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INTEGRATED MANAGEMENT OF BUD NECROSIS DISEASE OF WATERMELON

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ABSTRACT

Watermelon (*Citrullus lanatus*) belongs to the family Cucurbitaceae is one of the most important summer fruit vegetable crop, Bud-necrosis disease caused by Watermelon bud necrosis orthotospovirus (WBNV) is an emerging constraint to watermelon production in several regions.. In all parts of *Konkan* region of Maharashtra watermelon cultivation goes on increasing day by day but watermelon cultivation sustained severe setback due to watermelon bud necrosis disease. The present study was undertaken to overcome this disease by adopting different management practices. A three years field study (Rabi seasons 2020, 2021, & 2022) evaluated on management of bud necrosis disease of watermelon. Treatments were arranged in a randomized complete block design with seven treatments and three replications. Percentage disease incidence (PDI), thrips population, and marketable yield were recorded. The pooled data of three years study revealed that, among the seven different treatments, the treatments $T_{6=}$ Black mulching (30 micron) + drenching *of Pseudomonas fluorescens* at true leaf stage + one spray of Imidachloprid (0.3 ml/l) @ 30 DAS + Application of blue sticky trap (2 trap / plot) + one sprays of neem oil @ 2 ml/l 45 DAS was found significantly superior for management of bud necrosis disease of watermelon over rest of the treatments with minimum percent disease intensity (PDI) 29.21% and maximum per cent disease reduction 41.85% over control along with significantly increased the fruit yield (21.11qh a^{-1}) over control as well as low thrips population..

Keywords **:** Watermelon, Imidachloprid, bud necrosis, Integrated, *Pseudomonas,* mulch.

Introduction

Watermelon (*Citrullus lanatus*) belongs to the family Cucurbitaceae.is one of the most important summer fruit vegetable crop. It is native to Africa and was then introduced to Asia, Europe, and the Americas. Even though watermelon is commonly classified as a vegetable, it is botanically considered as a fruit and used primarily as a dessert. World over it is grown in an area of 3.69 million ha with an estimated annual production of 97.43 million tonnes and average productivity of 26.37 tonnes per ha. Bud necrosis disease is an emerging threat for watermelon cultivation in India. It is characterized by necrotic spots and patches on leaves, bud and fruits with characteristic chlorotic ring spots as documented in Konkan region. The disease is endemic in many watermelons growing region causing enormous loss in yield, quality and quantity of watermelon (Pandey and Pandey, 2001). The topographic and climatic conditions greatly influence disease incidence and its further development. The disease was shown to be caused by a virus named Watermelon bud necrosis virus (WBNV). This virus is transmitted by a tiny, slender insects (less than 2 mm long) called 'thrips' and widespread across India. Thrips feed on flowers and leaves of plants using piercing and sucking mouthparts. In all parts of *Konkan* region of Maharashtra watermelon cultivation goes on increasing day by day but watermelon cultivation sustained severe setback due to watermelon bud necrosis disease. Watermelon bud necrosis disease, caused by Watermelon bud necrosis orthotospovirus (WBNV), is transmitted by thrips (notably *Thrips palmi*) and can cause significant yield losses. Therefore it was necessary to adopt the different integrated management practices to overcome this disease. Hence the present study was undertaken.

Materials and Methods

The field experiments on watermelon were conducted at MAE farm, Regional Agricultural Research Station, Karjat, Dist. Raigad with over a period of three years during season *Rabi* 2019-20, *Rabi* 2020-21 and *Rabi* 2021-22 on variety **BS -529** in Randomized Block Design (RBD) comprising seven treatments and three replications maintaining a spacing of 2.0 X 0.6 m .

Table 1: Details of the treatments

Tr. No	Treatments /Dose/ Conc. (%)
T_1	Drenching *of Pseudomonas fluorescens* 5 g / lit at true leaf stage and 2nd drenching 15 days after 1st drenching.
T_2	Spraying of Imidachloprid (0.3 ml) at true leaf stage and 2nd spraying 15 days after 1st spraying.
T_3	Sowing of two lines of maize as a border crop around the plant
T_4	Application of Blue sticky trap (2 trap / plot)
T_5	Two sprays of neem oil @ 2 ml/l first at 30 DAS and second spray at 45 DAS.
T_6	Black mulching (30 micron) + drenching *of Pseudomonas fluorescens* at true leaf stage + one spray of Imidachloprid (0.3 ml/lit. @ 30 DAS + Application of blue sticky trap (2 trap / plot) + one sprays of neem oil 2 ml/lit. @ 45 DAS.
T_7	Control

As per the treatment details sprays were given at true leaf stage to 45 days after sowing with respective treatments. Trials conducted under natural inoculum pressure near a WBNV hotspot field to mimic farmer conditions. For thrips monitoring five plants per plot sampled were selected and weekly; thrips counted from (true leaves) young leaves and flowers using a 1-minute plant beat and stereomicroscope to know the populations of thrips .

Disease assessment: Percent disease incidence (PDI) recorded fortnightly from 30 to 90 days after sowing (DAS). PDI = (Number of symptomatic plants / Total plants) × 100. Similarly marketable fruit yield (t ha^{-1}) was also recorded at harvest

Results and Discussion

Effect of various treatments for management of bud necrosis disease of watermelon was studied during season *Rabi* 2019-20, *Rabi* 2020-21 and *Rabi* 2021-22 and data narrated in the table 2. Pooled data of three years studies revealed that among the seven treatments the treatment T_6 (Black mulching + drenching *of Pseudomonas fluorescens* at true leaf stage + one spray of Imidachloprid (0.3 ml/I) @ 30 DAS + Application of blue sticky trap (2 trap / plot) + one sprays of neem oil @2 ml/l 45 DAS) was found significantly superior for for management of bud necrosis disease of watermelon over rest of the treatments with the minimum per cent disease intensity (PDI) 29.21% and maximum per cent disease reduction of 41.85 % over control (59.26 %). Similarly, mean fruit yield of three years also showed that treatment T_6 significantly increased the fruit yield (24.11 q ha^{-1}) over rest of the treatments as well as low thrips population under study.

Similarly, the economics of the effective treatment T_6 Black mulching + drenching *of Pseudomonas fluorescens* at true leaf stage + one spray of Imidachloprid (0.3 ml/I) @ 30 DAS + Application of blue sticky trap (2 trap / plot) + one sprays of neem oil @ 10000 ppm 45 DAS showed highest net returns of Rs. 256437**/-** ha^{-1} with B:C ration 2.44. Amalendu Ghosh, and his co-workers (2021) investigates the infection process of WBNV in its vector, *Thrips palmi*, highlighting the anterior midgut as the initial site of infection and detailing the virus's progression through various thrips tissues

Kamanan, B.C. and his co-workers 2010 and Priyanka K. Nagendran, G. Karthikeyan (2018) reported most effective integrated management and lowest incidence of WBNV and highest yield using seed treatments with Imidacloprid 70WS@ 10g/kg seed followed by three foliar sprays of Imidacloprid 17.8SL @ 0.25 ml/lit. Also discusses the molecular characterization of WBNV and evaluates various management strategies, including the use of resistant cultivars and vector control measures. It also finds that using insecticides alone or seed treatment alone is less effective—integrated control (seed treatment + foliar sprays) is necessary for better disease management. Similar findings were noticed in the present study**.** Priyanka and her co-workers (2019) studied on a comprehensive IPM module combines cultural, chemical and potentially biological methods that significantly reduced the thrips population and WBNV incidence, resulting in increased fruit yield. Same trend noticed in the present study that integration of treatments reduced the pest and disease of watermelon bud necrosis disease. Kumar and Venkatesh and Kumar (2006) reported that timing and method of vector control are critical as virus spread may occur very early, he also reported that black polythene mulch, seed treatments with Imidacloprid control the WBNV incidence. B.C. Kamanna, S.N. Jadhav, T.H. Shankarappa (2010) assesses the efficacy of different insecticides in controlling *Thrips palmi* populations and reducing the incidence of WBNV in watermelon

crops. Similar finding were also noticed in the present investigation.

Conclusions

From the pooled results of three years data, it is concluded that "Bud necrosis of watermelon disease" can be effectively controlled by application of Black mulching + drenching *of Pseudomonas fluorescens* at true leaf stage + one spray of Imidachloprid (0.3 ml/I) @ 30 DAS + Application of blue sticky trap (2 trap / plot) + one sprays of neem oil @ 10000 ppm 45 DAS. Drenching *of Pseudomonas fluorescens* 5 g / lit at true leaf stage and 2nd drenching 15 days after 1st drenching.

Plate 1: Watermelon growing under different treatments

Table 2: Effect of various treatments of bud necrosis on per cent disease incidence and yield (t ha^{-1}) of watermelon.

Treat.	Treatment Details	PDI				Per cent reduction in Disease over control	Mean Fruit Yield (q/ha)	Pooled mean of thrip population
		Rabi, 2019-20	*Rabi*, 2020-21	*Rabi*, 2021-22	Pooled			
T1	Drenching *of Pseudomonas fluorescens* 5g/ lit at true leaf stage and 2nd drenching 15 days after 1st drenching.	20.91 (27.21)	50.00 (45.00)	46.30 (42.88)	39.07 (38.36)	23.90	14.34	7.05 (5.27)
T2	Spraying of Imidachloprid (0.3 ml) at true leaf stage and 2nd spraying 15 days after 1st spraying.	21.76 (27.81)	29.63 (32.98)	38.89 (38.58)	30.09 (33.12)	34.29	18.02	3.13 (2.39)
T3	Sowing of two lines of maize as a border crop around the plant	35.88 (36.80)	46.29 (42.87)	50.00 (45.00)	44.06 (41.56)	17.55	12.86	6.6 (5.07)
T4	Application of Blue sticky trap (2 trap / plot)	20.80 (27.14)	44.44 (41.81)	48.15 (43.94)	37.80 (37.63)	33.84	14.00	4.97 (3.69)
T5	Two sprays of Neem oil @ 2 ml/l first at 30 DAS and second spray at 45 DAS.	33.51 (35.37)	48.15 (43.94)	50.00 (45.00)	43.89 (41.44)	17.79	13.58	6.37 (4.56)
T6	Black mulching + drenching *of Pseudomonas fluorescens* at true leaf stage + one spray of Imidachloprid (0.3 ml/I) @ 30 DAS + Application of blue sticky trap (2 trap / plot) + one sprays of neem oil @ 10000 ppm 45 DAS.	**13.67 (21.70)**	**27.78 (31.81)**	**31.48 (34.13)**	**24.31 (29.21)**	**41.85**	**24.11**	**1.67 (1.35)**
T7	Control	48.14 (43.94)	68.52 (43.94)	61.11 (55.87)	59.26 (50.41)	--	10.73	16.93 (12.08)
	S. Em (±)	3.54	3.21	1.87	1.57	--	0.26	0.29
	CD (0.05)	10.90	9.90	5.75	4.84	--	0.80	0.88

*Figures in the parenthesis are arcsine values.

Table 3: Economics of Integrated management of Bud necrosis disease of watermelon on input cost.

TR No.	Treatments	Cost of treatment application (Rs. ha^{-1})	Cost of Inputs (Rs. ha^{-1})	Pooled Fruit Yield (q/ha)	Gross* Return (Rs. ha^{-1})	Net Return (Rs. ha^{-1})	B:C ratio
T1	Drenching *of Pseudomonas fluorescens* 5 g / lit at true leaf stage and 2nd drenching 15 days after 1st drenching.	996	159446	14.34	258060	98614	1.62
T2	Spraying of Imidachloprid (0.3 ml) at true leaf stage and 2nd spraying 15 days after 1st spraying.	1096	159546	18.02	324420	164874	2.03
T3	Sowing of two lines of maize as a border crop around the plant	848	159298	12.86	231480	72182	1.45
T4	Application of Blue sticky trap (2 trap / plot)	489	158939	14.00	252060	93121	1.59
T5	Two sprays of neem oil @ 10000 ppm (2 ml/L) first at 30 DAS and second spray at 45 DAS.	5296	163746	13.58	244500	80754	1.49
T6	Black mulching + drenching *of Pseudomonas fluorescens* at true leaf stage + one spray of Imidachloprid (0.3 ml/I) @ 30 DAS + Application of blue sticky trap (2 trap / plot) + one sprays of neem oil @ 10000 ppm (2 ml/L) 45 DAS. Drenching *of Pseudomonas fluorescens* 5 g / lit at true leaf stage and 2nd drenching 15 days after 1st drenching.	19203	177503	**24.11**	**433940**	**256437**	2.44
T7	Control	0	158450	10.73	193120	34670	1.22

***Selling price of watermelon Fruits**: =Rs.1800/- per q, Treatment cost = Labour cost = Rs. 248/- day^{-1}, Psuedomonas @ Rs. 100/- L^{-1}, Imidachlopid @ Rs. 2000/- L^{-1}, Blue sticky trap @ Rs. 304/ 25 sticks, Maize seed Rs. 300/- kg^{-1}, Neem oil @ Rs. 2400/- L^{-1}, Blach mulch paper @ Rs. 48/- per Metre

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