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Influence of seed processing methods and seed treatments on seed mycoflora of guinea (*Panicum maximum*) and para (*Brachiaria mutica)* grasses

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Abstract
A study was undertaken to standardize suitable management strategy of seed borne mycoflora, maintaining the quality of seeds in guinea (*Panicum maximum*) and para (*Brachiaria mutica)* grasses. The experiment consisted of two seed processing methods (P_1: sweating method and P_2: non-sweating method) and nine seed treatments (S_1: seed treatment with captan (0.2%), S_2: seed treatment with vitavax power 0.2 % (carboxin + thiram), S_3: seed treatment with tebuconazole (0.2%), S_4: seed treatment with carbendazim (0.2%), S_5: seed treatment with carbendazim + mancozeb (sprint 0.2%), S_6: seed treatment with bioagent- *Pseudomonas fluorescens* (0.4%), S_7: seed treatment with bioagent- *Trichoderma harzianum* (0.4%), S_8: chemical control (dormancy treated but not with fungicide) and S_9: absolute control (without any treatment). The present study revealed para and guinea grass seeds were associated with different seed mycoflora *viz*., *Aspergillus flavus, Alternaria* sp. *Curvularia lunata, Bipolaris* sp. and *Rhizopus* sp. Seeds processed by non-sweating method found effective with highest field emergence (25.36% and 14.39%), seed germination (27.78% and 15.01%), seedling dry weight (16.69 mg and 39.50 mg), seedling vigor (395 and 218), thousand seed weight (0.96 g and 3.25 g) and lowest mycoflora incidence (19.45% and 37.64%) in both guinea and para grasses, respectively. Seed treatment with *Pseudomonas fluorescens* recorded lowest seed mycoflora incidence (13.73%) and highest field emergence (30.18%) in guinea grass and seed treatment with S_2 recorded lowest seed mycoflora incidence (25.86%) and highest field emergence (17.26%) in para grass. Seed quality parameters such as thousand seed weight, seed germination, seedling vigor and seedling dry weight were also found highest in the same treatments. Further results indicated that treatment combination of P_1 with S_2 and S_6 in guinea and para grass had positive effect.

Keywords: Quality, Seed mycoflora, Seed processing, Seed treatment, Tropical grasses

Introduction

Guinea (*Panicum maximum*) and para (*Brachiaria mutica)* grass are cultivated grasses and used extensively for fodder purpose in tropical parts of the world (Ram, 2009). As an excellent perennial fodder, these are much valued for their high productivity and palatability (Roy *et al*., 2019). Due to their perreniality and good persistence, these grasses can be profitably grown as a component of agro-forestry and plantation cropping systems (Nnadi *et al*., 2015). Being a perennial high yielding intensively cultivated forage grasses, they are propagated through seed and root slips. Establishment through root slips is highly successful and commonly practised. However, due to its bulkiness in both handling and transportation to cover larger areas, propagation through seeds is a better alternative. However, this alternative has the limitation of establishment (through nursery rising) and lower per cent of seed germination. Fast and synchronised germination is highly desirable to set successful forage grass pastures as well as to reduce the hazardous effects of weed species competition during the initial stages of seed germination. Nevertheless, most of the cultivated tropical forage grass species have low seed germination and variable seedling emergence periods (Herrera, 1994). Tropical grasses produces plenty of seeds, but the percentage of pure seeds in a seed lot is very low (Hopkinson *et al*., 1996; Parihar and Pathak, 2006). Apart from seed filling percentage and seed dormancy, seed borne pathogens play a vital role and influence the seed quality (Bahukhandi *et al*., 2017). Since the processing methodology followed in grasses is quite different from rest of the crops. Sweating method is used for the separation of seeds from the panicle in both the grasses. The panicles of these grasses are harvested at high moisture content to

avoid the seed shattering. Hence, the immature seeds are prone to seed mycoflora. The seed structure also has a very key role in influencing the entry of pathogens. The lemma and palea on seed coat is loosely held which may be the reason for entry of mycoflora. Similarly the higher moisture content is also one of the key factors. These immature seeds in the seed lot during imbibitions transfer the microorganisms to healthy seeds and make the seed lot vulnerable to microbial attack, thereby reducing the seed germinability and seed quality. There are also numbers of pathogens, whose presence in these grasses may serve as a reservoir for subsequent infection to other agricultural or horticultural crops (Clarke and Eagling, 1994). Harvesting the seeds at right time and stage helps in reducing the losses due to seed shattering and prevent the seed damages due seed borne mycoflroa. But the research works pertaining to management of seed borne mycoflora is very scanty. Hence, present study was undertaken to standardize suitable management strategy to maintain quality of grass seeds.

Materials and Methods

Study site: The field experiment was carried out during 2016-17 at Southern Regional Research Station (SRRS), ICAR-Indian Grassland and Fodder Research Institute (IGFRI), Dharwad (15^0 26' N and 75^0 7' E), India. The laboratory studies on seed treatment protocols to overcome seed borne infections and identification of seed borne mycoflora by standard blotter test method in guinea and para seeds were carried out in the Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Dharwad.

Experimental design: The treatments consisted of two seed processing methods (**P_1**: Sweating method and P_2: Non-sweating method) and nine seed treatments to overcome seed borne mycoflora (S_1: Seed treatment with captan, S_2: Seed treatment with vitavax power 0.2 % (carboxin + thiram) S_3: Seed treatment with tebuconazole (0.2%), S_4: Seed treatment with carbendazim, S_5: Seed treatment with carbendazim + mancozeb (Sprint), S_6: Seed treatment with bio-agent - *Pseudomonas fluorescens,* S_7: Seed treatment with bio-agent - *Trichoderma harzianum,* S_8: Chemical control (dormancy treated but not with fungicide) and S_9: Absolute control). Seeds were treated with fungicides @ 0.2% and bioagents @ 0.4% concentrations by following dry seed treatment with sprinkling of little water. Then the seeds were dried under shade. Eight replications of 25 seeds per treatment were tested in petri plate and then incubated in BOD incubators at 25±2^0 C under 12 hours of light and 12 hours of darkness. The untreated seed sample was used as control.

***Isolation and identification of seed mycoflora*:** Para and guinea grass seeds were examined for seedborne mycoflora by using standard blotter paper method (ISTA, 2012). Seed mycoflora observation was taken after seven days of incubation. The mycoflora associated with seed was recorded and observed using binocular compound microscope at 40X (Leica DM 2500 LED) for their morphological characteristics. They were identified based on identification keys (Woudenberg *et al*. 2013). The identification of fungi was done based on the spore morphology and colony characters of the fungus by referring to the 'Illustrated genera of Imperfect fungi' (Barnett and Hunter, 1972) and '*Dematacеous hyphomycetes*' (Ellis, 1971).

***Observations and data analysis*:** Observations were recorded on per cent incidence of seed borne fungi associated with treated and untreated seeds. Percent incidence of each micro-organism was calculated by using the following formula.

$$\text{Seed mycoflora incidence (\%)} = \frac{\text{Number of seeds recorded with fungi}}{\text{Total number of seeds examined}} \times 100$$

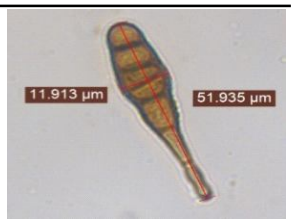
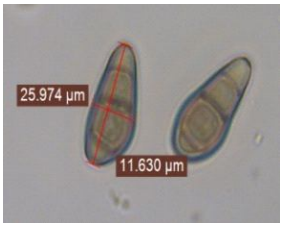
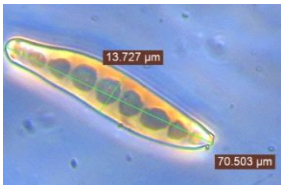
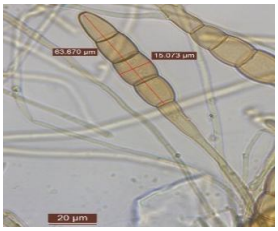
Seed quality parameters *viz.,* seed germination (%), field emergence (%), seedling dry weight (mg) seed vigour and test weights (g) were also recorded. The data were analysed using standard method of analysis for variance (ANOVA) for two factor completely randomized design (CRD) factorial concept for laboratory experiment as per Snedecor and Cochran (1994). The critical difference (CD) values were calculated at five per cent (P=0.05) and one per cent (P=0.01) probability level where 'F' test was significant.

Results and Discussion

***Seed mycoflora incidence*:** Seed mycoflora such as *Aspergillus flavus, Alternaria alternata, Alternaria* sp. *Curvularia lunata, Bipolaris* sp. and *Rhizopus* sp. of mycoflora were found associated with the seeds (Table 1). The percent incidence of *Bipolaris* sp. was highest (22.0%) in para grass seeds followed by *Curvularia lunata* (16.0%) and *Alternaria alternata* (13.50%). In case of guinea grass, highest percentage incidence (9.0%) was recorded by *Alternaria sp.* with long conidial beak. The occurrence and incidence of seed mycoflora differed

significantly due to seed treatments in both the grasses (Table 2). The treatment S_6 (seed treatment with P_2) recorded lowest mycoflora incidence (13.73%) in guinea grass and whereas, in para grass, significantly lowest (25.86%) mycoflora incidence was recorded in treatment combination (P_2S_2) and was significantly superior over other treatments. The control (S_9) recorded significantly highest mycoflora incidence of 27.49% and 70.96% in guinea and para grasses, respectively. Influence on seed mycoflora incidence due to interaction of seed processing methods and seed treatments was significant. Mycoflora incidence was found lowest (12.46%) in treatment combination of P_2S_6 in case of guinea grass, whereas in para grass, significantly lowest (25.44%) incidence was recorded with P_2S_2 treatment combination. The highest incidence of seed mycoflora (29.35% and 73.50%, respectively) was recorded in P_1S_9 in both the grasses. Various seed borne pathogens could be attributed to the deteriorating effects induced by one or few seed-infecting mycoflora along with prevailing atmospheric conditions in the area or in the field during seed developing stage, harvesting time etc. The main source of the infection and development of symptoms on the seed might be due to the infected reproductive parts which were yielded from severely infected fields by number of fungal diseases as investigated earlier by Patel (2003). Per cent mycoflora incidence differed significantly due to seed treatments in both the grasses. Seed treatments with *T. harzianum* (Khanna *et al*., 2003; Singh *et al.,* 2005), *P. fluorescens* (Sarkar and Bhattacharya, 2008) and seed bacterization with *P. fluorescens* (Minaxi and Saxena, 2010) were reported earlier as very effective to get maximum seed germination, seedling vigour index and management of *M. phaseolina.*

Table 1. Percent incidence of important seed mycoflora with seeds of guinea and para and their morphological characteristics

Seed mycoflora	Incidence (%)*		Morphological characteristics	Conidial shape and size (representative)
	Guinea grass	Para grass		
Alternaria alternata	9.0	13.5	Conidia arranged in acropetal manner and multicellular; Conidium is obpyriform with a short conical or cylindrical beak, pale brown coloured; size: 9.34 µm-14.24 µm x 43.28 µm-64.72 µm	
Curvularia lunata	6.5	16.0	Elongated geniculate conidiophore; conidia are pale brown with three or more transverse septa and conidia are cylindrical or slightly curved, with one of the central cells often being larger and darker; size 8.37 µm-14.5 µm x 18 µm-31.8 µm	
Bipolaris sp.	5.0	22.0	Microscopic morphology showed sympodial development of pale brown pigmented; pseudoseptate conidia on a geniculate conidiophore; size: 10.5 µm-16.7 µm x 42.28 µm-94.2 µm	
Alternaria sp.	-	11.5	Large conidia with long beak, pale brown coloured and conidia contained large multiple transverse septa; size 9.5 µm-17.7 µm x 42.28 µm-83.2 µm (without beak) and size: 9.5 µm-17.7 µm x 123.5 µm-220.45 µm (with beak), beak length: 98.72 µm - 146.2 µm	

* Incidence of seed mycoflora per 100 seeds

Table 2. Influence of seed processing methods and seed treatments on seed mycoflora incidence (%) in guinea and para grass

Treatments	Guinea grass			Para grass		
	Seed processing methods (P)			Seed processing methods (P)		
	P_1	P_2	Mean	P_1	P_2	Mean
S_1	17.68 (24.86)*	15.40 (23.11)	**16.54 (24.00)**	30.72 (33.66)*	29.40 (32.83)	**30.06 (33.25)**
S_2	21.97 (27.95)	18.99 (25.83)	**20.47 (26.90)**	26.30 (30.85)	25.44 (30.29)	**25.86 (30.57)**
S_3	23.50 (29.00)	20.82 (27.15)	**22.16 (28.08)**	33.74 (35.51)	31.00 (33.83)	**32.37 (34.68)**
S_4	27.66(31.73)	24.60 (29.73)	**26.10 (30.72)**	34.26 (35.83)	32.02 (34.46)	**33.14 (35.15)**
S_5	20.88 (27.19)	18.55 (25.51)	**19.71 (26.36)**	35.68 (36.68)	34.35 (35.88)	**35.01 (36.28)**
S_6	15.01 (22.79)	12.46 (20.67)	**13.73 (21.75)**	34.77 (36.13)	33.57 (35.41)	**34.17 (35.77)**
S_7	23.91 (29.27)	18.60 (25.55)	**21.24 (27.44)**	34.43 (35.93)	32.69 (34.87)	**33.55 (35.40)**
S_8	21.88 (27.89)	20.11 (26.64)	**20.96 (27.25)**	55.99 (48.44)	51.88 (46.08)	**53.93 (47.25)**
S_9	29.35 (32.80)	25.64 (30.42)	**27.49 (31.62)**	73.50 (59.02)	68.42 (55.81)	**70.96 (57.39)**
Mean	**22.42 (28.26)**	**19.45 (26.17)**	**20.93 (27.23)**	**39.93 (39.19)**	**37.64 (37.84)**	**38.78 (38.52)**
Comparison	**SEm±**	**CD (P=0.01)**		**SEm±**	**CD (P=0.01)**	
A	0.17	0.65		0.246	0.95	
B	0.36	1.38		0.522	2.01	
Interaction	0.50	1.96		0.738	2.84	

Table 3. Influence of seed processing methods and seed treatments on field emergence (%) in guinea and para grass

Treatments	Guinea grass			Para grass		
	Seed processing methods (P)			Seed processing methods (P)		
	P_1	P_2	Mean	P_1	P_2	Mean
S_1	28.61 (32.34)*	31.25 (33.99)	**29.93 (33.17)**	14.06 (22.02)*	15.64 (23.30)	**14.85 (22.67)**
S_2	19.43 (26.15)	19.94 (26.52)	**19.68 (26.34)**	16.06 (23.63)	18.45 (25.44)	**17.26 (24.55)**
S_3	22.07 (28.02)	24.38 (29.59)	**23.22 (28.81)**	14.60 (22.46)	15.95 (23.54)	**15.28 (23.01)**
S_4	27.21 (31.44)	29.13 (32.66)	**28.17 (32.06)**	13.31 (21.40)	15.96 (23.55)	**14.63 (22.49)**
S_5	22.23 (28.13)	23.13 (28.75)	**22.68 (28.44)**	15.53 (23.21)	16.51 (23.97)	**16.02 (23.59)**
S_6	28.10 (32.01)	32.27 (34.62)	**30.18 (33.32)**	14.34 (22.25)	14.83 (22.65)	**14.59 (22.46)**
S_7	22.55 (28.35)	23.13 (28.75)	**22.84 (28.55)**	13.04 (21.17)	14.65 (22.50)	**13.85 (21.85)**
S_8	19.20 (25.99)	26.57 (31.03)	**22.88 (28.58)**	8.90 (17.36)	9.65 (18.10)	**9.27 (17.73)**
S_9	16.33 (23.83)	18.45 (25.44)	**17.39 (24.65)**	6.27 (14.50)	7.87 (16.29)	**7.07 (15.42)**
Mean	**21.53 (27.65)**	**25.36 (30.24)**	**23.45 (28.96)**	**12.90 (21.05)**	**14.39 (22.29)**	**13.64 (21.67)**
Comparison	**SEm±**	**CD (P=0.01)**		**SEm±**	**CD (P=0.01)**	
A	0.25	0.95		0.106	0.41	
B	0.52	2.01		0.226	0.87	
Interaction	0.74	2.84		0.319	1.23	

*Figures in the parentheses indicate arcsine root transformed values

***Field emergence*:** Influence of seed processing methods had significant effect on field emergence. Significantly highest field emergence (25.36% and 14.39%) were recorded in P_2 in both guinea and para grasses, respectively and lowest field emergence (21.53% and 12.90%, respectively) was recorded in P_1 (sweating method). The difference in percent field emergence due to seed treatment with fungicides and bio-agents was highly significant (Table 3). The treatment S_6 recorded highest field emergence (30.18 %) in guinea grass, whereas in para grass, significantly highest field emergence (17.26%) was recorded with treatment S_2 and was significantly superior to other treatments. The control (S_9) recorded the lowest field emergence of 17.39% and 7.07% in guinea and para grasses, respectively. Influence on field emergence due to interaction of seed processing methods and seed treatments was significant. Field emergence was highest (32.27%) in treatment combination of P_2S_6, it was lowest (16.33%) in treatment combination of P_1S_9 in guinea grass. Whereas in *Para* grass, significantly highest (18.45%) field emergence was recorded in P_2S_2 and lowest (6.27%) was recorded

recorded in P_1S_9. The results clearly suggested the usefulness of seed treatment with S_6 for the management of seed borne pathogens in different crops and grasses as well. Whereas in para grass, seed treatment with S_2 effectively eradicated the seed borne pathogen, it was followed by *Trichoderma harzianum*. Similar results were also obtained earlier by Hooda and Singh (1993), who reported that seed treatment with vitavax (2 g/kg) in wheat seed recorded the germination per cent above minimum seed certification standard (85%). Jain (2004) reported that chemical seed treatments with saaf, bavistin 50 WP and vitavax (2 g/kg of seeds) were significantly superior in controlling head smut incidence in kodo millet. Bidari *et al.* (1992) observed that seed treatment with Bavistin (carbendazim) gave the best control of seed borne pathogens by reducing seed rot, seedling mortality and resulting in the highest yield of the *Vigna radiata* crop. Reddy *et al.* (1992) showed that fungicidal seed dressing with flutolanil, thiophanate-methyl or carbendazim effectively controlled damping-off of *Vigna radiata,* while mancozeb and zineb were the least effective. Dash and Narain (1996) also found that pre-treatment of seeds of *V. radiata* with carbendazim + thiram followed by thiram, brassicol (quintozene), difolatan (captafol), dithane M-45 (flowable) and vitavax (carboxin) eliminated seed mycoflora and improved seed germination considerably for most of the crops tested.

***Seed germination*:** The difference in seed germination (%) due to seed treatment with fungicides and bio-agents was highly significant. The treatment S_6 recorded highest germination (32.93%) in guinea grass and whereas in para grass, significantly highest (18.11%) seed germination was recorded in treatment S_2 and was significantly superior to other treatments. The control treatment (S_9) recorded the lowest seed germination of 18.75 and 7.85% in guinea and para grasses, respectively. Seed processing methods had significant effect on seed germination (Table 4). Significantly the highest seed germination (27.78 and 15.01%) was recorded in P_2 (non-sweating method) in both guinea and para grasses, respectively and lowest seed germination (25.79 and 14.09%, respectively) was recorded in P_1 (sweating method). Influence on seed germination due to interaction of seed processing methods and seed treatments was significant. Seed germination was highest (35.53%) in treatment combination of P_2S_6, it was lowest (18.05%) in treatment combination of P_1S_9 in guinea grass. Whereas in case of para grass, significantly highest (18.53%) seed germination was recorded in P_2S_2 and lowest (6.91%) was recorded in P_1S_9. The loss of seed germination and seedling vigour in naturally infected para and guinea grass seeds were carried out for the first time, however, the similar results were also recorded earlier in other crops by many researchers. Higher seed germination and seedling vigour in *P. fluorescens* treated seed might also be due to the availability of growth promoting rhizobacteria. This was probably due to the fact that comparatively non-sweating method of seed processing recorded less pathogen

Table 4. Influence of seed processing methods and seed treatments on seed germination (%) in guinea and para grass

Treatments	Guinea grass			Para grass		
	Seed processing methods (P)			Seed processing methods (P)		
	P_1	P_2	Mean	P_1	P_2	Mean
S_1	30.33 (33.42)*	34.17 (35.77)	**32.25 (35.38)**	15.61 (23.27)*	16.80 (24.20)	**16.20 (23.73)**
S_2	25.40 (30.26)	24.67 (29.78)	**25.03 (30.02)**	17.69 (24.87)	18.53 (25.50)	**18.11 (25.19)**
S_3	23.50 (29.00)	26.07 (30.70)	**24.78 (29.85)**	15.70 (23.34)	16.11 (23.66)	**15.90 (23.50)**
S_4	29.35 (32.80)	30.90 (33.77)	**30.13 (33.29)**	15.88 (23.48)	16.01 (23.59)	**15.95 (23.54)**
S_5	26.05 (30.69)	26.41 (30.92)	**26.23 (30.81)**	16.05 (23.62)	16.79 (24.19)	**16.41 (23.90)**
S_6	32.88 (34.99)	35.53 (36.59)	**32.93 (35.02)**	14.73 (22.57)	15.20 (22.95)	**14.96 (22.75)**
S_7	23.91 (29.27)	24.43 (29.62)	**24.17 (29.45)**	15.07 (22.84)	15.93 (23.52)	**15.50 (23.18)**
S_8	22.67 (28.43)	28.37 (32.18)	**25.52 (30.34)**	9.27 (17.73)	10.93 (19.31)	**10.09 (18.52)**
S_9	18.05 (25.14)	19.44 (26.16)	**18.75 (25.66)**	6.91 (15.27)	8.81 (17.27)	**7.85 (16.27)**
Mean	**25.79 (30.52)**	**27.78 (31.81)**	**26.78 (31.16)**	**14.09 (22.05)**	**15.01 (22.79)**	**14.55 (22.42)**
Comparison	**SEm±**	**CD (P=0.01)**		**SEm±**	**CD (P=0.01)**	
A	0.18	0.68		0.159	0.61	
B	0.37	1.44		0.337	1.30	
Interaction	0.53	2.03		0.477	1.83	

*Figures in the parentheses indicate arcsine root transformed values

infection in both the grasses and hence, seed treatment with bio-agent *Pseudomonas fluorescens* effectively eradicated the seed borne pathogen resulting higher germination and lesser seed infection in a seed lot of guinea grass. Similarly the significant effect of seed treatment with different bio-agents was reported earlier (Someshwar and Sitansu, 2010).

***Seedling dry weight*:** Influence of seed processing method had significant effect on seedling dry weight (Table 5). Significantly highest seedling dry weights of 16.69 and 39.50 mg were recorded in P_2 in both guinea and para grasses, respectively and lowest seedling dry weight (16.39 and 38.88 mg, respectively) was recorded in P_1. The differences in seedling dry weights due to seed treatment with fungicides and bio-agents were highly significant. The treatment S_6 recorded highest seedling dry weight (18.03 mg) in guinea grass and whereas in para grass, significantly highest (41.85 mg) seedling dry weight was recorded in treatment S_2 and was significantly superior to other treatments. The control treatment (S_9) recorded the lowest seedling dry weight of 15.41 mg and 38.09 mg in guinea and para grasses, respectively. Influence on seedling dry weight due to interaction of seed processing methods and seed treatments was significant. Seedling dry weight was highest (18.28 mg) in treatment combination of P_2S_6 and it was lowest (15.33 mg) in treatment combination of P_1S_9 (sweating method and untreated seeds) in guinea grass. Whereas in case of para grass, significantly highest (42.03 mg) seedling dry weight was recorded P_2S_2 and lowest (37.79 mg) was recorded in P_1S_9.

***Seedling vigour index*:** Seed processing methods had significant influence on seedling vigour index in both the grasses (Table 6). Seedling vigour index was significantly highest of 395 and 218 in P_2 (non-sweating method) in both guinea and para grasses, respectively. Whereas the lowest seedling vigour index (361 and 203, respectively) was recorded with P_1. Significant difference in seedling vigour index was observed due to seed treatments in both the grasses. The treatment S_6 recorded maximum (510) seedling vigour index in guinea grass. However in para, it was significantly highest (277) in treatment S_2 and was significantly superior to other treatments. The control (S_9) recorded significantly lowest seedling vigour index of 247 and 107 in guinea and para grasses, respectively. Influence on seedling vigour index due to interaction of seed processing methods and seed treatments was found significant. Seedling vigour index was highest (559) in treatment combination of P_2S_6 and it was lowest (236) in treatment combination of P_1S_9 in guinea grass. Whereas in para grass, significantly highest (285) seedling vigour index was recorded P_2S_2. The lowest (93) was recorded in P_1S_9. These findings were in line with the findings of Srinivas *et al.* (2006), who observed that seed treatment with talc formulation of *P. fluorescens* or *Trichoderma harzianum* (10 g/kg seed) in chilli effectively reduced the infection of *Colletotrichum capsici* and increased the seed germination, vigour index in roll paper method (*in vitro)*.

Table 5. Influence of seed processing methods and seed treatments on seedling dry weight (mg) in guinea and para grass

Treatments	Guinea grass			Para grass		
	Seed processing methods (P)			Seed processing methods (P)		
	P_1	P_2	Mean	P_1	P_2	Mean
S_1	17.11	17.45	**17.27**	39.13	39.38	**39.26**
S_2	15.84	16.24	**16.03**	41.68	42.03	**41.85**
S_3	16.02	16.49	**16.25**	38.18	38.62	**38.40**
S_4	16.75	16.88	**16.81**	38.85	39.76	**39.30**
S_5	16.51	16.81	**16.65**	39.38	40.42	**39.90**
S_6	17.78	18.28	**18.03**	38.23	38.83	**38.53**
S_7	16.49	16.70	**16.57**	38.68	39.25	**38.97**
S_8	15.73	15.90	**15.82**	38.00	38.77	**38.38**
S_9	15.33	15.50	**15.41**	37.79	38.40	**38.09**
Mean	**16.39**	**16.69**	**16.54**	**38.88**	**39.50**	**39.19**
Comparison	**SEm±**	**CD (P=0.01)**		**SEm±**	**CD (P=0.01)**	
A	0.07	0.28		0.159	0.61	
B	0.16	0.60		0.337	1.30	
Interaction	0.22	0.84		0.477	1.83	

Due to interaction of seed processing methods and seed treatments, shoot length, root length and seedling vigour index differed significantly in both the grasses. In guinea grass, superior results were obtained in treatment combination of non-sweating method of seed processing and seed treatment with *Pseudomonas fluorescens*. It might be attributed to the fact that non-sweating method of seed processing and seed treatment with *Pseudomonas fluorescens* produced healthy and more vigorous seedlings resulting in higher vigour index. On the contrary, non-sweating method of seed processing and seed treatment with vitavax power recorded higher seedling growth and seedling vigour index in para grass. Influence on seedling dry weight due to interaction of seed processing methods and seed treatments was significant. Seedling dry weight was highest in treatment combination of non-sweating method treated with *Pseudomonas fluorescens* and it was lowest in treatment combination of sweating method and untreated seeds in guinea grass. Whereas in case of para grass, significantly highest seedling dry weight was recorded non-sweating method treated with vitavax power. Thus

Table 6. Influence of seed processing methods and seed treatments on seedling vigour index in guinea grass and para grass

Treatments	Guinea grass			Para grass		
	Seed processing methods (P)			Seed processing methods (P)		
	P_1	P_2	Mean	P_1	P_2	Mean
S_1	489.3	510.2	**499.8**	230.08	251.39	**241.00**
S_2	351.6	345.3	**348.4**	269.88	285.04	**277.46**
S_3	323.3	367.2	**345.2**	220.65	234.85	**227.75**
S_4	397.8	429.3	**413.5**	225.54	232.76	**229.15**
S_5	361.9	366.8	**364.4**	237.83	241.11	**239.47**
S_6	460.9	559.7	**510.3**	215.55	217.15	**216.35**
S_7	329.5	338.2	**333.9**	212.83	229.60	**221.22**
S_8	302.8	384.0	**343.4**	127.21	152.80	**140.01**
S_9	236.7	258.2	**247.4**	93.42	122.20	**107.81**
Mean	**361.5**	**395.4**	**378.48**	**203.67**	**218.55**	**211.11**
Comparison	**SEm±**	**CD (P=0.01)**		**SEm±**	**CD (P=0.01)**	
A	2.82	10.86		2.47	9.50	
B	5.98	23.03		5.24	20.15	
Interaction	8.47	32.57		7.41	28.50	

Table 7. Influence of seed processing methods and seed treatments on thousand seed weight (g) in guinea grass and para grass

Treatments	Guinea grass			Para grass		
	Seed processing methods (P)			Seed processing methods (P)		
	P_1	P_2	Mean	P_1	P_2	Mean
S_1	0.98	1.00	**0.99**	3.22	3.25	**3.23**
S_2	0.94	0.96	**0.95**	3.25	3.28	**3.26**
S_3	0.94	0.95	**0.94**	3.21	3.26	**3.24**
S_4	0.92	0.94	**0.93**	3.25	3.25	**3.25**
S_5	0.93	0.94	**0.93**	3.27	3.22	**3.24**
S_6	1.02	1.09	**1.05**	3.26	3.23	**3.24**
S_7	0.93	0.95	**0.94**	3.22	3.19	**3.20**
S_8	0.91	0.93	**0.92**	3.23	3.26	**3.25**
S_9	0.89	0.91	**0.89**	3.23	3.25	**3.24**
Mean	**0.94**	**0.96**	**0.95**	**3.24**	**3.25**	**3.24**
Comparison	**SEm±**	**CD (P=0.01)**		**SEm±**	**CD (P=0.01)**	
A	0.009	NS*		0.03	NS	
B	0.019	NS		0.03	NS	
Interaction	0.026	NS		0.05	NS	

*NS: Non-significant

the non-sweating method of seed processing and seed treatment with *Pseudomonas fluorescens* recorded higher values of seedling dry weight in case of guinea grass, whereas in case of para grass non-sweating method treated with carboxin + thiram recorded the highest seedling dry weight. Dry seed treatment with fungicide proved reliable and potent method for crop health and to get more yield with better quality in Para seeds.

Thousand seed weight: The difference in thousand seed weight due to seed treatment with fungicides and bio-agents was found non-significant (Table 7). The treatment S_6 recorded numerically highest thousand seed weight (1.05 g) in guinea grass and whereas in para grass, highest thousand seed weight (3.26 g) was recorded in treatment S_2.

Conclusion

Present study clearly indicated that seed mycoflora and processing methods do play a significant role in controlling the seed quality parameters of both guinea and para grasses. Among the seed processing methods, non sweating method proved to be better for obtaining higher seed quality parameters when compared to sweating method of seed processing in both the grasses. Seed treatment with *Pseudomonas fluorescens* minimize the incidence of seed associated mycoflora in guinea grass and enhanced the seed germination and seedling vigour. In para grass, seed treatment with vitavax power (carboxin + thiram) at 0.2% effectively checked the seed borne pathogen and increased the seed germination and seedling vigour index.

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