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Influence of Seed Film Coating Polymers on Seed Yield, its Components and Seed Quality Parameters of Rice

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ABSTRACT: The experiment was carried out to assess the influence of seed film coating polymers on seed yield and seed quality parameters of rice. The trial was conducted with four treatments by using the rice variety MTU-1010 both at field and laboratory during 2015-16 and 2016-17 at Seed Research and Technology Centre, Rajendranagar, Hyderabad. The study revealed that effect of seed film coating polymers was found to be non-significant among the treatments studied forseed yield and its components. Treatment with Polymer DISCO AG SP RED L-200 + Thiram + Quick Roots/mycorrhiza showed slight superiority over other treatments for plant height, number of tillers plant^{-1}, number of filled grains panicle^{-1}, seed set (%) and seed yield plant^{-1}. Studies on influence of seed coating polymers on storage of paddy seed revealed that germination percentage was found to be non-significant for the treatments studied, while storage periods were found to be significant. The seed treatment with Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots/mycorrhiza showed significantly higher seedling length and seedling vigour index compared to other treatments. Regardless of the seed treatments, all the seed quality parameters declined as the storage period prolonged. The present investigation revealed that seeds treated with Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots/mycorrhiza was able to increase seedling vigour.

Keywords: Rice, seed coating polymer, seed yield, seed quality, germination, seedling vigour index.

INTRODUCTION

Seed treatment provides protection during the critical germination and seedling establishment stages when the seed and emerging seedlings are unable to protect themselves from invasive pathogens (Haynes *et al*., 1997 and West *et al*., 1985). Seed enhancements are used to promote good germination and improved seedling vigour resulting in a healthier crop and thus enhanced yield potential. Generally, seed coating contains nutrients and seed protectants like fungicides and insecticides (Komala *et al*., 2018). The main advantages of film coating on seeds includes regulation of rate of water imbibition, the transport and release of photoactive chemicals, fungicides/insecticides and personnel protection against toxic dust.

The polymer coating is easy to apply, quickly disperses and non-hazardous to seeds during germination. It also reduces the wastage of chemical, helps to hold all required nutrients which facilitate to improve the physiological potential of seeds besides protecting the seeds from fungal and insect attack. Seed film coatings improve the germination, protecting the seeds from adverse field conditions and environmental stress. It may act as a physical barrier and reduce the leaching of inhibitors from the seed coverings and may restrict oxygen diffusion to the embryo (Vanangamudi *et al.*, 2003). Polymer coating favours the exploitation of fullest potential of the plant protectants by way of preventing dusting and proper adherence of the material on the seed surface (Sivasakthi and Renganayaki 2022).

Seed quality during storage is affected by moisture content, temperature and relative humidity in the storage environment. Though the seed quality is governed by genetic makeup, proper seed storage and retention of viability are important for maintenance of seed vigour (Deepa *et al*., 2013). The objective of this experiment is to assess the effect of seed film coating polymers with fungicide and microbial seed inoculants on seed yield, its components and seed quality parameters.

MATERIAL AND METHODS

The study was carried out to evaluate the benefits of film coating polymers on seed yield and quality parameters of rice variety MTU-1010. Both field and storage studies were conducted to assess the effect of film coating polymers on seed yield and seed quality parameters. The field trial was laid out in randomized block design with five replications during *kharif*, 2015 and *kharif*, 2016 at Seed Research and

Technology Centre, PJTSAU, Rajendranagar, Hyderabad. The experiment consists of four treatments *viz*., T_1 (Untreated seeds used as Control), T_2 (Polymer DISCO AG SP RED L-200 + Thiram + Carboxine), T_3 (Polymer DISCO AG SP RED L-200 + Thiram + Genius Coat) and T_4 (Polymer DISCO AG SP RED L-200 + Thiram + Quick Roots / mycorrhiza). Treatment wise seedlings were raised in nursery bed and 25 days old seedlings were transplanted in main field with a spacing of 20 cm between rows and 15 cm plant to plant. Recommended package of practices and need based plant protection measures were taken up to raise the healthy crop. Observations were recorded for the traits *viz*., days to 50% flowering, days to maturity, plant height (cm), internode length (cm), panicle length (cm), number of productive tillers plant^{-1}, number of filled grains panicle^{-1}, seed setting (%)and seed yield plant^{-1}(g). Ten randomly selected plants from each treatment and replication were used for recording the data on seed yield and its attributes. The data on days to 50% flowering and days to maturity were recorded on plot basis.

The laboratory study was conducted to assess the effect of film coating polymers on seed quality parameters during storage. The experiment was conducted in factorial completely randomized design and data was collected at bimonthly interval upto six months of storage. Observations were recorded for germination (%), seedling root length (cm), seedling shoot length (cm) and seedling vigour index. Standard laboratory test for germination was conducted as per the ISTA rules by adopting between paper method. Seed germination was calculated as number of normal seedlings obtained to the total number of seeds tested and expressed as percentage.

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

Ten normal seedlings were selected randomly from each treatment and replication on 14th day for measuring root length and shoot length. The root length was measured from the cotyledonary node to tip of the primary root using a linear scale. Ten seedlings used for recording root length were utilized for measuring the shoot length. The shoot length was measured from the collar region to the apex. The average value was computed and expressed in centimeter. The seedling vigour index-I was calculated as per the method suggested by Abdul-Baki and Anderson (1973) and expressed in whole number.

Seedling Vigour Index-I = Germination (%) × Seedling length (cm)

The mean data were subjected to statistical analysis as per the procedure given by Panse and Sukhatme (1985) and the data was analysed using the Windostat software.

RESULTS AND DISCUSSION

The results revealed that effect of polymer coating along with seed treating chemicals exhibited non-significant differences for seed yield and its components (Table 1). Among the treatments evaluated, seed coating with Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots / mycorrhiza showed slight numerical superiority for the traits such as plant height (94.74 cm), productive tillers plant^{-1} (13.98), number of filled grains panicle^{-1} (139.0), seed setting (90.76%) and seed yield plant^{-1} (29.80 g). Whereas the control (untreated seed) showed lower seed yield plant^{-1} (26.44 g) and its component traits. Higher seed yield in T_4 is attributed to higher productive tillers, filled grains panicle^{-1}and seed set (%). Similar results were observed by Dutta and Bhattacharya (2020) who reported that seed treatment with Polymer (DISCO AG SP RED L-200) + Thiram + Quick roots/Mycorrhiza influenced more translocation of nutrients from root zone thereby increased the number of tillers hill^{-1} and seed yield compared to control (T_1). Gevrek *et al.* (2012) who reported that seed treatment with GA_3 @ 1000 mg/L of water using seed film coating technique increased seed yield of rice.

Seed storage studies were conducted to evaluate the effect of seed film coating polymers on seed quality parameters such as germination (%), seedling length and seedling vigour index at bimonthly interval (Table 2). A narrow range of variation was observed for the trait germination percentage which varies from 93.61 to 94.22 and 92.67 to 95.04 for the seed treatments and storage periods studied respectively. Non-significant differences were observed for the seed treatments evaluated while storage periods showed significant differences. Whereas interaction effects between seed treatments and storage period were found to be non-significant. Irrespective of the seed treatments, germination percentage was declined as storage period prolonged. Seedling length was found to be significantly different for the seed treatments and storage periods studied. Seed treatment with Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots/mycorrhiza (T_4) was found to be significantly superior over other treatments. Seedling length was found to be high in 2MAS which was significantly superior over 4MAS and 6MAS. The influence due to seed treatments and storage periods on seedling length revealed the existence of significant differences among the interactions. The treatment T_4 at different storage periods studied showed superiority over other interactions. Different storage periods studied revealed that seedling length was gradually decreased from 2MAS to 6MAS with a mean reduction of 21.72%.

Higher mean seedling vigour index was noticed in the treatment Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots/mycorrhiza (2446) while lowest recorded in control (2203). Significant differences were recorded for seed treatments, storage periods and interaction effects. Among the different seed treatments evaluated, seeds treated with Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots/mycorrhiza registered significantly superior performance than other treatments. This is in accordance with the findings of Dutta and

Bhattacharya (2020) who reported superiority for seeding length and seedling vigour index. Higher seedling vigour index in polymer coating along with fungicide and bioagent might be due to higher germination percentage, low electrolyte leakage and less pathogen attack. Decreasing trend in seedling vigour index was observed as storage period advanced and it showed a mean reduction of 23.71 % at the end of storage period. The decrease in seedling vigour index may be due to age induced decline in germination and seeding length.

Table 1: Effect of seed film coating polymers on seed yield and its components in rice.

Treatment	Days to 50% flowering	Days to maturity	Plant height (cm)	Internode length (cm)	Panicle length (cm)	No. of productive tillers plant^{-1}	No. of filled grains panicle^{-1}	Seed setting (%)	Seed yield plant^{-1} (g)
Untreated seed (T_1)	93.40	125.20	90.74	10.34	20.84	12.82	132.80	89.72	26.44
Polymer (DISCO AG SP RED L-200) + Thiram + Carboxine (T_2)	94.00	124.90	93.36	10.92	21.82	12.80	135.80	90.42	28.18
Polymer (DISCO AG SP RED L-200) + Thiram + Genius Coat (T_3)	94.00	124.90	92.84	10.66	22.16	13.26	132.40	90.10	28.36
Polymer (DISCO AG SP RED L-200) + Thiram + Quick Roots / mycorrhiza (T_4)	94.40	125.0	94.74	9.94	22.38	13.98	139.00	90.76	29.80
GM	93.95	125.00	92.92	10.46	21.8	13.215	134.98	90.25	28.19
CV (%)	0.757	0.725	6.801	9.586	5.376	6.314	6.152	1.865	7.904
SE(d)	0.450	0.573	3.996	0.634	0.741	0.527	5.252	1.064	1.409
CD@5%	0.980	1.248	8.708	1.382	1.615	1.149	11.443	2.310	3.071

Table 2: Influence of seed film coating polymer on seed quality parameters of rice during storage.

Treatment	Germination (%)				Seedling Length (cm)				Seedling Vigour Index-I			
	2MAS	4MAS	6MAS	Mean	2MAS	4MAS	6MAS	Mean	2MAS	4MAS	6MAS	Mean
T_1	95.17	93.50	92.17	93.61	25.60	24.87	20.03	23.50	2438	2326	1846	2203
T_2	94.83	93.83	92.50	93.72	26.13	26.73	20.97	24.61	2480	2506	1939	2308
T_3	95.00	93.67	92.83	93.83	27.27	25.83	21.07	24.72	2592	2418	1955	2322
T_4	95.17	94.33	93.17	94.22	28.70	26.90	22.23	25.94	2731	2536	2070	2446
Mean	95.04	93.83	92.67		26.93	26.08	21.08		2560	2447	1953	
	C.D@5%	**SE(d)**	**SE(m) (±)**		**C.D@5%**	**SE(d)**	**SE(m) (±)**		**C.D@5%**	**SE(d)**	**SE(m) (±)**	
T	NS	0.319	0.226		0.55	0.27	0.19		49.91	24.04	17.00	
S	0.574	0.276	0.195		0.48	0.23	0.16		43.23	20.82	14.72	
T x S	NS	0.553	0.391		0.95	0.46	0.33		86.45	41.64	29.44	

T_1 - Untreated seed (Control)
T_2 - Polymer (DISCO AG SP RED L-200) + Thiram+Carboxine
T_3 - Polymer (DISCO AG SP RED L-200) + Thiram + Genius Coat
T_4 - Polymer (DISCO AG SP RED L-200) + Thiram+ Quick Roots / mycorrhiza
MAS- Months after storage, T-Treatment, M- Storage period

CONCLUSION

Based on the study it can be understood that there was no significant effect of seed film coating polymers on seed yield and its components in rice. However, seed treatment with Polymer (DISCO AG SP RED L-200 + Thiram + Quick roots/Mycorrhiza) showed superiority for seed quality traits such as seedling length and seedling vigour index. Further validation of results and identification of newer effective formulations are required for better delivery of the products.

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Conflict of Interest. None.

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