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RESEARCH PAPER

In vitro evaluation of seed dressing fungicides against seed borne diseases of Bt cotton by paper towel method

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Abstract: The research experiment was conducted in laboratory during 2020 to test the efficacy of different seed dressing fungicides against seed borne fungal infections in Bt cotton (DCH-32) by using paper towel method. The results of the experiment revealed the least per cent seed infection of 9.33 per cent was noticed in seed treatment with carboxin 37.5% WS + thiram 37.5% WS @ 2 g/ kg of seed and next best treatment was seed treatment with penflufen 13.28% w/w FS + trifloxystrobin 13.28% w/w FS @ 2 g/ kg of seed with seed infection of 12 per cent as compare to control with per cent seed infection of 32.67.

Key words: Bt cotton, DCH-32, Paper towel method, Seed borne fungal infection

Introduction

Cotton (*Gossypium* spp.) is one of the most important fibre crops, playing a key role in economic and social status of the world. Cotton locally known as "White Gold" and is also king of cash crops. Cotton crop is primarily cultivated for its fibre, which is used as textile raw material. Cotton seed is crushed to extract oil for human consumption and left over cake are used as cattle feed, which is a source of high quality protein for animals. The oil content of cotton seed varies from 15 to 25 per cent depending on the variety. Cotton seed cake after extraction of oil is an excellent organic manure that contains about 6 per cent nitrogen, 3 per cent phosphorus and 2 per cent potash. One of the reasons for the low productivity of Indian cotton is the biotic and abiotic stresses, to which the cotton is being exposed. After the introduction of Bt cotton hybrids in 2002, there is a subsequent continuous increase in area under these hybrids, the disease scenario has also undergone some changes (Monga *et al*., 2011).Various seed and soil borne diseases of cotton influence the seed germination, emergence, survival and plant stand in the field, as a result of which decline in cotton production and productivity is seen across the globe. The majority of diseases that infect cotton are seed borne *viz., Alternaria* blight, *Bacterial* blight, *Fusarium* wilt, *Myrothecium* blight, *Cercospora* blight *etc.* The existing seed treatment procedure for Bt cotton comprises only seed treatment with imidacloprid 70 per cent w/w (Gaucho 70 WS) to protect the seed and the seedlings from the sucking pest's damage. However, its role in providing protection to the seed borne fungal and bacterial infections in cotton is not clearly known. Hence to manage other seed borne fungal infections, seed treatment with seed dressing chemicals are necessary.

Material and methods

The present investigation was conducted at Department of Plant Pathology, College of Agriculture, Dharwad, University of Agricultural Sciences, Dharwad. Paper towel method was employed to know the effect of different seed treatments on seed borne inoculums as per the International Seed Testing Association Rules (ISTA). Genotype used in the experiment was hybrid DCH-32 (Bt version). Randomly selected 50 seeds were placed on a layer of moist germination paper and then it was covered with another layer of moist germination paper which was placed on a polythene paper and rolled carefully to avoid any excess pressure on seeds, consists of twelve treatments including control and each treatment were replicated thrice. These towels were incubated in seed germinator at 25±2 ºC for 12 days. Shoot length and root length of randomly selected ten seedlings were measured and germination percentage and per cent seed infection were recorded.

Per cent germination = (No. of seeds germinated / Total No. of seeds taken) ×100.

Per cent seed infection = (No. of seeds infected / Total No. of seeds taken) ×100.

Vigor index was calculated by the following formula, given by Abdul and Anderson (1973).

Vigor Index = Seed germination (%) × Seedling length (Shoot + Root length (cm))

The trade name, common name and chemical names of the fungicides used in the experiment are given below.

Results and discussion

Efficacy of different seed dressing fungicides, were tested for their efficacy against seed borne fungal infections in Bt cotton by using paper towel method, as explained in 'Material and methods' and results are presented in table 1, plate 1. The results indicated that all the treatments were significantly superior over untreated control. From the data, it is clear that the least per cent seed infection of 9.33 per cent with 71.43 per cent seed infection decrease over control was noticed in seed treatment with carboxin 37.5% WS + thiram 37.5% WS @ 2 g/ kg of seed, having per cent germination of 88.00 per cent with vigour index of 2976.13, which is found to be on par with seed

Common name	Trade name	Chemical name	Dosage
Carbendazim 50% WP	Bavistin	2-(methoxycarbomyl)- benzimidazole	0.2%
Carboxin 37.5% WS + thiram 37.5% WS	Vitavax Power	3-(3-5-dichlorophenyl)-N-(1-methyl ethyl)-2-4-dioxo-1-lemadazolidine carboximide	0.2%
Captan 50% WP	Captaf	Captaf 50 WP N-trichloromethyl mercapta 4-cyclolexene-1-2-dicarboximide-Ntrichlormethyl Thiotetrahydropthalamide	0.2%
Captan 70% WP + hexaconazole 5% WP	Taqat	N-trichloromethylmercapta 4-Cyclohexene-1-2-dicarboximide-Ntrichlormethylthiotetrahydropthalamide +2-(2,4-dichlorophenyl) -(1-14-1,2,4- triazole-yl) hexan-2	0.2%
Tebuconazole 2DS (2% w\w)	Raxil	(RS)-1-p-chlorophenyl-4,4- dimethyl-3-(1H-1,2,4- triazol-1- yl methyl) pentan-3-ol	0.2%
Tricyclazole 18% WP+ mancozeb 62% WP	Merger	Mixture of manganese ethylene bis (dithiocarbamate) polymeric complex + 5-methyl-1, 2, 4,- triazole [3,4-b] [1,3]benzothiazole.	0.2%
Penflufen 13.28% w/w FS + trifloxystrobin 13.28% w/w FS	EverGol Xtend	Mixture of Penflufen 13.28% w/w + trifloxystrobin 13.28% w/w FS	0.2%
Thiram 75% WS	Thiride	Tetramethylthiuram disulfide Mixture of	0.2%
Fluxapyroxad 250 g/L SC + pyraclostrobin 250 g/L SC	Merivon	Fluxapyroxad 250 g/L + pyraclostrobin 250 g/L SC	0.2%
Thiophanate methyl 45% FS + pyraclostrobin 5% FS	Xelora	Mixture of Thiophanate methyl 45% FS + pyraclostrobin 5% FS	0.2%
Metalaxyl 35% WS	Apron	Methyl N-(methoxyacetyl)-N-(2,6-xylyl)-D-alaninate	0.2%
Control	—	—	—

Table 1. Efficacy of seed dressing chemicals against seed borne fungal infection and seedling vigour of Bt cotton by paper towel method

Treatment details	Dosage	Per cent seed germination	Per cent seed infection	Per cent seed infection decrease over control	Seedling vigour index
Carbendazim 50% WP	0.2%	81.33(64.40) *	20.67(27.04)	36.73	2652.20
Carboxin 37.5% WS +thiram 37.5% WS	0.2%	88.00 (69.73)	9.33 (17.79)	71.43	2976.13
Captan 50%WP	0.2%	84.00 (66.42)	16.00 (23.58)	51.02	2743.72
Captan 70% WP+ hexaconazole 5% WP	0.2%	82.00 (64.90)	22.67 (28.43)	30.61	2418.99
Tebuconazole 2DS (2% w/w)	0.2%	80.67 (63.92)	24.67 (29.78)	24.98	2283.16
Tricyclazole 18% WP+mancozeb 62% WP	0.2%	83.33 (65.91)	23.33 (28.89)	28.57	2469.28
Penflufen 13.28% w/w FS + trifloxystrobin 13.28 w/w FS	0.2%	86.00 (68.03)	12.00 (20.27)	63.27	2809.47
Thiram 75% WS	0.2%	83.33 (65.91)	14.00 (21.97)	57.14	2723.33
Fluxapyroxad 250 g/l SC + pyraclostrobin 250 g/l SC	0.2%	82.67 (65.40)	22.00 (27.97)	32.65	2531.89
Thiophanate methyl 45 % FS + pyraclostrobin 5% FS	0.2%	81.33 (64.40)	27.33 (31.52)	16.33	2443.15
Metalaxyl 35% WS	0.2%	80.67 (63.92)	29.33 (32.79)	10.20	2262.30
Control		80.00 (63.44)	32.67 (34.86)	-	1970.67
S.Em.±		1.22	0.97		72.08
C D @ 1%		3.67	2.90		216.23
C. V(%)		2.45	4.69		3.75

* Arcsine transformed values

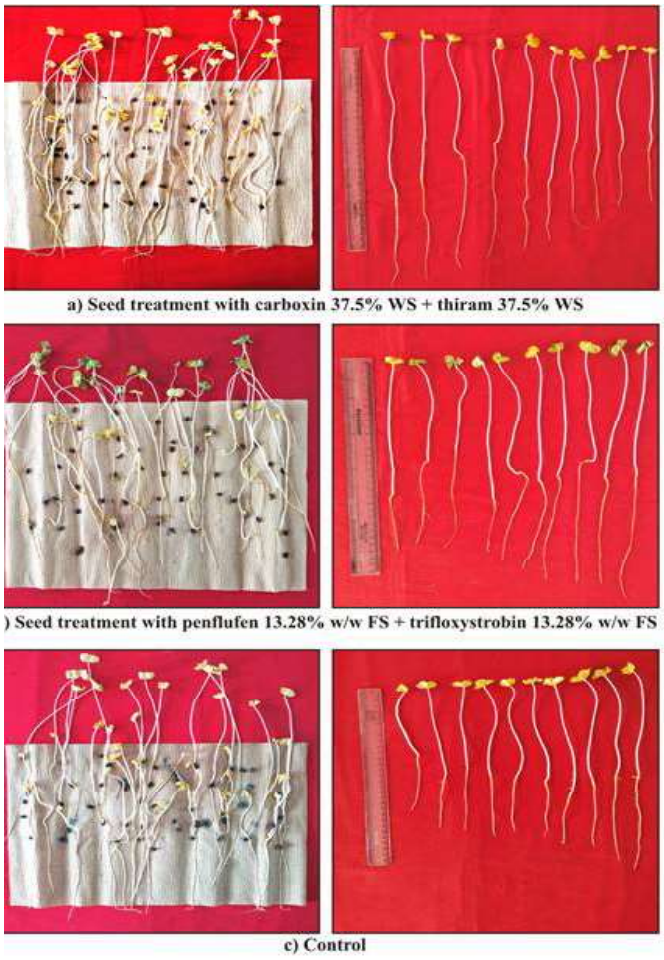

Plate 1. *In vitro* evaluation of seed dressing fungicides in Bt cotton by paper towel method

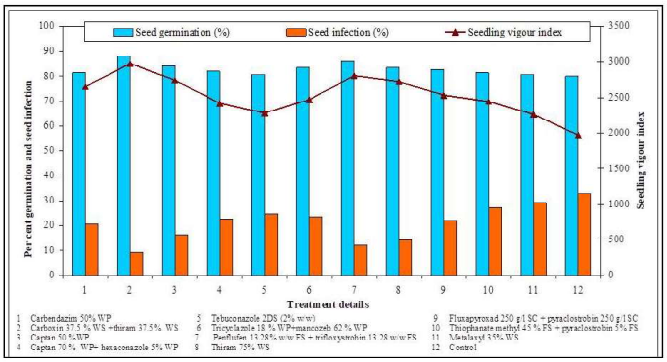

Fig 1. Graph representing the efficacy of seed dressing chemicals against seed borne fungal infection and seedling vigour of Bt cotton by paper towel method

treatment with penflufen 13.28% w/w FS + trifloxystrobin 13.28 w/w FS@ 2 g/ kg of seed with infection of 12.00 per cent, 63.27 per cent seed infection decrease over control, per cent germination of 86.00 and vigour index of 2809.47.While control recorded with least germination percentage of 80.00 per cent , high seed infection with 32.67 per cent and lowest vigour index with 1970.67. All treatments with seed dressing fungicides showed significant increase in seed germination, vigour index and per cent infection compared to control.

In vitro evaluation of seed dressing fungicides is very much necessary before they are taken to field. Hence, an attempt was made to evaluate eleven seed dressing fungicides in overcoming seed borne fungal infections of Bt cotton along with other seed contaminants by paper towel method. Results of the *in vitro* evaluation of fungicides by paper towel method in Bt cotton (hybrid DCH-32) indicated the efficacy of carboxin 37.5% WS + thiram 37.5% WS (vitavax power) and penflufen 13.28% w/w FS + trifloxystrobin 13.28% w/w FS (evergol xtend) in reducing seed borne fungal infections with higher percentage of germination, lower percentage of seed infection and higher vigour index compared to control (Fig. 1). Similar observations have been recorded by Sunilkumar *et al*. (2021), who reported the reduced per cent seed infection (7.33%) in seed treatment with carboxin 37.5% + thiram 37.5% against pod blight complex in soybean. Bhattiprolu (2018) investigated different seed treatment fungicides against seed and seedling disease of cotton among which penflufen 154 + trifloxystrobin 154 – 308 FS (w/v) exhibited superiority in germination and crop density at 14 days after sowing and seedling vigour at 28 days after sowing at dosage of 46.2 + 46.2 a.i./100 kg with maximum control of *Alternaria* leaf spot (58.34%) and upsurged yield (77.77%) with absence of phytotoxicity.

Conclusion

In vitro evaluation of different seed dressing fungicides were tested for their efficacy against seed borne fungal infections in Bt cotton (hybrid DCH-32) by using paper towel method. The least per cent seed infection, higher germination percentage and higher vigour index was noticed in seed treatment with carboxin 37.5% WS + thiram 37.5% WS @ 2 g/ kg of seed and the next best was seed treatment with penflufen 13.28% w/w FS + trifloxystrobin 13.28 w/w FS @ 2 g/ kg of seed. Result of the present study indicated the efficacy of combi-products than solo products as the combi-products consists of two molecules which can take care of wide range of seed borne inoculum.

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