

## Influence of seed treatment with three recommended fungicides on the seed germination percentage of three wheat cultivars

Hussein Ali Salim<sup>\*1</sup>, Noora Bandar Maizar<sup>2</sup>, Liqaa Mohammed Shiblawi<sup>1</sup>, Ibrahim Khalil Aswad<sup>1</sup>, Hiba Salman Gasam<sup>1</sup>, Donia Ali Zedan<sup>1</sup> and Balqees Othman Rosoki<sup>1</sup>

<sup>1</sup>Directorate of Diyala Agriculture, Ministry of Agriculture

<sup>2</sup>Ministry of Higher education, Diyala University, Iraq

\*E-mail: [h\\_salim11111@yahoo.com](mailto:h_salim11111@yahoo.com)

### Abstract

The aim of this study was to evaluate the effect of seed treatments of three wheat cultivars (Farris, Al-Baraka, and Iba 99) with three fungicides (Raxil, Dividend, and Carboxin) on seed germination percentage under laboratory and field conditions. The results of the study indicate that an interaction between fungicides and wheat cultivars was significant in seed germination percentage, where treatments of Iba 99 with control recorded the highest value of germination 90% after 6 and 10 days of planting, whereas Farris and Al-Baraka cultivars gave the highest significant value in the seed germination mean of 92.91% compared to Iba 99 cultivar 85.41%, and the treatments of Al-Baraka with control and Farris with Carboxin recorded a high germination percentage (96.66%) when combining fungicides and wheat cultivars after 13 days of planting in the petri dishes. Farris and Al-Baraka cultivars were superior in the seed germination mean (62.91% and 75%, respectively) compared to the Iba 99 cultivar (25.83%), and the treatments of Al-Baraka with Carboxin recorded a high germination percentage of 80% when combining fungicides and wheat cultivars after 11 days from sowing in the pots.

**Key words.** Germination percentage, wheat cultivars, fungicides

### Introduction

As high-yield agricultural products, the Iba 99 and Al-Baraka cultivars are very important economically in Iraq. Their main contributions are to food security and economic diversification. Seed treatment provides an efficient way to protect the seeds against fungi, insects, and other pests and plays a vital role in controlling diseases and improving the vigor of the seedling. Once planted, the seed is exposed to the deleterious effects of the soil pathogens; thus, the majority of the wheat seed is treated with fungicides, which lead to a more uniform seedling emergence, healthier plants, and significantly reduced disease damage. There are positive environmental impacts for seed

treatment, where the fungicide covers the small seed surface completely, thus protecting the germinating seed and reducing the need to apply fungicides over the entire field. Prior to the introduction of fungicides, hot water treatments were the only way to reduce smut infection levels. Treated seed with a fungicide inhibits surface-borne fungi on the seed coat and protects against soil-borne fungi. The seed treatment with fungicides has been the usual practice in Iraq for the control of smuts for many years. Several fungicides have been recommended for control of seed-borne fungi in wheat crops. Raxil, Dividend, and Carboxin are systemic seed dressing fungicides that control seedborne diseases in wheat and smut

diseases in cereals such as covered smut and loose smut in wheat, barley, and oats. The systemically translocated triazole fungicides such as Raxil and Dividend are effective for controlling cereal smuts and various other diseases [10,2,6,4]. The objective of this study was to investigate the influence of fungicides, viz., raxil, dividend, and carboxin, on the germination of three wheat cultivars, viz., Farris, Al-Baraka, and Iba 99.

### Materials and methods

The experiment was conducted at the plant diseases laboratory and Baqubah Nursery in the Directorate of Diyala Agriculture, Iraq, in 2019 to determine the effect of three seed treatments with fungicides such as Raxil, Dividend, and Carboxin on the germination of three winter wheat cultivars, viz., Farris, Al-Baraka, and Iba 99. The fungicides were applied in recommended doses of 1.5 kg per ton of seed for Raxil and 1.5 L per ton of seed for Dividend and Carboxin on November 28, 2019. In the laboratory experiment, which was done under controlled conditions, the chemical fungicides were directly applied to each of the cultivar seeds that had previously been moistened with water in the recommended ratio into petri dishes; untreated seed without any fungicide served as a control, and then the seeds were dried in the shade. 20 seeds were kept in each 9-cm petri dish, which contains double-layered wet papers with three replications for each treatment. They were placed in the growth chamber at 20°C on December 2, 2019, and then water was added as needed. Sprouted seeds were counted at 6, 10, and 13 days after sowing, and the percentage of germination was measured using the following formula:

Germination (%) = (Number of germinated seeds / Total number of seeds) × 100

The pot experiment was done under field conditions, where the treated seeds were sown in each pot (20 seeds) on December 11, 2019, the sprouted seeds were counted, and the germination percentage 11 days after planting was measured. A factorial experiment design was carried out with two factors, viz., cultivars and fungicides, and three replicates for each treatment. The analysis of variance (ANOVA) technique was applied for drawing conclusions from the data; the calculated values were compared to the tabulated values at a 5% level of probability [3].

### Results and Discussion

The results of the germination percentage mean revealed that there were no significant differences between fungicides and wheat cultivars after 6 and 10 days, whereas the interaction of fungicides and wheat cultivars gave the highest value of germination percentage in the treatments of Iba 99 with control 90%, while the treatments of Farris with Raxil and Al-Baraka with Raxil gave the lowest value of germination percentage, reaching 50% and 60% after 6 and 10 days, respectively. Farris and Al-Baraka cultivars were superior in the seed germination mean of 92.91% compared to Iba 99 cultivar 85.41%, whereas control treatment led to an increase in seed germination mean of 95% compared to fungicides that showed non-significant among them, while an interaction between fungicides and wheat cultivars was significant, where the treatments of Al-Baraka with control and Farris with Carboxin recorded high germination percentages of 96.66%, whereas treatments of Iba 99 with Carboxin recorded a low 80% after 13 days (Table 1).

The results in Table (2) showed that superior of Farris and Al-Baraka cultivars in the seed

germination mean which reached 62.91% and 75% respectively compared to Iba 99 cultivar 25.83%, while no significant differences between cultivars, whereas the interaction between fungicides and wheat cultivars was significant, where the treatments of Al-Baraka with Carboxin were recorded high germination percentage reached 80% and treatments of Iba 99 with control were recorded low germination percentage 13.33% after 11 days from sowing in the pots.

The results of the study indicate that there are differences in seed germination percentage of wheat cultivars that were treated with fungicides through the interaction between them, where cultivars of Farris and Al-Baraka were better than the Iba 99 cultivar, while there were no differences between fungicides and the control on germination percentage. Application of fungicides leads to enhanced seedling germination, in addition to

reducing seed decline and fungal infection in crops [9,1,8]. In some cases, covering seeds with fungicides may cause germination to be delayed [5]. [11] reported that there is an increase in seed germination through the seed treatment with Raxil and Vitavax (carboxin). [7] reported that an interaction between cultivars and fungicides was important, which indicated a genotypic response as well as the adverse effect of seed treatments on seedling emergence.

### Conclusion

The results of the conducted study indicate that there are differences in seed germination percentage when combining wheat cultivars and fungicides, whereas Farris and Al-Baraka cultivars were superior on the Iba99 cultivar and there were no differences between fungicides and control in seed germination percentage.

**Table 1.** Effect of fungicides on seed germination percentage of wheat cultivars in petri dishes after 6,10 and 13 days of planting

After 6 days					
A- Wheat cultivars	B- Pesticides				
	Raxil	Dividend	Carboxin	Control	Mean
Farris	50	60	88.33	60	64.58
Al-Baraka	58.33	66.66	76.66	81.66	70.83
Iba 99	75	70	66.66	90	75.41
Mean	61.11	65.55	77.22	77.22	
CD 0.05	A= 19.08, B= 22.03, A x B= 38.17				
After 10 days					
Farris	63.33	60	88.33	56.66	67.08
Al-Baraka	60	75	81.66	88.33	76.25
Iba 99	83.33	78.33	70	90	80.41
Mean	68.88	71.11	80	78.33	
CD 0.05	A= 15.73, B= 18.17, A x B= 31.47				
After 13 days					
Farris	90	90	96.66	95	92.91
Al-Baraka	86.66	95	93.33	96.66	92.91
Iba 99	86.66	81.66	80	93.33	85.41
Mean	87.77	88.88	90	95	
CD 0.05	A= 5.84, B= 6.75, A x B= 11.69				

**Table 2.** Effect of fungicides on seed germination percentage of wheat cultivars in pots after 11 days of planting

After 11 days (Pots)					
A- Wheat cultivars	B- Pesticides				
	Raxil	Dividend	Carboxin	Control	Mean
Farris	71.66	55	60	65	62.91
Al-Baraka	75	70	80	75	75
Iba 99	43.33	21.66	25	13.33	25.83
Mean	63.33	48.88	55	51.11	
CD 0.05	A= 21.24, B= 24.53, A x B= 42.48				

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