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RESEARCH **P**APER

Integrated pest and disease management for sustainable small onion production in Ramanayakanpatti village of Namakkal district

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Ramanayakanpatti, Pudhuchathiram block, Namakkal district, Tamil Nadu is one of the main small onion cultivating village in an area of 712 acres. In this village small onion variety Co4 is cultivated mainly in *Rabi* season (October – December). Onion is mainly affected by basal rot and thrips resulting in a yield loss of 30 – 40 per cent. Farmers sprayed profenophos @ 4 ml/ lit from 30 days after sowing at 15 days interval thrice for thrips management and also followed seed treatment with SAAF @ 3 g/kg to control basal rot. They spent Rs. 6600 – 7000 /0.4 ha- for chemical spray. Under front line demonstration, IPDM practice was followed to control basal rot and thrips in small onion in an area of 30 ha covering 75 farmers. A package of IPDM practices was followed for entire crop duration , which included seed treatment with bio control agents *Trichoderma viride* @ 4g/kg of bulb + *Pseudomonas fluorescence* @10g/kg of bulb was done 12 hrs before sowing. Then five days after sowing of bulbs, a barrier crop maize variety NK 6240 was sown around the field and ridges at a spacing of 15 cm interval, to prevent the entry of thrips from the outside field. Thereafter, blue sticky traps were installed at 10 m interval with a total of 20 traps /0.4 ha at 30 cm height above the onion plant. It attracted 82 per cent of thrips within the field in 30 - 40 days after sowing. All the IPDM practiced farmers did not spray any chemical for the entire crop cultivation period and also they spend only Rs.1028/-for IPDM practices in addition to getting a yield of 7.3 to 8 tonnes /0.4ha.

Key words : Ramanaickenpatti, IPDM practices, Basal rot, Thrips, Small onion

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INTRODUCTION

Onion, *Allium cepa* L. (Alliaceae) is one of the most important commercial vegetable crops in India, cultivated in an area of 756,000 ha. Two main types of onions, bulb onion (*Allium cepa* variety *cepa*) and shallot or multiplier onion/small onion (*Allium cepa* variety *aggregatum*), are cultivated in India with the production and productivity of 12.16 million tonnes and 16.10 tonnes/ ha, respectively (*www.nhb.gov.in*). The small onion is the most common type of onion cultivated in Tamil Nadu in an area of 30,255 ha with a production of 286,000 tonnes and it is commonly propagated through bulbs. The average productivity of small onion in Tamil Nadu is 9.45 tonnes/ha (*www.tn.gov.in*). Considering the insect pests and diseases especially onion thrips (*Thrips tabaci* L.) and

basal rot (*Fusarium oxysporum* f.sp.*cepae* W.C.synder and H.N.Hansen) limit the production and productivity of onion in this village. Thrips is considered as a pest of national importance in India, causing an annual yield loss of 10-15 per cent in onion through feeding damage and indirectly through predisposing onion plants to purple blotch and transmitting Iris Yellow Spot Virus (IYSV) disease (Gupta *et al.*,1994 and Zen *et al.*, 2008). Repeated application of insecticides resulted in resistance development in onion thrips to insecticides (Alston and Drost, 2008).

Basal rot is an economically important disease of onion and generally occurs when soil temperatures are very warm (Optimum 29^{0}C). Disease incidence increases where onion is grown continuously. The early symptoms in the field are yellowing of leaves and tip dieback. As the disease progresses, the whole plant may collapse and if the plant is pulled, it often comes out without any roots attached because they have decayed. If infection occurs late in the season, the symptom may not show up until the onions are in storage because of latent infections (Brayford, 1996). Yield losses of 25-35 per cent to fusarium basal rot have been reported in onion (Lacy and Roberts, 1982).

Onion growers in the village generally rely on synthetic pesticides like profenophos, cypermethrin, carbendazim + mancozeb, copper oxychloride for management of pests and diseases and the frequency of applications ranges from six to seven sprays depending upon the season and pests and disease load (Selvamuthukumar, 2011). Repeated synthetic pesticides applications often result in resistance development, resurgence and natural enemy destruction besides environmental degradation (Thanki *et al.*, 2003). In response to the threat of damage due to thrips and basal rot in small onion, Krishi Vigyan Kendra, Namakkal, Tamil Nadu has introduced and implemented integrated pest and disease management practices for sustainable small onion production in 75 farmers field covering 30 ha area at Ramanayakanpatti village of Namakkal ditrict under front line demonstrations during September 2015-December 2015. The main objective of the study was to reduce the pesticide usage, thrips population, basal rot incidence, cost of production and to increase the natural enemy population and crop quality.

RESEARCH METHODOLOGY

The experiments were carried out in seventy five farmers' field of Ramanayakanpatti village of Namakkal district of Tamil Nadu during *Rabi* season (September 2015 – December 2015 covering 30 ha area under front line demonstrations. In this village small onion is cultivated in an area of 712 acres. Ramanayakanpatti is situated at 1124/7^{0}N latitude and 3075/1^{0}E longitude and at an elevation of 720m above mean sea level. It received an average rainfall of 596 mm annually, spreading over an average of 32 days in a year. The soil type is red sandy loam with a pH of 6.92 and EC of 0/066 dSm^{-1} with a soil nutrient status of low nitrogen (163/1 kg/ ha), medium phosphorus (11 kg / ha) and high potassium (597 kg /ha).

Weather and climate :

During the study period (September, 2015 – December, 2015), 167 mm of rainfall was received in 11 rainy days. Maximum monthly mean temperature was 35.9^{o}C and minimum was 23.9^{o}C. Maximum monthly mean relative humidity was 79.0 per cent and minimum was 51.3 per cent at 07.22 and 14.22 hr, respectively (Table A).

The experiment was laid out in Factorial Randomized Block Design. The treatments were imposed in small onion as detailed below,

Farmers practice :

Farmers sprayed profenophos @ 4 ml/ lit of water from 30 days after sowing at 8 days interval for thrips management and also followed seed treatment with SAAF

Table A : Weather parameter prevailed during the demonstration period at Ramanayakanpatti

Month/Year	Temp (^{o}C)		Relative humidity (%)		Wind speed (km/hr)	Rainfall (mm)	Rainy days
	Max.	Min.	Max.	Min.			
September 15	35/9	27/3	79/8	50/4	3/3	101	8
October 15	36/3	24/0	78/5	49/5	3/1	60	3
November 15	35/5	24/0	78/6	52/3	3/1	6	?
December 15	35/8	23/8	79	53/0	3/2	?	?
Average	35/9	23/9	79/0	51/3	3/2	167	11

@ 3 g/kg to control bulb rot.

KVK intervention :

Seed bulb selection and bulb treatment :

Selection of healthy seed bulbs for planting is very important because basal rot caused by *Fusarium* sp. is occurred both in field as well as storage. Healthy and fungus free seed bulbs @ 500 kg / 0.4 ha were manually selected from stored seed onion. Then the bulbs were treated with *Trichoderma viride* (TNAU formulation) @ 4g/kg of bulb + *Pseudomonas fluorescence* (TNAU formulation – pf_1) @10g/kg 12 hrs before sowing. These bio agents were spreaded over the onion bulbs by means of kada cloth and manually turned for uniform coating of the bio agents over the seed bulbs.

Soil amendments with bioagents :

The bioagents such as *Trichoderma viride* (TNAU formulation) @ 1 kg / 0.4 ha + *Pseudomonas fluorescence* (TNAU formulation) @ 1 kg/0.4 ha was thoroughly mixed with 200 kg of well powdered and decomposed farm yard manure and applied uniformly in the field before planting.

Maize as a barrier crop :

Five days after sowing of onion bulbs, a barrier crop maize variety NK 6240 was sown around the field and ridges in 2 rows at spacing of 15 cm, to prevent the entry of thrips from the outside field. Totally 250 g of maize seed required for raising barrier crop / 0.4 ha.

Blue sticky traps :

Clear blue colour plastic coated with sticky adhesive traps of 33 cm length x 22 cm breadth (supplied by Pest control of India Limited, Chennai) were installed at 10 m interval with a total of 20 traps/ 0.4 ha at 30 cm height above the onion plant.

Vegetable micronutrient mixture :

Foliar spray of IIHR vegetable micronutrient mixture @ 5g/lit of water was done at 30 and 45 days after transplanting.

Sampling and observations :

Five micro plots of 20 square meter area at Ramanayankanpatti village were choosen for recording observations on thrips and basal rot incidence in all 30 ha

Table 1 : Thrips population (number of thrips / plant) in farmer field vs IPDM field in Ramanayakanpatti village

Treatment /Field number	Farmer practice (M_1)	IPDM practice (M_2)	Mean
F_1	9.53	3.73	6.63
F_2	8.30	2.51	5.41
F_3	13.21	5.35	9.28
F_4	16.21	5.87	11.04
F_5	11.15	4.74	7.95
F_6	10.99	4.79	7.89
F_7	16.56	8.38	12.47
F_8	11.81	5.47	8.64
F_9	11.46	3.63	7.55
F_{10}	11.97	6.45	9.21
F_{11}	10.48	2.80	6.64
F_{12}	11.49	2.72	7.11
F_{13}	10.53	2.40	6.46
F_{14}	10.55	2.36	6.45
F_{15}	9.62	2.51	6.07
Mean	11.59	4.25	7.92
Source	S.E.±		C.D.(P=0.05)
M	0.09		0.19
F	0.27		0.54
MF	0.39		0.77

experimental field. In each micro plot, onion thrips population was counted from 10 randomly selected plants. Incidence of basal rot was assessed by counting the total number of plants in each micro plot and infected plants and expressed as per cent incidence.

RESEARCH FINDINGS AND ANALYSIS

The results (Table 1) revealed that the IPDM implemented field registered minimum population of onion thrips (4.25 thrips/plant) compared with higher thrips population in farmer practice (11.59 thrips/plant). This might be due to planting of live barriers around the field. Thrips are weak filtres and can be carried by wind. Therefore, planting live barriers like maize could effectively blocked adult thrips from reaching onion plants and also helped in the conservation of coccinellid populations. Two rows of maize surrounding onion plots blocked the adult thrips up to 80 per cent (Srinivas and Lawande, 2006). This practice brought down insecticide application by half. This is in conformity with the findings of Srinivas and Lawande (2002). In addition to that, effective monitoring and timely implementation of pest management strategies is important for successful thrips management. Blue sticky trap with peak reflectance at 480 nm were highly preferred by thrips. Similar findings was also reported by Muvea (2011) in tomato, where blue sticky traps caught 1.66 – 5.08 times number of adult thrips as many as yellow traps and upto 13.24 – 59.12 times more than clear traps. In French beans, blue sticky traps caught 2.05 – 3.52 times as many thrips as yellow traps and 22.07 – 29.31 times more than clear traps. Blue sticky traps used for mass trapping of *Thrips tabaci* adults and thus preventing the females from ovipositing the eggs into the host leaves belong to the alternative methods for thrips control. This is in conformity with the finding of Trdan *et al*. (2005).

With respect to incidence of basal rot (Table 2), it was lesser in IPDM field (2.92 %) when compared with farmers practice which recorded a disease severity of 9.94 per cent. This might be due to influence of bio control agents such as *Trichoderma viride* and *Pseudomonas fluorescence* which have proven to be effective against basal rot pathogen (Malathi and Mohan, 2011). These antagonistic organisms induced systemic resistance in plants and in addition promoted plant growth (Bennett and Whipps, 2008 and Bennett *et al*., 2009). *Trichoderma*

Table 2 : Basal rot incidence (%) in small onion at Ramanayakanpatti village

Treatment / Field number	Farmer practice (M_1)	IPDM practice (M_2)	Mean
F_1	5.75	1.41	3.58
F_2	4.79	1.69	3.24
F_3	5.90	2.77	4.33
F_4	5.94	2.32	4.14
F_5	5.95	1.75	3.85
F_6	6.78	2.56	4.67
F_7	16.68	7.18	11.93
F_8	11.06	3.36	7.21
F_9	5.37	2.40	3.88
F_{10}	15.29	4.64	9.96
F_{11}	13.42	3.69	8.56
F_{12}	12.71	3.05	7.88
F_{13}	12.65	2.09	7.37
F_{14}	13.09	2.40	7.74
F_{15}	13.65	2.49	8.07
Mean	9.94	2.92	6.43
Source	S.E.±	C.D.(P=0.05)	
M	0.07	0.14	
F	0.20	0.40	
MF	0.28	0.57	

species can inherently tolerate the antagonistic activities of competing in soil leading to extremely rapid growth and abundant production of spores, appropriate enzymes and antibiotics.Hydrolytic enzymes produced by *Trichoderma* sp. play an important role in destruction of plant pathogens (Chet *et al.*,1981). Coskuntuna and Ozer (2008) reported that seed treatment with *T.viride* gave significant reduction in basal rot incidence on onion under pot and field conditions.

Rhizobacteria such as *Pseudomonas fluorescence* could provide significant levels of disease suppression and substantially enhanced plant growth and yield. Antagonistic bacteria are ideal biological control agents owing to their rapid growth, easy handling and aggressive colonization in rhizosphere . *Pseudomonas fluorescence* was found to be the most effective in inhibiting the growth of *Fusarium oxysporum* f.sp.*cepae*. It might be due to the production of antibiotics, volatile compounds and lytic enzymes. This is in conformity with the findings of Gardener *et al*. (2000).

The economic analysis revealed that the highest expenditure (Rs. 49, 395 /-) was incurred in farmers practice as compared to IPDM practice (Rs. 47,219 /-) and the maximum net return (Rs.1,52,781/-) was obtained from the IPDM practice. Therefore, farmers can save an amount of Rs.5,660/- besides getting additional profit of Rs.67,716/- while implementing integrated pest and disease management practices against onion thrips and basal rot in Ramanayakanpatti village. The Cost: Benefit also highest (1:4.2) in IPDM implemented field.

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