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Abhishek Kumar
Department of Plant Pathology, SVPUA&T, Meerut, Uttar Pradesh, India

Kamal Khilari
Department of Plant Pathology, SVPUA&T, Meerut, Uttar Pradesh, India

Anupam Kumar
Department of Plant Pathology, SVPUA&T, Meerut, Uttar Pradesh, India

Priyanka Yadav
Department of Plant Pathology, SVPUA&T, Meerut, Uttar Pradesh, India

Vikas Rathi
Department of Plant Pathology, SVPUA&T, Meerut, Uttar Pradesh, India

Shivani Chaudhary
Department of Plant Pathology, SVPUA&T, Meerut, Uttar Pradesh, India

Corresponding Author:
Abhishek Kumar
Department of Plant Pathology, SVPUA&T, Meerut, Uttar Pradesh, India

Effect of plant nutrient on incidence of bakanae disease of rice caused by *Fusarium moniliforme* in western Uttar Pradesh

Abhishek Kumar, Kamal Khilari, Anupam Kumar, Priyanka Yadav, Vikas Rathi and Shivani Chaudhary

Abstract
Rice (*Oryza sativa* L.) is the most important cereal crops in the tropical and subtropical region of the world. Rice crop is affected by many fungal, bacterial, viral and nematode diseases. Among the fungal diseases the bakanae disease is an emerging disease of rice and cause severe losses. Bakanae disease causing pathogen produces different type symptoms on rice, such as; seedlings elongation, foot rot, seedling rot, chaffy grains and grain discoloration. Management of this disease includes chemicals, bio-agents and other cultural practices. Since chemical management has its own certain drawbacks like environmental pollution. There is a more scope to develop suitable package of cultural practices to manage the bakanae disease. Among cultural practices, one of the important practices is application of balanced fertilizer. Therefore, a study was undertaken to look at the effectiveness of nutrients on foot rot disease of PB- 1121 variety of basmati rice. In field condition, in respect of different doses of fertilizers, minimum 2.68% disease incidence was observed in recommended dose of NPK+ Z_nSo_4 + $FeSO_4$ + Carbendazim (0.1%) followed by double dose of K & recommended dose of N&P with 3.38% disease incidence. Maximum (9.12%) disease incidence was observed in double dose of Nitrogen and recommended dose of phosphorus and potash over the control (9.94%). So, it can be concluded that use of Carbendazim with recommended dose of balanced fertilizer may be useful for eco-friendly management of bakanae disease of rice.

Keywords: Rice, Bakanae, Foot rot, *Fusarium moniliforme*, nutrients and fungicides

Introduction
Rice is the most important cereal crop in the tropical and subtropical region of the world. It is one of the main staple foods for nearly two- third of the population of the world (Roy *et al*., 2011) [7]. India ranks second after China in rice production in the world. Unlike wheat, 95% of the world's rice is grown in developing nations, primarily in Asia, Africa, and Latin America. In India rice ranking first among cereals in terms of area and production. The goal of Indian agriculture has to be "increase in food grain production with minimum and efficient use of chemical fertilizers" (Prasad, 2009) [6]. Rice is second most important food crops of the world after wheat. Rice is major staple crop of the world to diet of 2.7 billion people. It is being grown in all the countries except Antarctica. It is occupying 163. 20 million hectares of area, producing 719. 73 million tonnes of rice with an average productivity of 4.41 per hectare (Anonymous, 2014) [1].

In India, rice occupies an area 43.95 Million hectare with production and productivity of 106.65 mt 10 and 2.4 tons per hectare respectively (Anonymous, 2015-16) [1, 2]. India is the leading exporter of basmati rice to the global market. India export about 1.18 million tonnes of basmati rice costing Rs. 4345 crores in 2007-08. Further the area production and export of basmati rice showed increasing trend and in 2009-10 the export of basmati rice jumped to 2.01 million tonnes costing 10,889 crores more than double of the values of 2007-08. It clearly indicates that the increasing demand for basmati rice in international market, there is more scope to increase the area and production of basmati rice. The country has exported basmati rice to world for the worth of Rs. 22718.44 crores during the year 2015-16 (APEDA 2015-16) [3]. In recent days some countries rejected the Indian basmati rice consignment due to presence of heavy metals and pesticides residue in the products. So use of balance fertilizers and other ecofriendly methods for the management of disease will be helpful in reducing the application of pesticides that may boost the export of basmati rice.

In recent years among the different diseases of rice, the bakanae disease is an emerging as very serious threat to basmati rice production. It occurs in both upland and lowland rice fields. This disease is widely distributed in almost all the rice growing areas. Previously this disease was as a minor disease but now it is becoming a major disease particularly in basmati rice variety PB-1121 which is most popular among farmers in all basmati rice growing areas (Khilari *et al*., 2011) [5]. The first symptoms of bakanae disease appeared in seedling stage in rice nursery. Typical symptoms of bakanae disease are etiolation and abnormal elongation of the infected plants, induced by fungi due to production of gibberellins. In advance stage of' disease, rotting of foot region is common, that leads the complete death of infected plants. Infected plants are taller than healthy plants and light yellowish in color. They are clearly apparent from distance in field. The infected plants produced roots on the lower nodes, in later stages of disease, white or light pinkish growth of fungus developed on the lower nodes. At the time of ear emergence, infected plants produced white ears. Panicles which produced by the infected plants are sterile or with few grains of poor quality.

To minimize the use of chemicals in the management of bakanae disease, more research is required to develop suitable package for the management of bakanae disease. Keeping all these in view in present study effect of different combination of nutrients, and fungicides were tested on the occurrence of bakanae disease in field condition.

Material and Methods

Experimental site

The field experiment was carried out at the Crop Research Center of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut. (U.P.) located at latitude of 29° 40' north and longitude of 770 42' east and at an altitude of 237 meter above mean sea level. Meerut lies in the heart of Western Uttar Pradesh and has sub-tropical climate. The experimental field had an even topography with good drainage system.

Preparation for experiment

The seeds were sown in nursery after pre-treatment to raise the seedlings. After 24 days of sowing, the seedlings were ready for transplanting in the field. The experiment was conducted in a Randomized Block Design (RBD) with twelve treatments. This field experiment to study the effect of different nutrients on the incidence of bakanae disease of rice was conducted during kharif 2016. In this experiment different inorganic fertilizers (urea, single super phosphate, murate of potash, zinc sulphate and ferrous sulphate) at different doses and a fungicide (carbendazim) were tested alone and in combination against bakanae disease of rice and control were maintained with double dose of nitrogen only. Three replications were maintained for each treatment. Plot size for each replication was 4X3 m. Treatments were applied as per plan. The experiment was conducted during July (2016) in open environment and data on percentage of disease incidence and plant height was recorded at 30 and 90 days after transplanting and the observation on plant height was measured from the base of plant to tip of the fully opened leaf till at 30 and 90 DAT. Data on height were collected on three plants which were marked in each plot. Data on number of bakanae infected plants were recorded in each plot at 30 and 90 DAT. The per cent disease incidence was calculated according to the following formula given by (Teng and James, 2001; Zainudin *et al*., 2008) [8, 9]:

$$\text{Percent disease incidence} = \frac{\text{Total no. of infected plants}}{\text{Total plant examined}} \times 100$$

Results and Discussion

Effect of different nutrients on incidence of bakanae disease and plant height at 30 days after transplanting

Incidence of bakanae disease

The data related to incidence of bakanae disease as affected by different treatments at 30 days after transplanting are presented in table 1. It was observed that after 30 days of transplanting, minimum 1.51% bakanae disease incidence was observed in recommended dose of NPK+ZnSO4+FeSO4+Carbendazim 0.1% (T11) followed by double dose of K & recommended dose of N&P (T7) with 2.34% disease incidence. Recommended dose of NPK+ZnSO4+FeSO4 (T10) and half dose of N & recommended dose of P&K (T2) were observed with average 4.09% and 4.79% incidence of bakanae disease, respectively. Significant difference was recorded in all the treatments over control. Maximum disease incidence was observed in double dose of N & recommended dose of P&K (T3) with 8.30% followed by half dose of P & recommended dose of N&K (T4) with 6.78% disease incidence. In control 8.53% incidence of bakanae disease was observed. Dordas (2008) reported in a review article summarizes regarding the effect of nutrients, such as N, K, P, Mn, Zn, B, Cl and Si, on disease resistance and tolerance and their use in sustainable agriculture. There is a difference in the response of obligate parasites to N supply, as when there is a high N level there is an increase in severity of the infection. K decreases the susceptibility of host plants up to the optimal level for growth and beyond this point there is no further increase in resistance. In contrast to K, the role of P in resistance is variable and seemingly inconsistent. Among the micronutrients, Zn was found to have a number of different effects as in some cases it decreased, in others increased and in others had no effect on plant susceptibility to disease.

Plant height (cm)

The data related to plant height as affected by different treatments at 30 days after transplanting are presented in table 1. It was observed that after 30 days of transplanting, the maximum 85.10 cm plant height was recorded in double dose of N & recommended dose of P&K (T3) which was statistically at par with double dose of K & recommended close of N&P (T7) with 84.10 cm plant height but differed significantly than other treatments. The minimum plant height was recorded in double dose of P & recommended dose of N&K (T5) with 76.92 cm plant height which was statistically at par with half dose of K & recommended dose of N&P (T6) with 79.73 cm plant height and half dose of P & recommended dose of N&K (T4) with 80.88 cm plant height over the control (86.67 cm).

Effect of different nutrients on incidence of bakanae disease and plant height at 90 days after transplanting

Incidence of bakanae disease: The data related to incidence of bakanae disease as affected by different treatments at 90 days after transplanting are presented in table 1. After 90 days

of transplanting, minimum 2.45% bakanae disease incidence was observed in recommended dose of NPK+ ZnSO4 + FeSO4+Carbendazim 0.1% (T11) followed by double dose of K & recommended dose of N&P (T7) with 3.38% disease incidence. Recommended dose of NPK+FeSO4 (T9) and recommended dose of NPK+ZnSO4+FeSO4 (T10) were observed with average 4.79% and 5.02% incidence of bakanae disease, respectively. Significant difference was recorded in all the treatments over check. Maximum disease incidence was observed in double dose of N & recommended dose of P&K (T3) with 8.65% followed by half dose of P & recommended dose of N&K (T4) with 7.13% disease incidence. In case of control 9.82% incidence was recorded at 90days after transplanting.

Plant height (cm)

The data related to plant height at 90 days after transplanting are presented in table 1. At 90 days after transplanting, maximum 147.56 cm plant height was recorded in recommended dose of NPK+ZnSO4+FeSO4+Carbendazim 0.1% (T11) which was statistically at par with double dose of K & recommended dose of N&P (T7) with 144.70 cm plant height, but differed significantly than other treatments. It was found that the minimum plant height was recorded in half dose of N & recommended dose of P&K (T2) with 128.11 cm plant height which was statistically at par with recommended dose of NPK (T1) with 131.14 cm plant height over the control (163.55 cm).

Table 1: Effect of nutrients on the incidence of bakanae disease of rice and plant height in field condition at 30 and 90 days after transplanting

S. N	Treatments	30 day after transplanting			90 day after transplanting		
		Infected plants	Disease incidence	Plant height (cm)	Infected plants	Disease incidence	Plant height (cm).
1	Recommended dose of NPK(100:60:60)	17.00	5.96	83.44	18.33	6.43	131.14
2	Half dose of N & recommended dose of P&K	13.67	4.79	81.33	16.00	5.61	128.11
3	Double dose of N & recommended dose of P&K	23.67	8.30	85.10	24.66	8.65	143.77
4	Half dose of P & recommended dose of N&K	19.33	6.78	80.88	20.33	7.13	139.11
5	Double dose of P & recommended dose of N&K	14.66	5.14	76.92	16.00	5.62	131.23
6	Half dose of K & recommended dose of N&P	18.33	6.43	79.73	20.00	7.01	138.59
7	Double dose of K & recommended dose of N&P	6.66	2.34	84.10	9.66	3.38	144.70
8	Recommended dose of NPK+ZnSO4	15.33	5.37	78.18	17.66	6.19	144.45
9	Recommended dose of NPK+FeSO4	13.33	4.68	81.22	13.66	4.79	138.40
10	Recommended dose ofNPK+ZnSO4+FeSO4	11.66	4.09	82.99	14.33	5.02	143.34
11	Recommended dose of NPK+ZnSO4+FeSO4+Carbendazim 0. 1%	4.33	1.51	81.88	7.00	2.45	147.56
12	Control(Double dose of N)	24.33	8.53	86.67	28.00	9.82	163.55
	C.D. at 5% level		0.623	9.633		0.696	15.070

Conclusion

The above investigation clearly indicates that the pathogen causing bakanae disease of rice responding well to the more doses of nitrogen as compare to other nutrients. Whereas use of recommended dose of nitrogen fertilizers along with other fertilizers and carbendazim may reduce the incidence of bakanae disease. So it can be concluded that to maintain ecological balance and sustainability in agriculture, there should be go for adopting well cultural practices which suits well to the crop growth but not suitable for the survival, growth and development of pathogens like use of well-balanced fertilizers application. Therefore use of Carbendazim with recommended dose of balanced fertilizers may be beneficial tool to management of bakanae disease of rice.

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References

1. Anonymous. 3rd advance estimate, Government of India, 2014.
2. Anonymous. Agricultural statistics at a glance, Ministry of Agriculture. GOI: and FAS/New Delhi, 2015-16.
3. APEDA. Agricultural statistics at a glance, Ministry of Agriculture. GOI, 2015-16.
4. Gupta AK, Singh Y, Jain AK, Singh D. Prevalence and incidence of bakanae disease of rice in Northern India. Journal of Agriculture Research. 2014;1(4):233-237.
5. Khilari K, Bhanu C, Sharma R, Gupta A, Gangwar B. Bakanae disease a serious threat to basmati rice cultivation. In proceeding advances in Biotechnology in agricultural crops for sustaining productivity, quantity improvement food security. 2011, pp12.
6. Prasad R. Efficient fertilizer use: the key to food security and better environment. Journal of Tropical Agriculture. 2009;47:1-17.
7. Roy P, Orikasa T, Okadome H, Nakamura N, Shiina T. Processing conditions, rice properties, health and environment. International Journal of Environmental Resources, Public Health. 2011;8:1957-1976.
8. Teng PS, James WC. Disease and yield loss assessment. CABI Publishing Company Inc. Boston, Massachussetts. 2001, Pp.25-38.
9. Zainudin NAIM, Razak AA, Salleh B. Bakanae disease of rice in Malasia and Indonesia: etiology of the causal agent based on morphological, physiological and pathogenicity characteristics. Journal of Plant Protection Research. 2008;48(4):475-485.