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Eco-friendly management of mealybug and wilt in pineapple

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A B S T R A C T

In an on-farm RBD trial (3 treatments, 8 replicates) in 2006-07 at Chopra, Islampur, Uttar Dinajpur, West Bengal, for eco-friendly pest management of mealy bug, *Dysmicoccus brevipes* Cockerell in pineapple, the treatments were: T_1 [Farmers' practice: phorate 10 G @ 20 kgha^{-1} during planting + monocrotophos 36% EC @ 0.03% at 100 DAP + endosulfan 35% EC @ 0.02% during 150-180 DAP]; T_2 [Treating planting materials (basal portion) with monocrotophos 36% EC @ 0.02% + phorate 10 G @ 15 kg ha^{-1}at 100 DAP + Neem oil 1500 ppm spray @ 2.5 m/L^{-1} at 150 DAP]; T_3 [Treating planting materials (basal portion) with monocrotophos 36% EC @ 0.02% + phorate 10 G @ 15 kgha^{-1} at 100 DAP + neem cake @ 1.5 tha^{-1} at 180 DAP + three times manual weeding]. By yield performance and reduction of percentage of wilted plants and mealy bug population, T_3 was the best and T_2 ranked second. Percent of wilted plants in T_1, T_2 and T_3 were 11.88, 4.19, 2.62; mean mealy bug population/plant were 9.33, 5.29, 4.20, and yields were 32.5 tha^{-1}, 38.7 tha^{-1}, 41.6 tha^{-1}, respectively. Benefit: Cost ratio was highest in T_3 (1.30) followed by T_2 (1.24) and T_1 (1.09).

Introduction

Pineapple (*Ananas comosus* Merril) is a tropical-subtropical fruit crop grown in Hawaii, South and Central America, Africa including the Caribbean, Australia, south-east Asia, India, Sri Lanka and Bangladesh. In India, it grows best in warm, humid and perhumid areas as well as in the coastal states of peninsular India. The major pineapple producing states in India are West Bengal, Assam, Karnataka, Meghalaya, Manipur, Arunachal Pradesh, Kerala and Bihar. The state - wise area, production and productivity during 2000-01 are presented in Table 1. The cultivated area has increased by more than 170% between 1970 and1989-90 (20,000 ha in 1970 and 54,517 ha in 1989-90) and by 43% between 1990 and 2000-2001 (54,517 ha in 1989-90 and 78, 200 ha in 2000-01) (Chadha & Pareek, 1993; Rangaswami & Mahadevan, 1999; Anonymous 2007). West Bengal ranked second (10,400 ha, 2, 79, 500 tonnes) after Assam (14,000 ha, 2,16, 100 tonnes) in area but first in production; and second (26.90 t ha $^{-1}$) in productivity after Nagaland (28.60 t ha $^{-1}$) (Table 1). In respect of area-productivity parameter in both 1989-90 and 2001-01, West Bengal ranks first, far ahead of other states and shall get top priority in promotion. During 2002-03, India produced 1.26 million tonnes of pineapple from about 80,000 ha. India produces more than 8% of total world production of pineapple. In Uttar Dinajpur district the pineapple cultivated area and production were 1,650 ha and 13,200 tonnes during 2002-03 (http://govt.wb.org.in.) Both productivity and quality are high in some humid areas. Overall proper planning and strategy have to be taken for raising production and productivity of pineapple in eastern and north states, especially West Bengal.

The roles of various pests and abiotic pathogens in lowering production and productivity in the states with large areas of cultivation have not yet been assessed. Cultivation of pineapple under well-drained humid condition is practised in the eastern and north-eastern states, which should bring about greater production and productivity than achieved now. If productivity could be raised in these states high mean productivity in India would be greatly improved as because these are the states with wide cultivation.

Materials and Methods

In an on-farm RBD trial with 3 treatments and 8 replicates in 2006-07 at Chopra, Islampur, Uttar Dinajpur, West Bengal, for eco-friendly pest management of mealy bug, *Dysmicoccus brevipes* (Cockerell) in pineapple under rainfed upland condition. The treatments were: T_1 [Farmers' practice: phorate 10G @ 20 kg ha^{-1} during planting + monocrotophos 36% E.C. @ 0.03% at 100 DAP + endosulfan 35% E.C. @ 0.02% during 150-180 DAP]; T_2 [Treating planting materials (basal portion) with monocrotophos 36% E.C. @ 0.02% + phorate 10 G @15 kg ha^{-1} at 100 DAP + neem oil 1500 ppm spray @ 2.5 ml l^{-1} at 150 DAP]; T_3 [Treating planting materials (basal portion) with monocrotophos 36% E.C. @ 0.02% + phorate 10 G @ 15 kg

Table 1

State - wise Area, Production and Productivity of pineapple of India (1989- 90) and (2000-01)

States	Area ('000ha)		Production ('000t)		Productivity (t/ha)	
	1989-90	2000-01	1989-90	2000-01	1989-90	2000-01
Arunachal Pradesh	26.09	73.0	11.25	32.00	4.34	4.40
Assam	107.42	140.0	166.39	216.10	15.55	15.40
Bihar	24.92	40.0	49.92	100.50	19.80	25.10
Goa	4.40	-	6.60	-	15.00	-
Karnataka	38.49	-	74.98	-	19.23	-
Kerala	45.45	95.0	49.43	68.30	10.87	7.20
Manipur	62.00	100.0	50.00	69.90	8.06	7.00
Meghalaya	85.60	92.0	68.75	81.70	8.03	8.90
Mizoram	8.42	-	10.64	-	12.63	-
Nagaland	7.65	29.0	1.76	82.90	2.30	28.60
Orissa	3.16	-	5.00	-	15.82	-
Tamil Nadu	10.10	-	39.39	-	39.00	-
Tripura	33.47	-	33.60	-	10.03	-
West Bengal	88.00	104.0	219.00	279.50	24.88	26.90
Others	-	109.0	-	290.20	-	-
Total	545.17	782.0	786.72	1221.10	8.92	15.60

Sources: Area and Production from Horticultural Statistics (National Horticulture Board, 1992), cit. Chadha and Pareek (1993). Productivity data have been computed. Pineapple Technical, *PNB Krishi Samachar*, Punjab National Bank.

ha^{-1} at 100 days after planting (DAP) + neem cake @ 1.5 t ha^{-1} at 180 DAP + three times manual weeding], with 8 replications.

Dates of transplanting and harvesting were between 2006-3-15 and 2006-4-5 and between 2007-8-5 and 2007-9-25 respectively. Wilted plants were recorded from a 5x5 m^2 area and mealy bug population was destructively recorded from 5 samples from among infested and mostly wilted plants) at one month interval from 100 days after planting. Production data were recorded from the whole plot and Benefit: Cost ratio (BCR) in fruit production was calculated as marginal profit/ marginal cost.

Results

Mealybug infestation caused wilted plants presumably with active pathogenetic role of virus. This was first noticed at 80 DAP. The leaves turn bright pink with some degree of flaccidity. The leaf tips turn brown, curl downward and the leaf margins show a slight inward curving. Later, these symptoms become more pronounced. Ultimately, the plant wilts and dries with downward browning due to necrosis at leaf tips. Finally, the leaf tips dry up completely, and the bright pink turns completely dull (Fig: 1). Correspondingly, the roots cease to elongate and collapse. Often, new roots appear above the old ones, and, concurrently, the renewed aerial growth is

Fig 1: Mealy bug wilted pineapple plant

Fig 2: Mealy bug at basal portion of pineapple plant

Fig 1: Mealy bug wilted pineapple plant

associated. Sometimes, infected plants recover from the ailment, and normal new leaves come out at the centre. Mealybugs attack in basal portion (Fig: 2), but in fruit as well (Fig: 3).

Wilted plants numbered highest in T_1 (11.88 %) and lowest in T_3 (2.62 %).Wilting intensities were significantly different between the treatments on all days of observation. Wilting percentage gradually increased by day (Table 2). Mealybug population per plant also highest in T_1 (9.33) followed by T_2 (5.29) and lowest in T_3 (4.20) (Table 3). Yield was highest in T_3 (41.6 tha^{-1}) followed by T_2 (38.7 tha^{-1}) and T_1 (32.5 tha^{-1}), also BCR was highest in T_3 (1.30) followed by T_2 (1.24) and T_1 (1.09) (Table 4).

Table 2
Percentage of plants wilted due to mealy bug infestation of pineapple

	Plant wilting percentage *						
Treatments	**100 DAP**	**130 DAP**	**160 DAP**	**190 DAP**	**220 DAP**	**250 DAP**	**Mean**
T1	1.17	7.08	11.43	15.15	17.88	18.57	11.88
T2	0.98	2.81	2.98	3.15	7.23	7.96	4.19
T3	0.84	2.13	2.22	2.98	3.65	3.89	2.62
CD at 5 %	0.12	1.31	1.21	0.76	1.15	0.87	

* Data present log *x*.

Table 3
Mealy bug population on pineapple per plant *

	Mealy bug population *						
Treatments	**100 DAP**	**130 DAP**	**160 DAP**	**190 DAP**	**220 DAP**	**250 DAP**	**Mean**
T1	6.47	8.37	9.18	11.24	10.87	9.82	9.33
T2	3.67	4.77	5.88	5.752	6.31	5.37	5.29
T3	2.92	3.64	4.34	4.509	5.53	4.29	4.20
CD at 5 %	1.29	0.82	0.89	0.87	0.89	0.83	

* Data present *v (x + 0.5)*.

Table 4
Yield and benefit: cost ratio of pineapple mealybug wilt management

Treatments	Yield (t ha^{-1})	BCR
T1	32.5	1.09
T2	38.7	1.24
T3	41.6	1.30
CD at 5 %	1.77	0.05

Discussion

Dipping the basal portion of the planting material in methyl parathion @ 0.02% to 0.05% or monocrotophos @ 0.02% as a prophylactic measure and application of carbofuran 3G @ 15 to 17 kgha^{-1} in affected fields or phorate 10G @ 1.75 kgaiha^{-1} at 100 DAP can effectively control pineapple mealybug (Anonymous 2007). It indicated that the basal portion of the planting material needed double prophylactic measures (phorate 10 G and neem cake ground application at 100 DAP and 180 DAP respectively), and three times manual weeding helps to protect from mealybug infestation (Mandal 2007). Rohrbach *et al*. (1988) also reported that eco-friendly integrated management options and components should include apparently clean planting materials (not necessarily virus-free), physical, chemical (against mealybugs and gardener ants), and cultural (clean-weeded plots and roguing) in Hawaii.

In Hawaii, mealybug numbers are directly related to ant density, which in its turn is dependent on dry weed biomass, weed matting area and density. Destruction of grasses and other monocot weeds, which serve as alternative hosts for the pest, has been strongly recommended. Chemicals such as heptachlor and mirex have been used earlier to control ant populations and consequently mealy bug wilt in pineapple was kept under control in Hawaii and elsewhere. These chemicals degrade slowly and are detrimental to environment, and have been banned for use by the Environmental Protection Agency (Jayma *et al* 2007). Among nonsystemic organophosphates, diazinon provided a minimum of 30 days of residual effects (*Pineapple News*, 1, 1995, p.9). According to Hu *et al.* (2005), spraying of quinalphos @ 0.025%, fenitrothion @ 0.05%, fenthion @ 0.05%, chlorpyriphos @ 0.05%, dimethoate @ 0.05% or monocrotophos @ 0.05% carefully so that the chemicals should reach the base and also the sides of the plant. They also suggested that ant control through application of carbaryl is essential to combat mealybugs. However, association of ants has not been observed anywhere in India. According to the *Pineapple Technical*, *PNB Krishi Samachar*, Punjab National Bank expressed their views that BCR in pineapple cultivation may be 1.92 and invest rupee return (IRR) may be more than 50% (Anon. 2007).

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