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Efficacy of chemicals for the management of discolored seeds from dirty panicle disease of rice

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Abstract
Dirty panicle disease of rice is a complex due to infection of several mycoflora on the glumes, kernels or both with varied symptoms. Based upon the natural disease pressure, seeds of 3 varieties (IR 36, IR 64 and Kranti) were selected among the 12 commonly grown popular rice varieties with different levels of infections, as per the measurement scale (IRRI, 1998) during Kharif 2017 and 2018. Influence of chemical fungicides on the emergence of seedlings after 10day of sowing indicate that seed treatment with Carboxin + Thiram @ 0.15% exhibited 84% seed emergence as observed in IR 36 in seeds from Level 9 (more than 50% area discolored) as compared to untreated seeds (55%) from Level 0 (with no incidence) which had 88% emergence as compared to untreated seeds (82%). In seeds from L9 category, 52.72% increase was noticed over check, indicating the efficiency of fungicide combination, followed by 49.09% increase in emergence in diseased seeds treated with Carbendazim + Mancozeb (@0.15%), prior to sowing in field soil. Similar trend of enhanced emergence was noticed in variety IR 64 and Kranti in different levels of diseased seeds (L9 and L7) as compared to check. Seed treatment with copper oxychloride (@0.25%) also supported the higher emergence (83%) of seedling when the diseased seeds were treated and sown in natural field conditions as compared to check (55%).

Keywords: Dirty panicle disease, measurement scale, seed treatment, seed emergence

Introduction
The rice (*Oryza sativa* L.) plant suffers from several biotic and abiotic stresses that seriously affect its production. A wide range of pathogens, insects and nematodes attack the crop (Mew *et al.*, 2004; Kar *et al*., 2018) [11, 9]. Productivity of rice is often adversely affected by several biotic stresses. Plant pathogens infect at various crop growth stages (Agrios, 2006) [2]. In recent years, it has been observed that due to high humidity and wet season during maturity stage the rice panicles become more prone to invasion by microorganisms, which lead towards the development of dirty panicle disease with varied degree of grain discoloration (Silodia, 2019) [21]. The disease once considered as a minor problem has posed a new threat in rice grain marketing (Janghel, 2014) [7]. The disease has been observed throughout the places wherever the crop is cultivated (Narain, 1992; Ou, 1985; Sachan and Agarwal, 1995) [12, 14]. In the present communication efficacy of chemicals for the management of discolored seeds obtained from Dirty Panicle disease of rice is discussed.

Methodology
Collection of seeds
The samples of Dirty Panicle Disease were obtained from 12 most commonly cultivated rice varieties grown at farmer's field. The diseased panicles from 13 districts covering 6 agro-climatic zones of Madhya Pradesh during Kharif 2017 & 2018 were also collected. The disease was initially identified on the basis of typical symptoms developed under natural field conditions. The collected samples were manually threshed under lab conditions and based upon the diseased area of the seeds, were categorized as per description mentioned (IRRI, 1998).

Measurement of Grain discoloration

Disease incidence: $\text{Grain discoloration (\%)} = \frac{\text{Number of discolored seeds}}{\text{Total number of seeds}} \text{ X } 100$

Table 1: Disease scale for the measurement of Dirty Panicle disease (IRRI, 1998)

Level	Area covered
Level 0	No incidence
Level 1	Less than 1%
Level 3	1-5%
Level 5	6-25%
Level 7	26-50%
Level 9	51-100%

Seed treatment

Influence of commercially available, ready to use fungicides as seed treatment was determined on the emergence of naturally infected seeds of different categories (different levels) of select varieties (Table 02). The treatment with the respective fungicide was done prior to sowing. The treated and untreated seeds were sown in field soil for the observations on the emergence after 10th day of sowing. The experiment was conducted in fields of Seed Technology & Research, Department of Plant Breeding & Genetics, JNKVV, Jabalpur which lies $22^0$21' and $80^0$5'8 East longitude at an altitude 411.78 meters above the mean sea level.

Table 2: Following fungicides were used

Fungicide	Trade name	Dosage
Carbendazim	Bavistin	0.15%
Mancozeb	Indofil M-45	0.25%
Carbendazim+ Mancozeb	Saaf	0.15%
Copper oxy chloride	Blue copper	0.25%
Tebuconazole	Folicur	0.10%
Tebuconazole + Trifloxystrobin	Nativo	0.10%
Pyraclostrobin + Metiram	Xelora	0.15%
Carboxin + Thiram	Vitavax	0.15%
Azoxystrobin	Amistar	0.10%
Tricyclozole	Blastin	0.10%

Efficacy of fungicides

Effect of seed dressing with fungicides on the emergence of seedlings using naturally infected seeds of select varieties was determined. Untreated seeds served as control. For each treatment 200 seeds were used. Observations were made on the emergence of seedling after 10th day of sowing.

Results & Discussions

Dirty panicle (glume & grain discoloration) is a complex due to infection by microorganisms on the glumes, kernels, or both. In previous investigation the associated mycopathogens observed are *Helminthosporium oryzae*, *Alternaria alternata*, *Pyricularia oryzae, Drechslera* sp., *Fusarium* moniliformae, *Nigrospora oryzae, Curvularia lunata*, *Phoma* sp. (Silodia, 2019) [21]. In recent years, due to change in unpredictable weather conditions and irregular rain distribution, the dirty panicle has been identified as an emerging problem (Schaad, 2008; Phat *et al.*, 2005) [20, 16]. Commonly the disease is recorded as darkening of glumes by one or more pathogens, intensity ranges from sporadic to complete discoloration of whole glumes with varied symptoms (Samira *et al.*, 2005; Chouhan *et al.*, 2005; Pandey *et al.*, 2000) [19, 6, 15].

Selection of sample

Incidence of Dirty Panicle disease was observed in popular rice varieties. Maximum panicle infection and grain discoloration (30%) was recorded in IR 64 followed by 28% in IR 36 and 22% in Kranti. With this basic infection, seeds were manually threshed from primary samples of infected panicles and a composite sample of each variety was created. Based upon the diseased area covered the different levels of categories of infection were created. Maximum percentage of (36.45) was recorded in IR 64 followed by 33.75% in IR 36 and least 28.87% in Kranti (Table 03). Higher number of discolored seeds belonged to L9 and L7. It was observed that the seed samples having basic seed infection (19.0-30.0%) had the seeds with no infection in the range of 497 to 714 (12.4-7.85%). The individual profile of IR 64 (4000) seeds from 30% basic seed infection consisted of 185, 217, 713, 1458 and 613 number of seeds distributed in Level 1 to Level 9 including 714 seeds with no incidence of grain discoloration in Level 0.

Table 3: Number of seeds in different grades

Grades	Area covered	Number of seeds (out of 4000)*		
	IR 36		IR 64	Kranti
Basic seed infection		28.0	30.0	19.0
Level 0	No incidence	497(12.42)	714(17.85)	658(16.45)
Level 1	Less than 1%	214(5.35)	185(4.62)	197(4.92)
Level 3	1-5%	408(10.20)	217(7.92)	470(11.75)
Level 5	6-25%	619(15.47)	713(17.82)	633(15.82)
Level 7	26-50%	1350(33.75)	1458(36.45)	1155(28.87)
Level 9	51-100%	912(22.80)	613(15.32)	887(22.17)

*values in parenthesis are percentage of seeds in different categories

The dirty panicle has been identified as an emerging problem. Commonly the disease is recorded as darkening of glumes by one or more pathogens, where intensity ranges from sporadic to complete discoloration of whole glumes (Phat *et al.*, 2005) [16]. The discoloration of grains leads to consumer's non-preference, poor marketability and economic losses. It results in altered seed germination, emergence, vigour, viability and test weight (Ashfaq *et al.*, 2017) [4]. The grain discoloration has been reported from different parts of the world (Mew *et al.*, 2004; Boonreeng and Boonlertnirum, 2013) [11, 5].

Seed treatment

Influence of ready to use fungicides was determined on the emergence of naturally infected seeds of L0, L7 and L9 categories of three select varieties having maximum natural infection. The treated and untreated seeds were sown in field soil. Observations on the emergence were recorded after 10th day of sowing.

Efficacy of fungicides

For several decades during Green Revolution era the application of synthetic chemical fungicides for the management of seed, soil and air-borne pathogens was considered the safest and cheapest with convincing effective results (Nene and Thapliyal, 1979) [13]. Fungicidal seed treatment kills the seedborne pathogens and form protective zone around seeds that reduces the degree of seed decay, seedling blight, resulting in healthy and vigorous seedling along with desired plant stand (Agarwal and Sinclair, 1997) [1]. Effect of seed dressing with fungicides on the emergence of seedlings using naturally infected seeds of select varieties was determined where untreated served as control. For each treatment 200 seeds were used. Observations were recorded on the emergence of seeds obtained from infected panicles.

Variety IR 36

Maximum seed emergence (84%) was recorded in seeds treated with Carboxin + Thiram @ 0.15% followed by Carbendazim + Mancozeb @ 0.15% (83%) and copper

oxychloride @ 0.25% (83%) in seeds from L9 where the discolored seed area was more than 50%. In untreated seeds, seed emergence was 55% indicating increase in around 29%. A similar trend in enhancement and efficacy of fungicides was noticed in seeds from L7. In seeds with no infection from L0 category seed emergence was 82% in untreated seeds that increased up to 88% in Carboxin + Thiram, followed by Carbendazim + Mancozeb (87%) and copper oxychloride. It was concluded that seed treatment with Carboxin + Thiram (0.15%) and Carbendazim + Mancozeb (0.15%) were effective in increasing the seed emergence when the infected seeds were sown. Efficacy of rice seed treatment with Carbendazime has been reported for minimizing the seed associated mycoflora (Ali *et al*., 1996; Sagar and Hedge, 2006; Lore *et al.*, 2007) [3, 10]. Sachan *et al.* (1994) [17] observed the reduction in inoculums of pathogens responsible for grain discoloration by the combo application of Bavistin + Dithane M- 45 and Bavistin + Thiram, among the seed dressers like Captan, Dithane M-45, Thiram and Bavistin. Enhanced seedling stand and seedling vigor was recorded in the seeds obtained from discolored panicles. Similar results were recorded by Ali and Deka (1996) [3].

Table 4: Efficacy of seed dressing with fungicides on the emergence of seedlings using naturally infected seeds

Fungicide	Dosage in g/kg seed	Percent seed emergence / Variety IR 36 /grade of seeds		
		L9	L7	L0
Carbendazim	1.5	81(47.27)	80(33.33)	86(4.87)
Mancozeb	2.5	79(43.63)	78(30.00)	86(4.87)
Carbendazim+ Mancozeb	1.5	82(49.09)	83(38.33)	87(6.09)
Copper oxychloride	2.5	83(50.90)	81(47.27)	87(6.09)
Tebuconazole	1.0	73(32.72)	75(33.33)	84(2.43)
Pyraclostrobin + Metiram	1.5	74(34.54)	73(30.00)	83(1.21)
Carboxin + Thiram	1.5	84(52.72)	85(41.66)	88(7.31)
Azoxystrobin	1.0	72(30.90)	70(16.66)	83(1.21)
Untreated	-	55	60	82

*sample size 200 seeds; observation on 10th day of sowing; values in parenthesis are the percent increase over check (untreated)

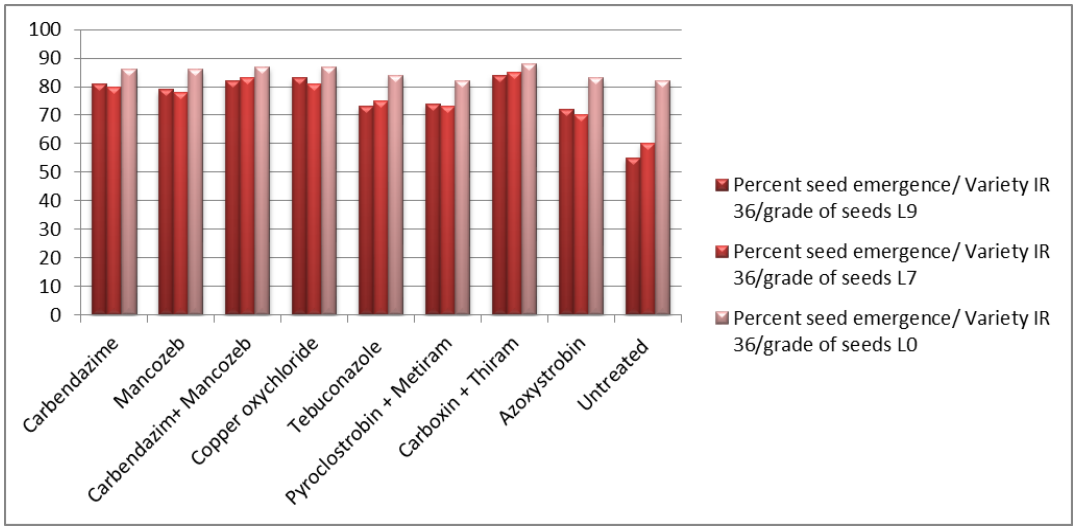

Fig 1: Effect of various chemicals on the seed emergence in variety IR 36

Variety IR 64

Similar trend of efficacy of Carbendazim + Mancozeb and Carboxin + Thiram was noticed for enhancing the emergence

Table 5: Efficacy of seed dressing with fungicides on the emergence of seedlings using naturally infected seeds

Fungicide	Dosage in g/kg seed	Percent seed emergence/ Variety IR 64/grade of seeds		
		L9	L7	L0
Carbendazim	1.5	82(30.15)	80(25.00)	86(2.38)
Mancozeb	2.5	80(26.98)	81(26.56)	85(1.19)
Carbendazim+ Mancozeb	1.5	86(36.50)	81(26.56)	86(2.38)
Copper oxychloride	2.5	83(31.74)	81(26.56)	86(2.38)
Tebuconazole	1.0	82(30.15)	80(25.00)	85(1.19)
Pyraclostrobin + Metiram	1.5	81(28.57)	79(23.43)	85(1.19)
Carboxin + Thiram	1.5	84(33.33)	83(29.68)	86(2.38)
Azoxystrobin	1.0	80(26.98)	75(17.18)	85(1.19)
Untreated	-	63	64	84

*sample size 200 seeds; observation on 10th day of sowing; values in parenthesis are the percent increase over check (untreated)

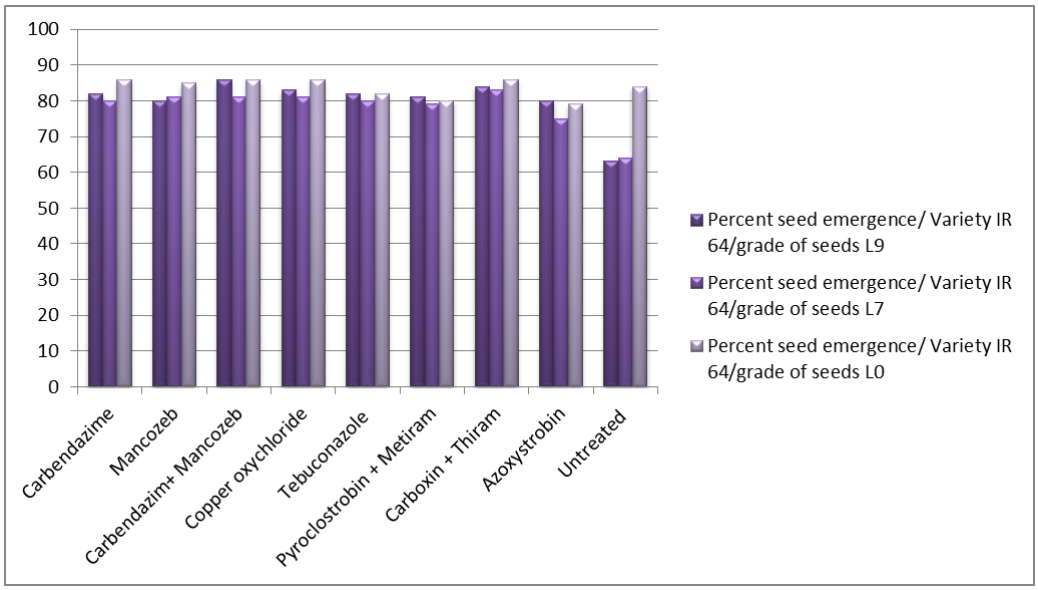

Fig 2: Effect of various chemicals in seed emergence in variety IR 64

The fungicide treated seed of L9 and L7 grade resulted in higher seed emergence as compared to untreated seeds. Seed treatment with Mancozeb provided 69.9% control of rice discoloration (Jin, 1989) [8], whereas, Vaid *et al.* (1994) [22] recorded the efficacy of seed dressing with Carbendazime (0.2%), among the six seed dressing fungicides. Seed dressing with fungicides resulted in higher plant stand.

Variety Kranti

In seeds from L9 category maximum field emergence (76%) in seeds treated with Carboxin + Thiram (0.15%) followed by treated with Carbendazim + Mancozeb (75%) was recorded as compared to untreated seeds (58%). Efficacy of fungicide treated seeds was also evident in L7 category. Emergence in fungicide treated seeds ranged from 70 to 76% in L9 and 70 to 78% was recorded. In seeds from L0 category the emergence ranged from 76 to 83% as compared to untreated seeds 75% (Table 06).

Table 6: Efficacy of seed dressing with fungicides on the emergence of seedlings using naturally infected seeds

Fungicide	Dosage in gram/kg seed	Percent seed emergence / Variety Kranti /grade of seeds		
		L9	L7	L0
Carbendazim	1.5	70(20.68)	72(12.50)	81(8.00)
Mancozeb	2.5	71(22.49)	71(10.90)	80(6.60)
Carbendazim+ Mancozeb	1.5	75(29.31)	74(15.60)	82(9.30)
Copper oxychloride	2.5	73(25.86)	73(14.06)	78(4.00)
Tebuconazole	1.0	72(24.13)	70(9.37)	78(4.00)
Pyraclostrobin + Metiram	1.5	70(20.68)	71(10.90)	76(1.33)
Carboxin + Thiram	1.5	76(31.03)	78(21.87)	83(10.60)
Azoxystrobin	1.0	71(22.41)	70(9.37)	76(1.33)
Untreated	-	58	64	75

*sample size 200 seeds; observation on 10th day of sowing; values in parenthesis are the percent increase over check (untreated)

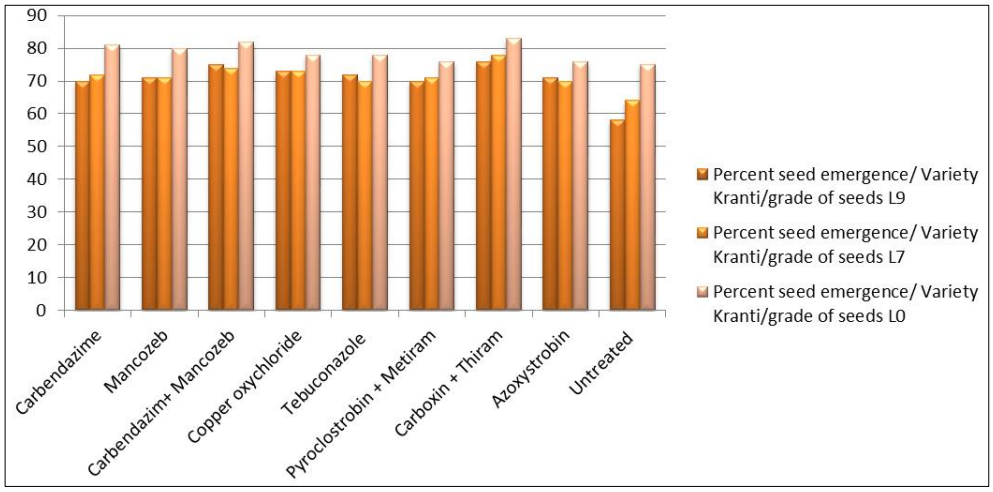

Fig 3: Effect of various chemicals in seed emergence in variety Kranti

Conclusions

Seeds obtained from dirty panicle disease had different levels of infection, in terms of area coverage of the seed. Seed treatment with fungicide Carboxin + Thiram @ 0.15% exhibited maximum increase in seed germination over untreated seeds. The efficiency of fungicides was apparent in seeds with higher level of disease coverage (L9 and L7) in 3 varieties. Seed treatment with Carbendazim + Mancozeb @0.25% and copper oxychloride @0.25% were also promising for reducing the infection and increasing the plant stand.

References

1. Agarwal VK, Sinclair JB. (IInd Ed.). Principles of Seed Pathology. CRC Press Inc. Boca Raton, Florida, USA, 1997, 539.
2. Agrios GN. Plant Pathology. Academic Press London, UK, 2006.
3. Ali MS, Deka B. Role of fungi causing grain discoloration of rice and management under storage. Indian Journal of Mycology and Plant Pathology. 1996; 26(1):79-85.
4. Ashfaq M, Mubashar U, Haider MS, Ali M, Sajjad M. Grain discoloration: an emerging threat to rice crop in Pakistan. The Journal of Animal & Plant Sciences. 2017; 27(3):696-707.
5. Boonreung C, Boonlertnirum S. Efficiency of Chitosan for controlling dirty panicle disease in rice plants. ARPN Journal of Agricultural and Biological Sciences. 2013; 8(5):380-384.
6. Chouhan HL, Patel KG, Patel RV. Efficacy of fungicides against grain discoloration of rice. Advances in Fungal Diversity and Host Pathogen Interactions, 2005, 18-20.
7. Janghel BK. Studies on mycoflora associated with grain discoloration of rice, their detection, characterization and management. MSc Thesis, Indira Gandhi Krishi Vishwavidayalaya (IGKV) Raipur, 2014, 89.
8. Jin MZ. Preliminary study of discolored rice grains caused by Curvularia. Acta Phytopathologica Sinica. 1989; 19(1):21-26.
9. Kar MK, Bose LK, Chakrborti M, Azharudhen MTP, Ray S, Sarkar S, *et al*. Utilization of Cultivated and Wild Gene Pools of Rice for Resistance to Biotic Stresses, Rice Research for Enhancing Productivity, Profitability, Resilience (eds. Pathak H, Nayak AK, Jena M, Singh ON, Samal P, Sharma SG).pp. 52-66. ICAR- National Rice Research Institute, Cuttack, Odhisha, India, 2018, 542.
10. Lore JS, Thind TS, Hunjan MS, Goel RK. Performance of different fungicides against multiple diseases of rice. Indian Phytopathology. 2007; 60:296-301.
11. Mew TH Leung, Savary S, Vera Cruz CM, Leach JE. Looking ahead in rice and influence on nutrition value. Indian Phytopathology. 2004; 48(1):14-20.
12. Narain A. Recent advance of few minor disease of rice posing threats. Indian Journal of Mycology and Plant Pathology. 1992; 22(1):1-26.
13. Nene YL, Thapliyal PN. Fungicides in Plant Disease Control. Oxford and JBH Publishing Corporation, New Delhi, 1979, 413.
14. Ou SH. Rice Diseases. CAB International Mycological Institute, Kew, Surrey UK, 1985, 109-201.
15. Pandey V, Agarwal VK, Pandey MP. Location and seed transmission of fungi in discolored seeds of hybrid rice. Indian Phytopathology. 2000; 53(1):45-49.
16. Phat CT, Duong NT, Du LT. Influence of grain discoloration to seed quality. Omonrice. 2005; 13:139-144.
17. Sachan IP, Agarwal VK. Efficacy of seed treatment of discolored seeds of rice on seed borne inoculum, germination and seedling vigour. Seed Research. 1994; 22(1):45-49.
18. Sagar SD, Hegde YR, Srikant Kulkarni, Rao MSL. Biocontrol of seed mycoflora of rice. Annals of Biology. 2005; 21(2):217-220.
19. Samira Serghat, Karima Mradmi, Tauhami AO, Alah D. Rice leaf pathogenic fungi on wheat, oat, Echinochloa phyllapogon and Phragmites australis. Phytopathologia Mediterranea. 2005; 44(1):44-49.
20. Schaad NW. Emerging plant pathogenic bacteria and global warming. In: Fatmi M. *et al*. (eds.), *Pseudomonas syringae* Pathovars and related pathogens- Identification, Epidemiology and Genomics. Springer Science, 2008, 369-379.
21. Silodia K. Epidemiology and development of integrated module for the management of dirty panicle disease of rice. PhD Research Thesis. Department of Plant Pathology JNKVV, Jabalpur, 2019.
22. Vaid A, Sharma OP, Sugha SK. Comparative efficacy of fungicides against discoloration of rice. Plant Disease Research. 1994; 9(2):150-152. www.IRRI.com