2009):**

$$\text{Pre-emergance damping–off (\%)} = \frac{\text{No. of un-germination seeds}}{\text{No. of planted seeds}} \times 100$$

Plant leaves were taken from each treatment 45 days after seeding in order to measure the activities of peroxidase and polyphenoloxidase. Measurements were made on growth factors like shoot length (cm), freshness, and leaf count.

Germination percentage (%):

For every concentration treatment, the germination % was determined using the guidelines suggested by **ISTI (1985).** From the first day after germination, when roots first emerged, until the tenth day, which is the last day, the number of seeds that germinated was tallied. The percentage of germination was computed as follows:

$$\textbf{Germination (\%)} = \frac{Number\ of\ seeds\ germinated}{Total\ number\ of\ seeds} \mathrm{X}\,100$$

According to the ISTA seed germination technique, only normally germinated seedlings were counted as germinated seeds during the germination test; dead (un-germinated) and aberrant seedlings were excluded.

Shoot length (cm): At the time of the germination count, ten healthy seedlings were chosen at random. The mean length of the primary root, measured from collar to tip, was expressed in cm. The shoot length of the ten seedlings used to test the root length was measured from the collar to the tip of the main shoot, and the mean value was expressed in centimeters. Seedling Fresh weight: Ten normally germinated seedlings were randomly selected from each replication using an electrically sensitive balance. The mean was recorded, and the weight was expressed in milligrams.

Fresh weight (g): Wash off any remaining filter paper after removing the seedlings from the Perti-dishes. To get rid of any free surface moisture, gently blot the seedlings with a soft paper towel. Weigh right away since plants contain a lot of water; waiting to weigh them could cause them to dry out and yield erroneous results.

Statistical Analysis

The **Snedecor and Cochran (1982)** procedure was followed in doing the statistical analysis.

3 Results and Discussion

1. Laboratory experimental:

- **Germination percentage of seeds soaking**

All fungicides (as seed treatments) had a substantial impact on the germination % of faba bean seeds, according to the results displayed in **Table (1) and Fig. (1).** The same table also showed that, in comparison to the control treatment, which recorded lower values of germination percentage (20.52, 26.96, 32.20, and 36.80%, respectively), the Moncerin 25% fungicide recorded the highest values of faba bean germination percentage after 3, 5, 7, and 10 days (30.64, 55.20, 67.44, and 79.42%), followed by Topsin-M70, which recorded (28.15, 41.40, 53.91, and 66.84%).

These results align with those of several researchers. **Vatchev and Maneva (2012)** found that fungicide mixtures comprising Topsin-M 70% WP (thiophanate-methyl) plus Previcur 607 SL (propamocarb hydrochloride) or Benlate 50% WP (benomyl) plus Previcur 60.7 SL provided more dependable control of the entire disease complex than when each product was applied separately when it came to controlling the root rot complex and stem rot of cucumbers. Fungicides applied to peanut seeds at 1, 2, and 3 gm kg-1 boosted emergence and plant stands, increased survival plants, and decreased damping off before and after emergence **(Hassuba *et al.*, 2016).** Carboxin + thiram, thiram, and tolclofos methyl + thiram were the therapies. **Mahmoud *et al.* (2018)** found that Rizolex-T (tolclofos-methyl + thiram), Vitavax-200 (carboxin + thiram), and Moncut (flutolanil) were the most effective fungicides in reducing the percentages of pre- and post-emergence damping-off in faba beans caused by F. solani and R. solani at a rate of 3 gm Kg^{-1} of seeds. **Khalequzzaman (2019)** claims that using Provax 200 WP (carboxin + thiram) and Autostin 50% WDG (carbendazim) to seeds and soil can reduce the incidence of fenugreek foot and root rot infections. **El-Kholy *et al.* (2021)** found that tolclofos-methyl + thiram (Rizolex-T 50% WP), carboxin + thiram (Tendro 40% FS), and fludioxonil + mefenoxam (Maxim XL 3.5%) were the most effective methods for reducing the amount of damping-off, rotted roots before and after emergence and thereby increasing the survival (healthy) plants in common beans.

Soaking seeds in fungicide solutions may solve the problem of sowing uniformity, but the phytotoxicity problem may be resolved by applying certain other fungicides during the pelleting process. Some of the newer systemic fungicides may also provide additional protection to older seedlings against late damping-off. Furthermore, the amount of a.i. required to achieve disease control as FST is often substantially smaller (5 to 10% of a.i. ha^{-1}) than foliar spraying or in-furrowing. Fluquinconazole was applied topically at 6.6 g a.i. kg^{-1} seed, flutriafol was applied in-furrow (100 g a.i. ha^{-1}) in combination with fertilizer, and flusilazole was applied topically at 100 g. These treatments with fungicides were compared by **Khangura and Barbetti (2004).**

They found that all fungicide treatments considerably reduced blackleg severity and increased yields across four field sites. Another benefit of FST over other administration methods is its ability to control seed-borne infections of soilborne and other seed-borne pathogens **(Paveley *et al.*, 1996).** Compared to the untreated control, there was a greater appearance of faba bean plants and a higher incidence of illness. The reduced pre-emergence damping down of the treated seeds may be due to the effect of these compounds on the fungal pathogens that attack the seeds and induce seed rot. Additionally, the results demonstrated that the investigated compounds were effective in reducing post-emergence damping off when compared to untreated seeds.

The higher germination rate indicates that the fungicides employed in this treatment help protect the seedling from adverse conditions **(Habib *et al.*, 2007).** An increase in the germination values of treated seeds in comparison to the untreated control is one potential specific response of *Z. mays* to fungicide treatment **(Ahmed and Siddiqui, 1995).** This conclusion is in line with the findings of **Umesh and Maske (2012),** who discovered that benomyl, dithane M-45, and bavistin effectively increased the cowpea germination percentage. In another study, **De and Chaudhury (1999)** found that legumes treated with bavistin, mancozeb M-45, and vitavax exhibited superior germination compared to control seeds. These results are fully supported by the current observation.

Table (1): Effect of fungicides on percent of seed soaking germination under laboratory conditions

Fungicides	Germination percentage /Days			
	3rd d	5th d	7th d	10th d
Control	20.52e	26.96e	32.20e	36.80e
Moncerin 25%	30.64a	55.20a	67.44a	79.42a
Topsin – M70	28.15b	41.40c	53.91c	66.84b
Rizolex - T50%	22.63d	30.64d	36.80d	49.04d
Vitavax-200	24.47c	49.04b	61.27b	64.40c

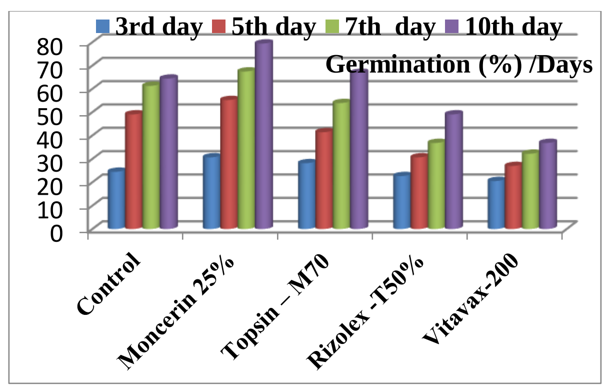

Fig. (1): Effect of fungicides on percent of seed soaking germination under laboratory conditions

- **<u>Germination percentage of seeds, dressing treat in laboratory</u>**

Four fungicides inducers, including Moncerin 25%, Topsin – M70, Rizolex -T50% and Vitavax-200 were investigated for their effects on seed dressing germination percentage on faba bean plants under laboratory conditions are presented in **Table (2) and Fig. (2).** The presented results indicated that all fungicides tested showed that Vitavax-200 recorded the higher dressing germination percentage after 3, 5, 7 and 10 days (71.48, 79.42, 83.60 and 88.00 %), followed by Moncerin 25% which recorded (67.42, 74.91, 78.85

and 83.00 %) and Rizolex -T50% which recorded (61.73, 68.59, 72.20 and 76.00 %), as compared to control which recorded the lower values of seed dressing germination percentage (47.11, 52.35, 55.1 and 58.00 %), respectively.

Based on their mobility, three different kinds of fungicides are employed for FST. The first category consists of contact-acting fungicides, which are surface protectors that target soilborne and seed-borne diseases. The second class of fungicides targets both internally and externally seedborne diseases and is locally systemic. Lastly, fungicides that are xylem mobile and so systemically translocated are included in the third group. Some fungicides, on the other hand, might possess many forms of mobility. All of these fungicides target infections that can persist for up to 4–5 weeks after planting and harm seed or emerging seedlings **(Kazda *et al*., 2005). Afzal *et al*. (2010)** state that because fungicidal seed treatment can reduce seedborne mycoflora, improving seed germination and allowing sufficient time for seedling protection, it is highly effective, economical, and easy to apply. **Dey and Singh (1994)** discovered that ascochyta blight growth on seedlings increased and seedling emergence decreased as the severity of seed symptoms increased. Fungicide seed treatments increased plant emergence at the Fargo location but not at the Carrington location when compared to the untreated control. This result was mostly caused by the metalaxyl seed treatment at Fargo, which offered defense against Pythium. According to **Sonhaji *et al.* (2013),** synthetic fungicides were found to be more efficient than other seed treatments at suppressing *Peronosclerospora maydis* in soybean seeds. **Nurahmi *et al.* (2010)** state that fungicides used to treat seeds can work in touch or systemically. Contact mechanisms suppress pathogens on the seed's surface, while systemic processes inhibit those in the seed tissue. It has been demonstrated that fungicides decrease pathogenic infections, particularly fungus Infections, during the three to four weeks that seeds are kept in storage **(Rahardjo and Sukamto, 1987).**

Table (2). Effect of fungicides on percent of seed dressing germination under laboratory conditions.

Fungicides	Germination percentage /Days			
	3rd day	5th day	7th day	10th day
Control	47.11e	52.35e	55.10e	58.00e
Moncerin 25%	67.42b	74.91b	78.85b	83.00b
Topsin – M70	54.42d	60.47d	63.65d	67.00d
Rizolex - T50%	61.73c	68.59c	72.20c	76.00c
Vitavax-200	71.48a	79.42a	83.60a	88.00a

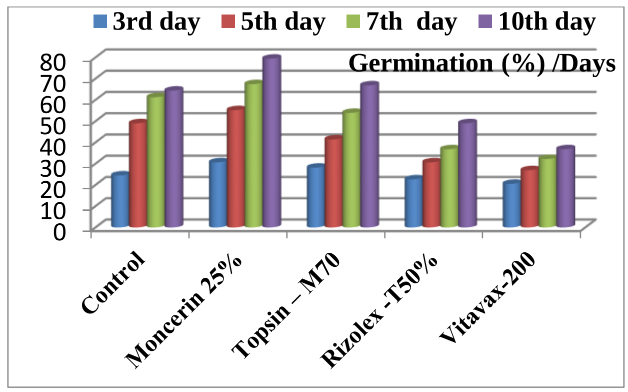

Fig. (2): Effect of fungicides on percent of seed dressing germination under laboratory conditions.

2. Greenhouse experimental

- **Germination percentage of seed soaking**

Table (3) and Figure (3) clearly show how seed soaking affected the germination rate and some morphological characteristics of faba bean plants grown in greenhouses during the 2024–2025 season. However, Moncerin 25%, which recorded higher values (23.4 cm, 8 and 24.5 g), Rizolex T50%, which recorded 18.5 cm, 7 and 20.5 g, and Topsin-M70, which recorded 17.5 cm, 6 and 19.7 g, all had a highly significant impact on shoot length, number of leaves, and fresh weight when seed soaking was used. In contrast, the control group recorded lower values for shoot length, number of leaves, and fresh weight (12.50 cm, 6 and 13.50 %). Furthermore, compared to Rizolex T50%, which recorded a lower germination percentage (71%) and Moncerin 25% (76%), Vitavax-200 (92%), Topsin-M70 (83%), and control treatment (80%) recorded a greater germination percentage for faba bean seed soaking. Likewise, broad bean plants infected with six fungicides showed increases in shoot length, dry matter weight, and chlorophyll content after seed treatment **(El-Aal *et al.*, 2010).**

Using the optimal fungicide seed pretreatment parameters selected above, the efficacy of the fungicide was evaluated using emergence, a measure of plant vigor **(BASF, 2016).** Fungicide seed treatment has long been used in agriculture to prevent illness in gourd seeds. Fungicide seed treatments offer several benefits to crops, such as improved germination and stand establishment, by protecting seeds from soilborne and seedborne diseases and pests. They also shield seedlings from illnesses and pests, boosting plant health and promoting steady growth. This leads to higher crop yields and quality. Additionally, by facilitating the accurate, targeted administration of insecticides, seed treatments lessen the likelihood that pest and disease resistance will emerge and lessen their impact on the environment **(Munkvold *et al.*, 2014).** Fungicide seed treatment has recently come under fire, though, because it may also destroy beneficial bacteria that are essential for seed germination in addition to shielding seeds from harmful illnesses. Germination was minimal at 24 hours and increased with longer soaking times; it peaked at 25 hours. Seeds need to absorb water in order to germinate, but it's also critical to know how long to soak them for. According to the current study, the ideal soaking duration for maize seeds in distilled water is 25 hours **(Ayesha *et al.*, 2021).** Similarly, **Nadeem *et al.* (2017)** discovered that the best way to promote germination of all the seed types they examined was to soak maize seeds in distilled water for 24 hours; extending the time to 12 or 36 hours reduced germination.

Esmaeilpour and Van Damme (2014) claim that soaking pistachio seeds for a full day is the best way for them to germinate. Delays in enzyme activation, inadequate water uptake, or seed dormancy may result in a decrease in seed germination below the optimal soaking time; oxygen deprivation, seed rot, or nutrient loss may result in a decrease above the optimal soaking time. It's possible that the seeds' hormonal activity was out of balance **(Zhang *et al.*, 2020)** or that some helpful bacteria required for seed germination were eliminated **(Ayesha *et al.*, 2021).** However, the germination of soybean seeds is unaffected by difenoconazole, a triazole fungicide **(Ramdan *et al.*, 2021).** According to **Ramdan *et al.* (2021),** this is probably because different triazole fungicides have variable levels of phytotoxicity or because some crops may be sensitive to the fungicide while others are not. These results showed that the application of fungicides and water treatment suppressed seedling growth for longer than 24 hours. It has been shown that the germination index, root length, and shoot length of maize seeds increase after soaking for 20 hours or less **(Ahmed and El-Mahdy, 2022).** While shorter soaking times may aid or at least not harm any of these processes, longer soaking times have a negative impact on both seed germination and seedling growth **(Yerima *et al.*, 2016).** The longest soybean seedling length was obtained with the metalaxyl-M + fludioxonil treatment **(Costa *et al.*, 2019).** The results support **Sultana and Ghaffar's (2010)** conclusions that fungi have a detrimental effect on seedling growth and that fungicidal treatment can encourage the growth of healthy seedlings. Fresh weight of seedlings was unaffected by fungicide treatments, and all treatments except CV produced results that were similar. The fresh weight of olas treated with metalaxyl was the lowest (183 mg $plant^{-1}$). It was demonstrated that Linas had a greater fresh and dry weight. The seedlings' dry weight was not considerably changed by the fungicides.

Table (3): Effect of seed soaking on germination percent and some morphological traits of faba bean plants.

Fungicides	**Germ. (%)**	**Morphological traits**		
		Shoot length (cm)	**No. leaves**	**Fresh Weight (g)**
Control	80	12.50	6	13.50
Moncerin 25%	76	23.40	8	24.50
Topsin – M70	83	17.50	6	19.70
Rizolex T50%	71	18.50	7	20.50
Vitavax-200	92	16.40	5	16.81

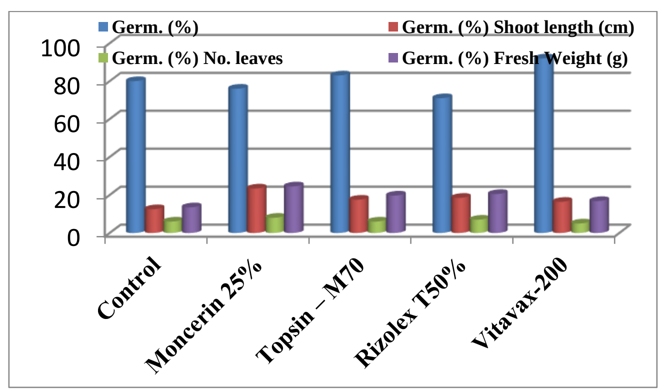

Fig. (3): Effect of seed soaking on germination percent and some morphological traits of faba bean plants.

Fig. (5) Control

Treatments seeds by

- **<u>Germination</u>**
- **<u>percentage of seed dressing</u>:**

The impacts of seed treatment on the germination rate and certain morphological characteristics of faba bean plants throughout the 2024–2025 season under greenhouse conditions were demonstrated by the results displayed in **Table (4) and Fig. (4).** However, the seed dressing had a highly significant impact on shoot length, number of leaves, and fresh weight. Vitavax-200 recorded the highest shoot length values (21.6 cm), followed by Moncerin 25% (20.4 cm), Topsin-M70 (19.7 cm), and control treatment (17.3 cm). In contrast, Rizolex T50% recorded the lowest values (16.6 cm). In contrast, Topsin-M70 recorded a higher fresh weight (20.50 g), followed by Moncerin 25% (19.7 g), Vitavax-200 (19.4 g), and Rizolex T50% (18.3 g), while Vitavax-200 recorded a higher number of leaves (10), followed by Moncerin 25% (8), and control treatment (8). The control treatment recorded a lower fresh weight (16.90 g).

Systemic fungicides related to sterol biosynthesis inhibitors act as regulators of plant development **(Windham and Windham, 2004).** Higher dosages of these fungicides have the potential to shorten the internode, which inhibits the growth of plant shoots. Changes in nitrogen metabolism may be the reason for the reduced growth in herbicide-treated wheat and maize plants **(Alla *et al.*, 2008).** The decrease in shoot length seen in this study resulting from the administration of metalaxyl may be due to internode shortening, which reduces shoot growth.

Table (4): Effect of seed dressing on germination rate and some morphological traits of faba bean plants.

Fungicides	Germ. (%)	Morphological traits		
		Shoot Length (cm)	No. leaves	Fresh Weight (g)
Control	72e	17.3d	8b	16.9e
Moncerin 25%	79d	20.4a	8b	19.7b
Topsin – M70	86b	19.7c	7c	20.5a
Rizolex T50%	85c	16.6e	7c	18.3d
Vitavax-200	96a	21.6b	10a	19.4c

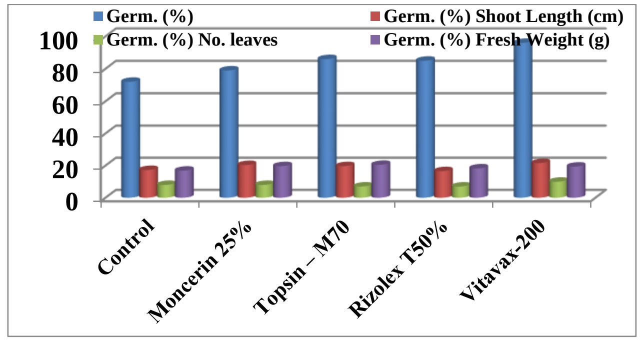

Fig. (4): Effect of seed dressing on germination rate and some morphological traits of faba bean plants.

4 Conclusions

While fungicides reduce contamination, optimizing their use to balance fungal control with minimal phytotoxicity is crucial. Exploring alternative fungicide formulations or combining them with biological treatments may provide a better approach to enhancing germination and seedling vigor while controlling fungal infections. Further research is necessary to validate these findings and refine fungicide application strategies. Therefore, the usage of fungicide beyond threshold concentration should be avoided for the better crop yield and also an inappropriate use of fungicide in crop production without the proper understanding of the fungicides– plant interactions is to be avoided so that the yield of crops can be protected from the toxicity of fungicides.

Recommendations

The results obtained indicated that soaking faba bean seeds in the fungicides Moncerin 25%, M70 Topsin, and Vitavax-200 led to an increase in germination rates, while the fungicide Rizolex T50% improved the vegetative characteristics of the faba bean plant. Therefore, we recommend using these fungicides within the permissible limits to enhance the germination rate of faba beans and to maintain the health of humans, animals, and the environment.

Acknowledgements

I would like thank the Faculty of Science and the Department of Botany for providing the facilities to conduct the research.

Conflict of interest: The authors declare that there are no conflicts of interest

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