Yield loss estimation due to major insect and mite pests on potato in Karnataka

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Abstract: Yield loss assessment studies were carried out in Madenur,Hassan and Beekanahalli, Chikmagalur during 2004 and 2005 on potato pests. Aphids, *Myzus persicae* caused on an average 6 per cent loss in yield at Madenur and 3 per cent loss in Beekanahalli. The yield loss due to *Spodoptera* litura was 8 per cent at Madenur and 4 per cent at Beekanahalli. The yield loss due topotato tuber moth, *Phthoremaea operculella* was 9 per cent at Madenur while it was 6 per cent at Beekanahalli. The yield loss due to mite, *Polyphagotarsonemus* latus was 26.80 per cent at Madenur and it was 4 per cent at Beekanahalli.

Key words: Potato, yield loss, Karnataka, insect and mites

Introduction

Potato (*Solanum tuberosum* L.) is a major food crop of world. In many parts of the world it is a staple food for local population. As the crop is cultivated almost throughout the year at diversified climatograpphical conditions in Karnataka (South India) the damage by different pests at different phenolphases results in variable yield losses. Comprehensive studies on yield loss estimation due to major insect and mite pests of potato at different zones in Karnataka are lacking, but urgently needed. Hence, the present studies were carried out.

Material and methods

In order to assess the extent of loss due to major pests, the crop was raised in two plots of 10x5 m areas, one with protection and another without protection of the crop against the specific pests. For assessing yield loss due to sucking pests, the crop was raised in a block and divided into two equal plots of 10x5 m size each. There were two replications. On one set of plots, imidacloprid @ 0.5 ml was sprayed at 10 days after crop emergence. Mancozeb @ 3 g/l was sprayed for imparting protection against fungal diseases. In another set, the crop was sprayed only with mancozeb @ 3 g/l for giving protection against fungal diseases but no spray was given against sucking insects. However, the plots were treated with dicofol @ 2.5 ml/l for protecting the crop against mites. To avoid the damage of defoliators, the larvae were hand picked and killed in both the plots. Aphids and thrips were counted at intervals of seven days from 20 days up to three weeks after germination and pooled as final count. Ten plants were randomly selected and sucking insects density were counted on compound leaf selected from bottom, middle and top canopy of plant (Konar et al. 2003). Prior to harvest quinalphos 25 EC @ 2ml/l was sprayed to both the plots to protect from potato tuber moth menace. Yields from two plots were taken separately and the loss due to sucking pests was worked out.

For assessing yield loss due to defoliators, the crop was raised as mentioned above and only defoliators were allowed on the crop. Rest of the pests controlled on the crop. Larval counts per plant were recorded at weekly intervals by selecting 25 plants at random in four spots per plot at 35-40 days after germination at intervals of seven days up to three weeks and pooled as final count.

For assessing yield loss due to potato tuber moth in field, the crop was raised as stated above and only potato tuber moth was allowed to damage the crop. Twenty five plants were selected at random in each plot and number of blotches or mines or leaf tying or bored shoots per plant and number of larvae per plant were counted at one week after spray on both the plots. At harvesting stage number of healthy tubers and affected tubers per plant was recorded and yield loss was estimated. To find out the storage losses in godown, two heaps having 500 tubers per set was selected. On one set, sand layer of two inch thickness was covered, while another set was exposed for natural infestation. Observations on number of tubers infested, number of rotten tubers, weight of rotten tubers and weight of potato tuber moth affected tubers were recorded at fortnightly intervals, up to two months.

In order to determine the yield loss due to mites, crop was raised as mentioned before. Quinalphos @ 2 ml/l was sprayed twice prior to harvest to manage the potato tuber moth in both the plots. Ten plants were selected at random and mites were counted on compound leaf of top and middle canopy of the crop at 45-50 days after germination at intervals of seven days up to two weeks and pooled as final count. Yields from both treated and untreated crops were recorded and compared.

Results and discussion

The yield loss studies at Madenur during *kharif* 2004 recorded 1.14 aphids with plant protection against the initial

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count 27.08 aphids per plant, while thrips count was 0.98 per plant against the initial of 1.89 thrips. The aphids count was 21.51 against the initial count of 25.15 aphids per plant, while the thrips count was 1.82 against initial count of 1.82 thrips without plant protection.

During kharif 2005, the aphids count was 2.81 with plant protection against the initial count 26.13 aphids per plant, while thrips count was 1.32 as against the initial count of 2.38 thrips. The aphids count was 20.41 against the initial count of 25.58 aphids per plant, while the thrips count was 4.10 against initial count of 1.89 thrips without plant protection.

Similarly during kharif 2004 at Beekanahalli, the aphid count was 1.95 against initial count of 10.14 aphids, while the thrips count was 0.95 against the initial count of 1.91 thrips, with plant protection. The aphid count was 9.75 against initial count of 7.97 aphids, while the thrips count was 3.23 against the initial count of 2.57 thrips without plant protection.

At Beekanahalli, during kharif2005 with plant protection, the aphids count was 1.56 against initial count of 11.03 aphids per plant, while the thrips count was 0.73 against the initial count of 2.88 thrips. The aphids count was 9.37 against the initial count of 8.04 aphids per plant, while thrips count was 2.61 against initial count of 2.56 thrips per plant without plant protection.

The yield data obtained with plant protection was 146.07 q/ha during 2004 while it was 97.09 q/ha during 2005 with an average of 121.58q/ha at Madenur, while the yield was 138.95 q/ ha during 2004 and 132.57 q/ha during 2005 with an average of 135.76 q/ha at Beekanahalli. The yield data obtained without plant protection was 138.02 g/ha during 2004 and 128.89 g/ha during 2005 with an average of 133.46 q/ha at Beekanahalli, while the yield was 132.95q/ha and 96.38 q/ha with an average of 114.67 q/ha at Madenur during kharif 2004 and 2005, respectively. There was 5.69 per cent loss in yield was noticed at Madenur while 2.78 per cent loss in yield was noticed at Beekanahalli (Table 1). The field experiment conducted at Shimla during 1978-82 gave a hint that the rate of degeneration of Kufri Jyothi due to PVX (Potato virus X) alone was 15, 36 and 52 per cent in the first, second and third year. On the other hand, infection of PVY (Potato virus Y) alone was only 3, 6 and 11 per cent in the seed exposed for 1, 2 and 3 years (Khurana and Singh, 1988).

The major and the dominant defoliator pest was S. litura only. The larval count at Beekanahalli under yield loss trial during kharif 2004 was 0.34 against larval count of 1.01 per plant with plant protection, while larval count was 0.33 against the larval count of 1.09 per plant during kharif 2005. The S. litura count without plant protection during kharif 2004 was 0.79 against larval count of 1.08 larvae per plant. During kharif 2005 the larval count was 0.66 against the count of 1.18 larvae per plant.

The larval count at Madenur, was 0.21 as against the initial density of 1.76 larva per plant during kharif 2004 with plant protection, while 0.22 larva were recorded against the initial count of 1.52 larvae per plant during kharif 2005. The defoliator count was 0.78 larva per plant as against the initial count of 1.52 during kharif 2004 without plant protection. During *kharif* 2005, it was 0.71 larva per plant against the initial count of 1.43 larvae.

The yield data obtained with plant protection against *S. litura* at Beekanahalli was 144.62 and 87.43 on an average of 116.03 q/ha during kharif 2004 and 2005, respectively, while 138.86 and 84.50 on an average of 111.68 q/ha was obtained without plant protection. Similarly the yield data obtained with plant protection at Madenur against *S. litura* was 149.27 and 138.72 on an average of 144.00 q/ha during kharif 2004 and 2005, respectively while 137.60 q/ha and 127.54 q/ha on an average of 132.57 q/ha was obtained without plant protection. The per cent yield loss was 7.94 at Madenur and 3.75 Beekanahalli. Konar *et al.* (2003) reported 35-40 per cent tuber damage and 35 per cent damage by cutworm, *Agrotis ipsilon*.

The PTM larva was not detected at Beekanahalli in the plot with plant protection first week after spray against the initial larval count of 0.21 larvae per plant during kharif2004, but 0.17 larvae in the first week against the initial larval count of 0.23 larvae under yield loss study as recorded without plant protection. During kharif2005, the larvae per plant with plant protection, while it was 0.25 larvae against the initial larval count of 0.44 larvae without plant protection.

The PTM larval count at Madenur with plant protection was 0.04 larva in the first week after spray against the initial count of 0.76 larvae per plant during kharif2004, while it was 1.00 larvae against the initial count of 1.04 larvae without

Tabl	e	1.	Estim	ation	of	yi	eld		oss	due	to	suc	king	insect	S
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Treatments	Potato tuber yield (q/ha)			% Yield loss	Potato tu	ber yield (% Yield loss	
	Madenur		Mean		Beekan	ahalli	Mean	
	2004	2005			2004	2005		
With plant protection	146.07	97.09	121.58	5.69	138.95	132.57	135.76	2.78
Without plant protection	132.95	96.38	114.67		138.02	128.89	133.46	
T- test	*	*	*	*	*	*	*	*

*T-test significant at 5% with 1df

Yield loss estimation

Treatments	Potato	tuber yield	(q/ha)	% Yield loss	Pota	to tuber yie	% Yield loss	
	Madenur		Mean		Beekanahalli		Mean	
	2004	2005			2004	2005		
With plant protection	149.27	138.72	144.00	7.94*	144.62	87.43	116.03	3.75*
Without plant protection	137.60	127.54	132.57		138.86	84.50	111.68	

Table 2. Estimation of potato tuber yield loss in kharif due to defoliator, Spodoptera litura

*T-test significant at 5% with 1df

Table 3. Estimation of potato tuber yield loss due to Phthoremaea operculella

Treatments	Potato tu	ber yield	(q/ha)	% Yield loss	Potato	tuber yiel	ld (q/ha)	% Yield loss
	Madenu	r	Mean		Beekana	ahalli	Mean	
	2004	2005			2004	2005		
With plant protection	136.84	91.80	114.32	8.58	144.27	127.60	135.94	5.95
Without plant protection	128.26	80.73	104.50		136.70	118.96	127.83	
T- test		*					*	

* T-test significant at 5% with 1df

plant protection. During kharif 2005, the larval count was 0.03 against the initial count of 1.16 larvae per plant with plant protection, while 0.89 larvae against the initial count of 0.90 larvae recorded without plant protection.

The yield of 136.84 and 91.80 q/ha with a mean of 114.32q/ha was obtained at Madenur with plant protection, while 128.26 and 80.73 q/ha with an average of 104.50 q/ha was obtained at Madenur without plant protection during kharif2004 and 2005, respectively. The yield of 144.27 and 127.60 q/ha with a mean of 135.94 q/ha was obtained with plant protection, while 136.70 and 118.96 on an average of 127.83 q/ha was obtained without plant protection at Beekanahalli during kharif2004 and 2005, respectively. The percent yield loss was 8.58 per cent at Madenur while, it was 5.95 per cent at Beekanahalli (Table 3). Nirula (1960) reported 30 to 70 per cent yield loss in country stores. Similarly Singh et al. (1990) and Chandel et al. (2001) have reported 30 to 60 per cent loss. In plateau region (N.E. hill), Himachal Pradesh,. Maharashtra and Tamil Nadu heavy damage was noticed. Trivedi et al. (1994) reported 100 per cent tuber infestation. The overall research finding confirmed that even mere less than 5 per cent infestations in field condition is enough to spread infestation in storage condition.

The mites count at Madenur with plant protection was 0.20 against the initial count of 18.52 mites per compound leaf during kharif 2004, while it was 0.84 against the initial count of 19.80 mites during kharif 2005. The mites count without plant protection, was 19.16 against the initial count of 20.27 mites per compound leaf during kharif 2004, it was 19.04 against the initial count of 17.60 mites during kharif 2005. At Beekanahalli, with plant protection, the mite's number was 0.33 against the initial count of 12.97 mites per compound leaf during kharif 2005. The mites count in the plot without plant protection recorded 15.79 against the initial count of 12.92 mites per compound leaf during kharif 2004, while it was 15.60 against the initial count of 15.27 mites per compound leaf during kharif 2005.

The yield was 138.75 q/ha and 72.81 q/ha with an average of 105.78 q/ha with plant protection during kharif2004 and 2005 at Beekanahalli, while it was 134.10 q/ha and 69.85 q/ha on an average of 101.98 q/ha without plant protection. The percent yield loss of 3.36 and 4.02 with an average of 3.69 per cent was obtained during kharif 2004 and 2005, respectively. At Madenur, the yield of 146.49 q/ha and 124.17 q/ha on an average of 135.33 q/ha was obtained with plant protection during

Table 4. Estimation of potato tuber yield loss due to mite, Polyphagotarsonemus latus

Treatments	Potato ti	uber yield ((q/ha)	% Yield loss	Potato tu	ber yield	% Yield loss		
	Madenur		Mean		Beekanahalli		Mean		
	2004	2005			2004	2005			
With plant protection	146.49	124.17	135.33	26.81	138.75	72.81	105.78	3.69	
Without plant protection	115.77	82.33	99.05		134.10	69.85	101.98		
T- test		*				*			

*T-test significant at 5% with 1df

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kharif 2004 and 2005, while it was 115.77 q/ha and 82.33 q/ha on an average of 99.05 q/ha was obtained without plant protection during kharif 2004 and 2005. The percent yield loss was 26.81

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per cent at Madenur while, at Beekanahalli it was 3.69 per cent (Table 4). Gibson and Valenchia (1978) and Liu *et al.* (1991) reported 60 per cent yield loss due to mite infestation. This was in concord with the present study.

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