



RESEARCH PAPER

Survey for incidence and severity of grain discolouration of paddy in northern parts of Karnataka

K.B. Yadahalli * and Jyoti A. Konnur

Department of Plant Pathology, College of Agriculture

(University of Agricultural Sciences, Dharwad), Hanumanamatti (Karnataka) India

(Email : kbyadahalli@gmail.com)

Abstract : A roving survey was conducted in major paddy growing areas of northern parts of Karnataka. A total five districts viz., Belagavi, Dharwad, Haveri, Koppal and Uttara Kannada were surveyed during *Kharif* 2017 to record the severity and incidence of grain discolouration. In all the areas surveyed, rice was grown in black and red soils under both irrigated and rainfed condition. During the survey the disease was observed at early grain filling to maturity stage. The disease severity ranged from 06.66 to 26.23 PDI and per cent disease incidence ranged from 12.21 to 46.66 per cent. The maximum severity (26.23 %) and per cent incidence (46.66 %) was recorded in Medleri village of Ranebennur taluk on Haveri district. The minimum severity (06.66 %) and per cent incidence (15.19 %) was recorded in Gundenhatti village of Khanapur taluk on Belagvi district. The maximum disease severity and incidence was observed in black soil under irrigated conditions during maturity stage.

Key Words : Grain discolouration, Incidence, Severity, PDI, Disease, Maturity

View Point Article : Jainuddin, S.M., Seema, Suhasini, K. and Lavanya, T. (2021). Price and non-price decision making factors for groundnut production in Karnataka: An evidence from Nerlove's supply response approach. *Internat. J. agric. Sci.*, 17 (2) : 209-215, DOI:10.15740/HAS/IJAS/17.2/209-215. Copyright@2021: Hind Agri-Horticultural Society.

Article History : Received : 22.02.2021; Accepted : 14.03.2021

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important crop of the world both in terms of area and production. About 90 per cent of world rice is grown and consumed in Asian countries and 60 per cent of world population also depends on rice for their half of the calorie intake from this crop. After China, India is the second largest producer of rice in the world.

In India, rice crop is grown under wide range of agro-climatic conditions and is being cultivated over an area of rice contributes around 45 per cent of India's

cereal production and cultivated in about 43.49 million hectares area with production of 104.40 million tones and productivity of 2.40 tonnes per hectare (Anonymous, 2016). The major rice growing states of India are West Bengal, Bihar, Madhya Pradesh, Odisha, Andhra Pradesh and Uttar Pradesh.

In Karnataka rice occupies an area of 1.11 million hectare with a production of 3.02 million tones and productivity of 2.72 tonnes per hectare (Anonymous, 2016). It is largely grown in Koppal, Raichur, Mandya, Tumkur, Kolar, Gadag and Chitradurga districts under irrigated conditions. In high rainfall areas it is being grown

* Author for correspondence :

under drill sown conditions (Dharwad, Belagavi, Haveri and Uttara Kannada).

In rice some of the diseases which were less significant earlier, are now gradually gaining importance and posing serious threat to the crop production (Gupta *et al.*, 2015). Grain discolouration is prevalent in almost all parts of the world where paddy is grown. It was earlier considered to be a minor disease and it is now gaining more importance due to its severity in tropical rice growing areas. In many regions of India particularly during wet seasons due to high humidity and warm environmental condition during flowering and post flowering stages which significantly induce the disease.

Seed discolouration is an early indication of poor seed germination or grain quality which is complex disease and cannot be diagnosed prior to harvest, in nature disease is generally associated with many pathogens, among them fungi predominates. Bodalkar and Awadhiya (2014) reported that the seed borne inoculum of *Alternaria alternata* is responsible for grey discolouration and *Cochilobolus miyabeanus* for black discolouration, these pathogens are present in seed coat and endosperm of discoloured seed, whereas *Curvularia lunata* (eye shaped spots), *Fusarium moniliformae* produces pinkish discolouration and *Sarocladium oryzae* is responsible for light brown discolouration which are found in the seed coat, endosperm and embryo of discoloured seed (Sachan and Agrawal, 1995). *Nigrospora oryzae*, *Aspergillus niger*, *Bipolaris oryzae*, *Alternaria padwickii*, *Burkoldaria oryzae* are other pathogens which are responsible for discolouration.

Although grain discolouration diseases has been a minor problem in the past. But in recent years it is becoming a serious problem if no attention is given to the disease. Keeping in view all the factors a survey was conducted for the effective management of the disease.

MATERIAL AND METHODS

An intensive roving survey was conducted during *Kharif* 2017 from major rice growing districts of northern Karnataka *viz.*, Haveri, Dharwad, Belagavi, Koppal and Uttara Kannada. In each districts observations were recorded from different farmer's field for both disease incidence, disease severity, stage of the crop, variety grown and other details were recorded.

The disease was scored by following IRRI recommended grading scale (0-9) scale of Standard

Evaluation System for Rice, 1996).

Ten representative panicles from different fields at each location comprising of different cultivars were collected randomly, labeled and data on disease severity was computed by counting number of discoloured grains. The per cent disease index in the field will be assessed with the following formula given by Wheeler (1969).

$$\text{Per cent disease index (PDI)} = \frac{\text{Sum of the individual diseased ratings} \times 100}{\text{Number of grains assessed} \times \text{Maximum disease grade}}$$

$$\text{Per cent disease incidence (PDI)} = \frac{\text{Number of plants infected} \times 100}{\text{Total Number of plants observed}}$$

Collection of disease samples:

Discoloured grains were collected from different rice growing areas, the collected samples were packed in covers, labeled and were brought to the laboratory and stored at room temperature ($25^{\circ} \pm 2^{\circ} \text{C}$) for isolation and further investigation.

RESULTS AND DISCUSSION

An intensive roving survey was conducted in major rice growing areas of northern parts of Karnataka. A total of fourteen taluks in five districts (Belagavi, Dharwad, Haveri, Koppal and Uttara Kannada) were surveyed during *Kharif* 2017. The data of the survey are presented in the Table 1.

In all the areas surveyed, rice was grown in black and red soils under both irrigated and rainfed condition. During the survey the disease was observed at early grain filling to maturity stage. The disease severity ranged from 06.66 to 26.23 PDI and per cent disease incidence ranged from 12.21 to 46.66 per cent (Table 1). In different districts surveyed, the maximum disease severity (17.69 %) as well as maximum per cent disease incidence (25.84 %) was noticed in Haveri district. Least disease severity (11.84 %) and per cent disease incidence (19.05 %) was observed in Belagavi district. In taluka surveyed, the mean severity (21.56 %) and mean per cent incidence (35.55 %) was maximum in Ranebennur taluk and mean severity (10.21 %) as well as mean per cent disease incidence (17.40) was minimum in case of Khanapur taluk. Among the villages surveyed the disease severity (26.23 %) as well as per cent disease incidence (46.66 %) was maximum in Medleri village of Ranebennur taluk (%). Minimum per cent disease index (06.66 %) as well as per cent disease incidence (12.21

Survey for incidence & severity of grain discolouration of paddy in northern parts of Karnataka

Table 1 : Incidence and severity of grain discolouration of paddy in northern parts of Karnataka during Kharif 2017

District	Taluk	Village	Soil type	Rainfed /Irrigated	Genotypes	Upland /Lowland	Stage of the crop	Latitude (N)	Longitude (E)	Per cent disease index	Per cent disease incidence	Other diseases observed	
Belagavi	Bailhongal	Kittur	Black soil	Rainfed	Intan	Upland	Milky	15.59	74.49	10.67	20.01	Blast	
		Belavadi	Black soil	Rainfed	Intan	Upland	Maturity stage	15.51	74.76	16.28	26.66	Blast, Brown spot	
		Devarsigahalli	Black soil	Rainfed	Jaya	Upland	Maturity	15.50	74.64	14.89	17.33	Blast	
			Taluk mean								13.94	21.33	
	Belagavi	Belagavi	Black soil	Rainfed	Local	Drill sown	Early grain filling	15.85	74.50	08.88	21.10	Blast	
			Narsipura	Black soil	Rainfed	Doddiga	Drill sown	Maturity	16.08	74.57	13.78	17.28	Blast
			Taluk mean								11.33	19.19	
	Gokak	Gokak	Black soil	Irrigated	Jaya	Transplanting	Maturity	16.15	74.81	12.20	20.10	Blast	
			Arabhavi	Black soil	Rainfed	Local	Drill sown	Milky stage	16.22	74.82	11.61	16.50	-
			Taluk mean								11.90	18.30	
	Khanapur	Khanapur	Black soil	Irrigated	Samba masuri	Transplanting	Maturity	15.64	74.51	12.86	20.85	Blast, Brown spot	
			Bidi	Red soil	Rainfed	Basmati	Drill sown	Maturity	15.56	74.65	11.11	16.16	Blast
Gundenhatti			Black soil	Rainfed	Doddiga	Drill sown	Early grain filling	15.66	74.67	06.66	15.19	-	
		Taluk mean								10.21	17.40		
<i>Table 1 contd...</i>													
District	Taluk	Village	Soil type	Rainfed /Irrigated	Genotypes	Upland /Lowland	Stage of the crop	Latitude (N)	Longitude (E)	Per cent disease index	Per cent disease incidence	Other diseases observed	
Dharwad	Dharwad	Mummigatti	Black soil	Rainfed	Intan	Upland	Maturity	15.40	74.94	18.46	33.34	Blast	
		Mugad	Black soil	Rainfed	Mugad sugand	Upland	Maturity	15.43	74.89	17.37	26.76	Blast	
		Daddikamalapur	Black soil	Rainfed	Doddiga	Upland	Maturity	15.55	74.95	11.85	17.77	-	
		Alnavar	Black soil	Rainfed	Intan	Upland	Milky stage	15.45	74.97	13.87	22.41	Blast	
			Taluk mean								15.38	25.07	
	Hubli	Adargunchi	Black soil	Rainfed	Doddiga	Upland	Milky stage	15.28	77.15	11.52	17.28	Blast	
			Gabbur	Black soil	Rainfed	Doddiga	Upland	Early grain filling	16.30	77.15	08.40	12.21	Blast
			Taluk mean								09.96	16.39	
	Kalaghatgi	Kalaghatgi	Red soil	Rainfed	Siri 1253	Upland	Milky stage	15.18	74.97	13.21	24.43	Blast	
			Dummavad	Black soil	Rainfed	Doddiga	Upland	Maturity	15.12	75.05	10.43	15.64	-
			Dastikoppa	Black soil	Rainfed	Local	Upland	Early grain filling	15.69	74.70	09.55	15.50	Blast
			Taluk mean								11.06	17.42	

Table 1 contd...

Table 1 contd.....

District	Taluk	Village	Soil type	Rainfed /Irrigated	Genotypes	Upland /Lowland	Stage of the crop	Latitude (N)	Longitude (E)	Per cent disease index	Per cent disease incidence	Other diseases observed
Haveri	Haveri	Haavanuru	Black soil	Irrigated	Jaya	Lowland	Maturity	14.86	75.68	16.67	26.24	Brown spot
		Niralagi	Red soil	Rainfed	Doddiga	Upland	Early grain filling	14.76	75.33	11.16	18.79	Blast
		Galganath	Black soil	Irrigated	Kaveri sona	Lowland	Milky stage	14.92	75.73	18.34	19.84	False smut
						Taluk mean				15.39	21.62	
	Ranebennur	Medleri	Black soil	Irrigated	MTU-1010	Lowland	Maturity stage	14.79	75.39	26.23	46.66	False smut
		Udagatti	Black soil	Irrigated	RNR sona	Lowland	Maturity stage	14.48	75.24	21.13	33.34	Brown spot
		Heeladahalli	Black soil	Irrigated	RNR sona	Lowland	Maturity stage	14.63	75.65	17.34	26.67	Bacterial blight
						Taluk mean				21.56	35.55	-
	Shiggaon	Bada	Red soil	Rainfed	MTU-1010	Upland	Early grain filling	16.24	75.51	16.23	20.49	-
		Bankapur	Red soil	Irrigated	Tirumalgold	Lowland	Milky stage	14.56	75.36	14.28	17.32	Blast
		Shiggaon	Black soil	Rainfed	Abhilash	Upland	Maturity	14.99	75.22	17.88	23.32	-
						Taluk mean				16.13	20.37	

Table 1 contd...

District	Taluk	Village	Soil type	Rainfed /Irrigated	Genotypes	Upland /Lowland	Stage of the crop	Latitude (N)	Longitude (E)	Per cent disease index	Per cent disease incidence	Other diseases observed
Koppal	Gangavati	Basavapatna	Black soil	Irrigated	Samba masuri	Lowland	Maturity	15.44	76.48	10.94	13.31	-
		Anegundi	Black soil	Irrigated	Samba masuri	Lowland	Maturity	15.61	76.66	11.14	14.50	-
		Gangavati	Black soil	Irrigated	IR-64	Lowland	Milky stage	15.53	76.63	15.52	20.99	Blast
						Taluk mean				12.53	15.50	
	Koppal	Hosahalli	Black soil	Irrigated	Kaveri sona	Lowland	Milky stage	15.89	76.12	08.87	12.21	-
		Ganigera	Black soil	Irrigated	Samba masuri	Lowland	Maturity	15.35	76.24	13.12	17.66	Blast
		Hitnal	Black soil	Irrigated	Samba masuri	Lowland	Maturity	15.33	76.31	14.45	19.17	Blast
						Taluk mean				12.14	17.11	
	Uttar Kannada	Mundagod	Herehalli	Black soil	Irrigated	Abhilash	Lowland	Milky stage	14.52	75.73	17.67	20.13
Siddankoppa			Black soil	Irrigated	Doddiga	Lowland	Maturity	14.82	74.99	16.28	18.24	Blast
Ramapur			Red soil	Irrigated	Local	Lowland	Flowering	14.87	75.02	09.12	12.42	Brown spot
Mundagod			Black soil	Irrigated	MTU-1001	Lowland	Milky stage	14.97	75.03	19.55	23.13	Blast
						Taluk mean				15.65	18.48	
Sirsi		Devakoppa	Red soil	Irrigated	MTU-1010	Lowland	Milky stage	14.72	74.92	18.89	21.82	Blast
		Sirsi farm	Red soil	Irrigated	Sirsi local	Lowland	Maturity stage	14.63	74.81	22.23	26.66	False smut
	Navanagere	Red soil	Irrigated	Rasi	Transplanting	Flowering	14.63	74.81	15.78	23.12	Blast	
					Taluk mean				18.96	23.86		

Survey for incidence & severity of grain discolouration of paddy in northern parts of Karnataka

Table 2a : District and Taluk wise mean severity and incidence of grain discolouration in northern parts of Karnataka during *Kharif* 2017

District	Taluk	Mean	
		Per cent disease index	Per cent disease incidence
Belagavi	Bailhongal	13.94	21.33
	Belagavi	11.33	19.19
	Gokak	11.90	18.30
	Khanapur	10.21	17.40
	Mean	11.84	19.05
Dharwad	Dharwad	15.38	25.07
	Hubli	09.96	16.39
	Kalaghatgi	11.06	17.42
	Mean	12.13	19.62
Haveri	Haveri	15.39	21.62
	Shiggaon	16.13	20.37
	Ranebennur	21.56	35.55
	Mean	17.69	25.84
Koppal	Gangavati	12.53	15.50
	Koppal	12.14	17.11
	Mean	12.33	16.30
Uttar Kannada	Mundagod	15.65	18.48
	Sirsi	18.96	23.86
	Mean	17.30	21.17

Table 2b: Severity and incidence of grain discolouration of rice in different soil type, irrigation and rainfed condition during *Kharif* 2017

Mean	Soil type		Conditions		Stage of the crop		
	Black soil	Red soil	Rainfed	Irrigated	Flowering	Milky	Maturity
Per cent disease index	14.65	13.53	12.46	13.47	11.30	14.32	15.11
Per cent disease incidence	20.94	19.76	20.28	21.30	18.75	19.27	22.48

Table 2c: Severity and incidence of grain discolouration of rice on different varieties during *Kharif* 2017

Sr. No.	Varieties	Mean	
		Per cent disease index	Per cent disease incidence
1.	Abhilash	17.77	21.75
2.	Basmati	11.11	16.16
3.	IR- 64	15.52	20.99
4.	Dodiga	11.26	17.89
5.	Intan	14.54	23.27
6.	Jaya	14.58	21.85
7.	Kavery sona	08.87	14.50
8.	Local	09.79	15.55
9.	Mugad suganda	18.46	26.76
10.	MTU- 1001	19.55	23.13
11.	MTU- 1010	20.45	30.05
12.	Rasi	15.78	23.12
13.	RNR sona	19.23	29.65
14.	Siri 1253	13.21	24.43
15.	Sirsi local	22.23	26.66
16.	Sambamasuri	12.50	16.64
17.	Tirumala gold	14.28	17.32

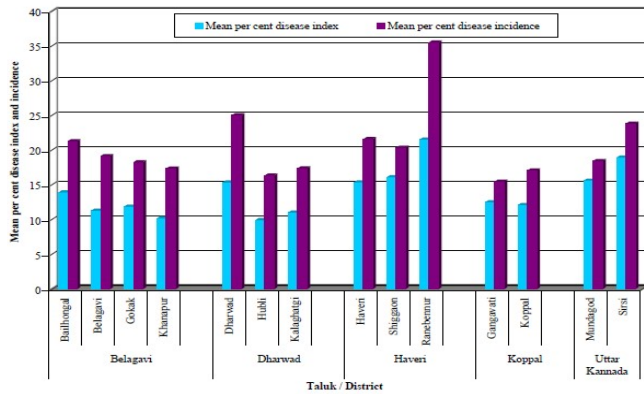


Fig. 1 : District wise mean severity and incidence of grain discoloration in northern parts of Karnataka during Kharif 2017

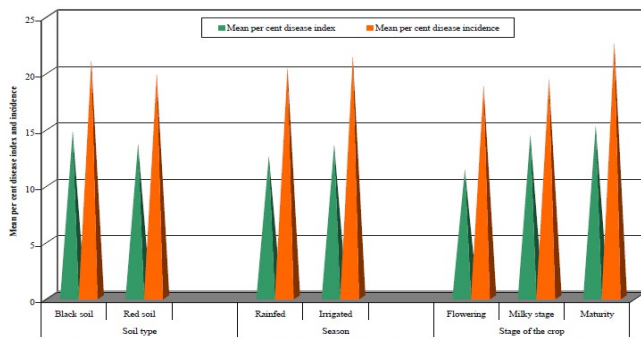


Fig. 2 : Mean severity and incidence of grain discoloration of rice in different soil type, irrigation, rainfed condition and stage of the crop during Kharif, 2017

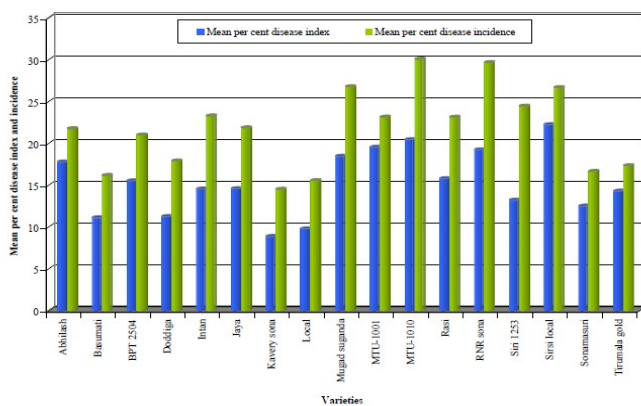


Fig. 3 : Mean severity and incidence of grain discoloration of rice in different varieties during Kharif, 2017

clear that the disease incidence was noticed in all localities because of use of same variety and congenial environmental conditions prevailing over the locality. Sharma and Vaid (1989) reported that the grain discoloration of rice in Himachal Pradesh where the overall incidence of the disease ranged from 3.17 to 78.36 per cent.

Disease severity and incidence was maximum in black soil (14.65 % and 20.94 %), irrigated condition (13.47 % and 21.30 %) and maturity stage (15.11 % and 22.48 %). Across the locations, the maximum per cent disease severity and incidence was observed in varieties viz., MTU- 1010, MTU- 1001, Mugad Sunganda, RNR Sona, Tirumal gold and Sirsi local. Further, Haveri, Uttara Kannada and Koppal areas are identified as hot spot for grain discoloration of paddy in northern Karnataka. The grain discoloration was more predominant in MTU-1010 variety when compared to Sirsi local and RNR sona varieties.

The disease incidence and severity was more noticed in Haveri district, this may be due to high temperature and low soil moisture coupled with dry weather conditions prevailed during later part of the crop stage. Environmental conditions like high temperature, high relative humidity, high rainfall and consequently congenial weather for the pathogen infection and survival.

Conclusion:

The present investigation included a roving survey conducted during Kharif 2017 revealed that, incidence and severity of grain discoloration was noticed in most of the rice cultivated areas of northern Karnataka viz., Belagavi, Dharwad, Haveri, Koppal and Uttara Kannada. Maximum disease severity (26.23 %) as well as maximum per cent disease incidence (46.66 %) was recorded from Medleri village of Ranebennur taluk. Least per cent disease index (06.66 %) as well as per cent disease incidence (12.21 %) was noticed in Gundenahatti village of Khanapur taluk. Out of five districts surveyed, the mean maximum per cent disease index (17.69 %) as well as mean maximum per cent disease incidence (25.84 %) was noticed in Haveri district, followed by Uttara Kannada (17.30 %) and (21.17 %). respectively.

REFERENCES

Anonymous (1996). Standard evaluation system for rice. International Rice Research Institute. P.O. Box 933, 1099 Manila, Philippines, 4th Ed. p. 56.

%) was recorded in Gundenahatti village of Khanapur taluk. Observations revealed that disease was more prominent in Haveri and Uttara Kannada districts. It is

Anonymous (2016). The area under cultivated rice in India. Ministry of Agriculture and Farmers Welfare, GOI, New Delhi, www.India stat.com. p. 48.

Bodalkar, C. and Awadhiya, G.K. (2014). Efficacy of fungicides against grain discoloration of *Oryza sativa* L. variety mhamaya. *Internat. J. Curr. Res. Biosci. Plant Biol.*, **1** (5): 45-48.

Gupta, A.K., Solanki, I.S., Bashyal, B.M., Singh, Y. and Srivastava, K. (2015). Bakanae of rice-an emerging disease in Asia. *J. Animal Plant Sci.*, **25** (6): 1499-1514.

Sachan, I.P. and Agarwal, V.K. (1994). Efficacy of seed treatment of discoloured rice on seed borne inoculum, germination and seedling vigour. *Seed Res.*, **22** (1): 45-49.

Sharma, O.P. and Vaid, A. (1989). Status and distribution of grain discolouration disease of rice in Himachal Pradesh. *Indian Phytopathol.*, **43**: 47.

Wheeler, B.E.J. (1969). An introduction to plant diseases. John Wiley and Sons Ltd., London. pp. 156-158.

17th
Year
★★★★★ of Excellence ★★★★★