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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(10): 1447-1450

www.thepharmajournal.com
Received: 06-08-2023
Accepted: 16-09-2023

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Efficacy of different seed dressing fungicides and foliar spray on seed quality in durum wheat (*Triticum durum* L.)

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Abstract
The present experiment was conducted during *rabi* 2022-23 at H block Main Agricultural Research Station, University of Agricultural Sciences Dharwad. The experiment comprised of nine different treatments with three replications in randomized block design. Before sowing seeds were treated with different fungicides at different concentrations to control seed borne infections in Durum wheat. *viz*., T_1: Control (Untreated), T_2: Seed treatment with Carboxin 37.5%+ Thiram 37.5% @ 0.3%, T_3: Seed treatment+ foliar spray with Carboxin 37.5%+Thiram 37.5% @ 0.2%, T_4: Foliar spray with Propiconazole @ 0.1% at 30 DAS, T_5: Seed treatment with Penflufen 13.28%+ Trifloxystrobin 13.28% @ 0.2%, T_6: Seed treatment with Penflufen 13.28% + Trifloxystrobin 13.28% @ 0.2% and foliar spray with Propiconazole @ 0.1% at 30 DAS, T_7: Seed treatment with Thiophanate methyl 45% + Pyroclrostrobin 5% @ 0.2%, T_8: Seed treatment with Carbendazim 50% WP @ 0.2%, T_9: Seed treatment With Carbendizim 25% + Mancozeb 50% @ 0.2%. Durum wheat seeds of the variety UAS – 446 were collected from seed unit, Main Agricultural Research Station, UAS, Dharwad Karnataka. After harvest seeds were collected and recorded seed quality parameters such as germination (%), root length (cm), shoot length (cm) and seedling vigour index. Further the data obtained was subjected to statistical analysis. The results revealed that among different seed treatments, seeds treated with Carbendazim 50%+ Mancozeb 25% WS @ 0.2% recorded significantly higher germination (90.33%), root length (17.06 cm), shoot length (14.82 cm) and increased seedling vigour index (2878) followed by seeds treated with Carbendazim 50% compared to control (80.00%), (12.54 cm), (10.07 cm) and (1939) in Durum wheat

Keywords: Durum wheat, seed treatment, Carbendazim, seed infection

Introduction

Wheat, belongs to poaceae family and it is an incredibly significant cereal crop that feeds one-third of the world's population and recorded as staple food according to (Kerasa *et al.*, 2000) [7]. Because of its vast cultivation area, ability to provide high productivity, and prominent position in international food grain trade, it has been. referred to as the "King of cereals." India is one of the few countries in the world where in, all three genotypes of wheat are *viz*., *Triticum aestivum* (95% area), *Triticum durum* (4% area) and *Triticum dicoccum* (1% area) are grown. The majority of cultivated wheat varieties come under three primary species of the *Triticum* genus: the hexaploid *Triticum aestivum* L. (bread wheat) with 2n=42 chromosomes, the tetraploid *Triticum durum* and *Triticum dicoccum* with 2n=28 chromosomes and the diploid *Triticum monococcum* with 2n=14 chromosomes, as stated by Kimber and Feldman (1987) [8].

Wheat has a favourable nutritional profile, containing 12.1% protein, 1.8% lipids, 1.8% ash, 2.0% reducing sugars, 6.7% pentosans, 59.2% starch and 70% total carbohydrates, providing 314 k cal/100 g of food. Wheat is the most extensively-cultivated cereal crop, accounting nearly 30% of the world's grain production and 50% of the world's grain trade. According to FAO projections, the world will require an additional 198 million tonnes of wheat by 2050 to meet future demands, necessitating 77% improvement in wheat production in developing countries by Reilly *et al.* (2015) [10].

Occurrence of disease is a crucial obstacle to economic seed production leading to significant losses. Wheat is vulnerable to various infections, starting from seed germination to seed development and maturity. The production of wheat is hindered by seed-borne diseases, which are considered significant stumbling blocks. Seed-borne fungal infections pose a significant threat to seed quality, leading to a decline in production and overall seed quality. To combat these issues, it is essential to employ effective contact and systemic fungicides as seed treatment chemicals. Seed dressing fungicides offer protection against seed-borne pathogens that could impede seed germination or infect seedlings soon after germination. Furthermore, they provide growth substances that facilitate better seed germination.

Materials and Methods

The present field study was carried out during *rabi* 2022-23 at H block Main Agricultural Research Station, University of Agricultural Sciences Dharwad, Seed quality investigations were carried out in the Department of Seed Science and Technology, University of Agricultural Sciences, Dharwad Karnataka. Seeds of Durum wheat *var*. UAS-446 used for the experiment were collected from the Seed Unit Main Agricultural Research Station, University of Agricultural Sciences, Dharwad.

Observations recorded

Germination (%): The standard germination test was conducted by adopting the rolled paper towel between paper method in four replications of randomly drawn 100 seeds and placed at slanting position in a cabinet seed germinator at constant temperature of 25 ± 1^0C and 95 ± 1 percent relative humidity. On 8^{th} day (final count) of germination test, number of seeds germinated counted and expressed as germination percentage.

$$\text{Germination (\%)} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds}} \times 100$$

Root length (cm): From the germination test, the root length of ten randomly selected normal seedlings ware measured on 8^{th} day (final count) from the tip of primary root to the base of hypocotyls and will be expressed in centimetre

Shoot length (cm): From each treatment and from all the replications of germination test, ten normal seedlings were randomly selected on 8^{th} day and the shoot length was measured from the base of primary leaf to the base of hypocotyls and mean shoot length was expressed in centimetre using metric scale.

Seedling vigour index I: The seedling vigour index I and seedling vigour index II were calculated by using the formula suggested by Abdul-Baki and Anderson (1973) [1].

Seedling vigour index I = Germination (%) x [Root length (cm) + Shoot length (cm)]

Results and Discussion

The data on various seed characteristics were significantly influenced by seed treatments with seed dressing fungicides are presented in the Table 1, Fig 1 and Fig 2. Among the various seed treatments, seed treatment with Carbendazim 50%+ Mancozeb 25% WS @ 0.2% (T_9) recorded significantly higher germination percent (90.33%), root length (17.06 cm), shoot length (14.82 cm) and seedling vigour index (2878) followed by seed treatment with Carbendazim 50% WP @ 0.2% (T_8) (89.33%, 15.00 cm, 13.49 cm, 2545). in seed treatment with Penflufen 13.28% + Trifloxystrobin 13.28% (Seed treatment) @ 2ml/kg of seeds +Propiconazole (Foliar spray) @1ml/litre (T_8) (86.00%, 14.98 cm, 13.22cm, 2405). Where as, seeds without any seed treatment shown significantly lower germination percent, root length, shoot length and seedling vigour index (80.00%, 12.54 cm, 10.07 cm, 1939, respectively) in Durum wheat variety UAS-446.

In the present investigation data pertaining to seed quality parameters like germination (%), root length and shoot length in Table 1, Fig 1 and Fig 2 has been significantly increased with respect to seed treatment with Carbendazim 25% +Mancozeb 50% @ 2g/ kg (SAAF). The increase in seed germination percentage, root length and shoot length might be due to the influence of seed treatment with the combinational fungicide which helps in prevention of seed from attack of pathogens in early developmental stage which helps in reducing degradation of reserve metabolites which helps during the germination and seedling establishment. The obtained results are in accordance with the results reported by Hegde *et al.* (2000) [6] in rice, Platz *et al.* (2001) [9] in wheat crop. Gowda *et al.* (2020) [5] in soybean crop. (Shivankara *et al*., 2000) [11] in wheat. Anitha *et al.* (2013) [2] revealed that influence of seed treatment with Carbendazim 25% +Mancozeb 50% 0.2% which has systemic mode of residual action and additional benefit of Zn and Mn which helps in increasing the metabolic activities of the enzymes and those enzymes will make the enormous division and enlargement of root length and shoot length by plumule meristem along with shoot cells.

The data with respect to seedling vigour index which was increased in seed treatment with Carbendazim 25%+Mancozeb 50% @2g/ kg (SAAF) in comparison with other treatments and control. The vigour of the crop determined by the rate of germination and development of shoot length and root length. These results are in accordance with the data of El kholy (1999) [3] in wheat, Gnyandev *et al* (2009) [4]. Nagavani (2005) who reported that seed treatment with the effective fungicide Carbendazim 25% +Mancozeb 50% which controls many seed borne pathogens like *Fusarium* spp., *Alternaria* spp, and *Rhizopus* spp which are major hindrance to the germination and seedling vigour.

Table 1: Effect of seed treatment and foliar spray on germination, root length, shoot length and seedling vigour index of Durum wheat

Treatment details	Germination (%)	Root length (cm)	Shoot length (cm)	SVI
T_1: Control	80.0 (61.34)	12.54	10.07	1939
T_2: Carboxin 37.5% + Thiram37.5% (Seed treatment) @ 3g/kg of seeds.	83.0 (65.67)	13.12	13.37	2120
T_3: Carboxin 37.5% + Thiram 37.5% (Seed treatment @ 2g/kg of seeds) + (Foliar spray @ 1 ml/litre)	82.0 ((64.34)	14.59	12.54	2225
T_4: Propiconazole (Foliar spray) @ 1ml/litre @ 30 DAS	81.0 (62.50)	13.66	12.05	2100
T_5: Penflufen 13.28% + Trifloxystrobin 13.28% (Seed treatment) @ 2ml/kg of seeds	81.7 (64.17)	14.31	12.45	2186
T_6: Penflufen 13.28% + Trifloxystrobin 13.28% (Seed treatment) @ 2ml/kg of seeds +Propiconazole (Foliar spray) @1ml/litre	86.0 (68.06)	14.98	13.22	2406
T_7: Thiophanate methyl 45%+Pyraclostrobin 5% (Seed treatment) @ 2ml/kg of seeds	81.4 (62.26)	14.74	13.12	2281
T_8: Carbendazim 50% (Seed treatment) @ 2g/kg of seeds	89.3 (71.94)	15.00	13.49	2545
T_9: Carbendazim 25% + Mancozeb 50% (Seed treatment) @ 2g/kg of seeds	90.3 (70.96)	17.06	14.82	2878
S.Em (±)	0.77	0.68	0.39	81.02
CD (1%)	2.31	2.04	1.25	317.63

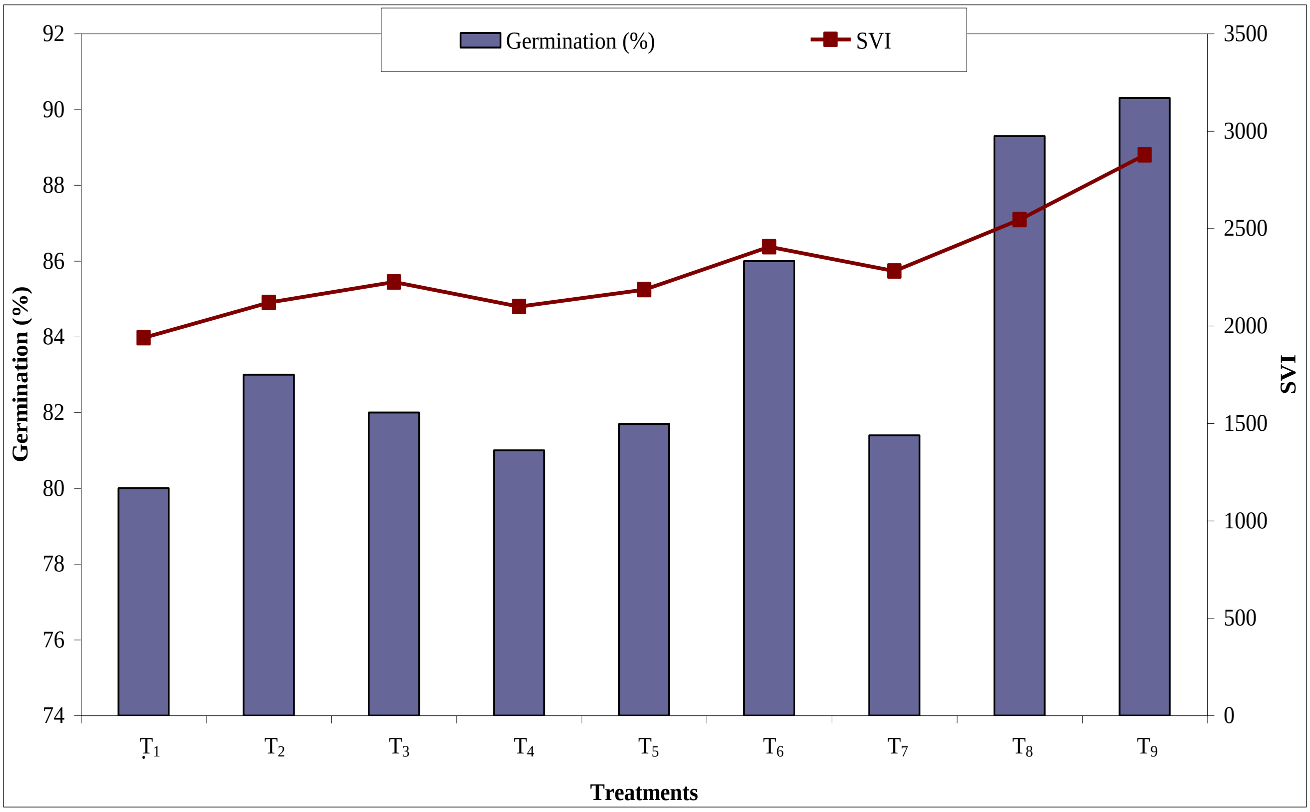

Fig 1: Effect of seed treatment and foliar spray on germination and seedling vigour index of durum wheat

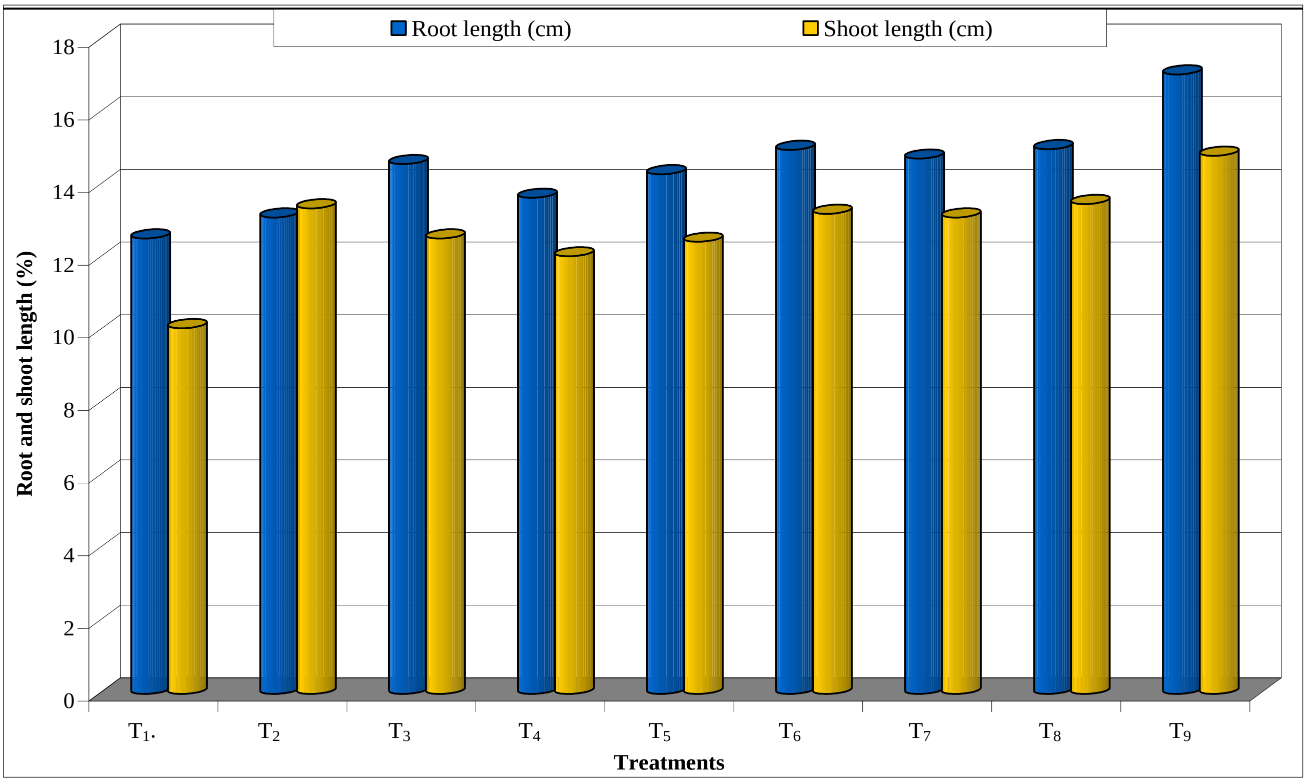

Fig 2: Effect of seed treatment and foliar spray on root length and shoot length of Durum wheat

Conclusion

Seed treatment with Carbendazim 25%+Mancozeb 50% @ 2g/ kg (SAAF) seeds before sowing is an effective method to enhance several key seed quality characteristics. The application of seed dressing fungicides had a positive impact on seed quality. These fungicides effectively controlled seed-borne fungal pathogens, reducing the risk of seed borne diseases that can compromise seed quality. One of the most significant benefits observed was the improvement in germination rates. Treated seeds exhibited higher germination, root length and shoot compared to untreated seeds, indicating that seed treatment with fungicides has positively influenced seed germination potential and helps in quality seed production.

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