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EFFECT OF FARMSCAPING TOMATO WITH MARIGOLD ON INSECT PESTS COMPLEX

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ABSTRACT

A field experiment on the effect of farmscaping on the seasonal incidence of major insect pests of tomato was carried out during August to November, 2012 at the Horticulture Farm, Rajasthan College of Agriculture, Udaipur (Rajasthan). The pest status was evaluated on tomato cultivated as sole crop and with marigold under stacked and unstacked treatments. The population of the sucking insect pests of tomato was significantly the lowest when marigold was used as a farmscape crop with tomato, especially when unstacked [aphids (6.51), jassids (5.96) and whiteflies (5.16)]. Sole tomato, stacked or unstacked, significantly harboured more sucking insect pests than when tomato was farmscaped with marigold. Stacked tomato cultivated with marigold was more effective against the tomato fruit borer infestation, as evident by the lowest number of damaged fruits (1.60 per plant) with minimum loss in fruit weight of 51.84g leading to an increase in yield of 84 per cent; while unstacked tomato sole had the highest numbers of damaged fruits (10.00 per plant) with a corresponding loss in fruit weight of 324g.

Key words: Farmscaping, tomato, marigold, stacked, *Helicoverpa armigera*

INTRODUCTION

"Farmingscaping" is a whole–farm ecological approach to pest management, often defined as the use of hedgerows, insectary plants, cover crops, and water reservoir to attract and support populations of beneficial organisms such as parasitic and predatory insects, spiders, bats, and birds of prey. Trap cropping and planting of diversionary hosts have been widely applied and recommended in the past. Use of planting African marigold among several rows to tomato specifically to control *H. armigera* on tomato was developed by entomologists at the Indian Institute of Horticulture Research. Tomato fruit worm adults preferred marigold at flowering stage for oviposition compared to tomato. This reduced *H. armigera* infestation of tomato (Srinivasan *et al.*, 1994). Trap crop has an important attribute that is distinctly more attractive to the pest than the main crop and have additional function for natural enemies (Pats *et al.*, 1997).

Zavaleta and Gomez (1995) concluded that by manipulating the *Tagetes* planting date and spacing between plants, it is possible to achieve some phytosanitary protection on tomato and a significant increase in fruit production. All intercropped treatments, independent of planting date of *T. erecta* and plant spacing, showed a reduction in infection of tomato roots by the nematode *Nacobbus aberrans* compared with the control treatment with tomatoes alone. Tomato foliar damage and incidence of damaged tomato fruit by *Alternaria solani* was significantly reduced in all the intercropped plots. A significant increase of total (69%) and commercial fruit (120%) per tomato plant over the control was obtained with *T. erecta* planted 30 days before tomatoes and with a planting distance of 50 cm. Intercropping tomato with maize reduced the level of attack by *Scrobipalpuloides absoluta* to stem apices (to 4%) and to leaves (11%) and caused greater attack by *H. zea* to tomato fruits (ca. 50%). Vertically staked tomato plants were less susceptible to *S. absoluta* attack to the stalk apex (ca. 5%), the lowest level of attack by this pest occurred in leaves of conventionally staked plants (Picanco *et al.*, 1996).

MATERIALS AND METHODS

The experiment on effect of farmscaping on the incidence of insect pests of tomato was conducted during *kharif* season at Horticulture Farm, Rajasthan College of Agriculture, Udaipur (Rajasthan). The trial was laid out in a randomized block design with four treatments *viz.*, stacked tomato sole, unstacked tomato sole, stacked tomato with marigold and unstacked tomato with marigold. The seeds of early flowering marigold variety Pusa Narangi were sown in well prepared raised nursery beds (1 meter wide) in the first week of June. Similarly, seeds of tomato variety, SS–22 were sown in 25 square meter area on raised seed bed (7.5m × 1.2m × 0.1m) in the fourth week of June. The beds were covered with a layer of farm yard manure @ 4kg/sq.m.) and sand mixed in equal proportions. With a

view towards protecting the crops from diseases, the nursery bed was treated with formaldehyde (10%) and seeds were treated with thiram at 2g/kg. Other usual recommended horticultural operations were followed while raising the seedlings of marigold and tomato. After the seedlings attained a height of about 15 cm with 8–10 leaves they were transplanted in uniformly sized plots measuring 5m × 3m (15m2) at 60cm × 45cm row to row and plant to plant spacing by adopting recommended agronomic practices and each treatment was replicated five times. The observations on the incidence of insect pests and associated natural enemies were recorded on ten randomly tagged plants per plot throughout the experiment.

Populations of different insect pests were recorded at weekly intervals during morning hours between 6.30 to 8.00 AM when most insect species are less active.

(i) Aphids: The estimation of aphid population was essentially on the numerical count method described by Heathcote (1972). The population was counted only on three leaves as per method of Satpathy (1973).

(ii) Jassids: The method suggested by Rawat and Sahu (1973) was adopted for estimating the population of jassids.

(iii) Whiteflies: Three leaves one each from the upper, middle and lower portion of each of the tagged plants were randomly selected to determine the population. The base of the leaf was held in between fingers and thumb and twisted gently; nymphs and adults were counted quickly but carefully with least disturbance.

(iv) Leaf miner: Three leaves one each from the upper, middle, and lower portion of each of the tagged plants were randomly selected to determine the numbers of live mines.

(v) Fruit borer: The population of fruit borer was estimated by absolute sampling count on 10 plants in each plot, which were randomly tagged and carefully examined.

(vi) Coccinellids: The population of adult coccinellids and their grubs were recorded on the same tagged plants of tomato and marigold.

RESULTS AND DISCUSSION

The seasonal mean population of insect pests and their natural enemies in different treatments as presented in table 1 depicts that stacked or unstacked tomato with marigold carried significantly low population of insect pests and higher population of natural enemies when compared with that of stacked or unstacked sole tomato crop. The lowest numbers of aphids, jassids, whiteflies and leaf miner per plant were recorded from tomato unstacked with marigold being 6.51, 5.96, 5.16 and 6.83, respectively. Tomato being unstacked favoured more number of coccinellids that were possibly responsible for the relatively lower number of sap sucking herbivores. The quantitative abundance of natural enemies *viz.*, spiders, wasps and coccinellids, differed marginally between the stacked and unstacked farmscaped tomato treatments with marigold (Table 2); and the unstacked condition favoured the natural enemies more than the stacked condition. Data presented in Table (2) also reveals that the population of natural enemies in sole tomato and when farmscaped with marigold showed a significant difference especially with regard to the wasp. The abundance was lowest in sole tomato stacked and the maximum when tomato was grown with marigold and stacked.

During the present study, observation on natural enemies revealed an increase in the number of the predatory spiders and wasps, which was the most important factor for the fruit borer management. Stacked tomato with marigold had lowest number of damaged fruits as well as corresponding loss in weight thereby evincing an increase in yield to the tune of 84.0 per cent. It can also be noted that stacking tomato sole crop was responsible for a 28 per cent increase in fruit yield and farmscaping with marigold when tomato was left unstacked there was an increase in yield by 72 per cent. The data clearly indicate the significant role played by marigold in minimizing the incidence of fruit borer and the sucking pests such as jassids, whiteflies and aphids.

In earlier studies, Zavaleta and Gomez (1995) reported that the alate aphid and whitely populations and incidence

Table 1. Relative population of sap sucking insect pests on tomato (Aug–Nov., 2012)

Farmscape	Insect Pests (Numbers/Plant)			
treatments	Aphids	Jassids	Whiteflies	Leaf Miner
Tomato–marigold stacked	7.21[b]	6.23[b]	5.58[b]	7.14[a]
Tomato–marigold unstacked	6.51[a]	5.96[a]	5.16[a]	6.83[a]
Tomato–sole stacked	9.86[c]	8.35[c]	7.84[c]	10.45[b]
Tomato–sole unstacked	12.73[d]	10.18[d]	9.00[d]	11.44[c]
S.Em. ±	0.07	0.08	0.08	0.03
C.D. ($P = 0.05$)	0.22	0.25	0.25	0.94

Table 2. Relative abundance of natural enemies on tomato during Aug–Nov., 2012

Farmscape treatments	Natural enemies		
	Spiders	Wasps	Coccinellids
Tomato + marigold stacked	8.39[d]	17.21[b]	3.01[c]
Tomato + marigold unstacked	6.54[c]	16.51[b]	3.31[c]
Tomato sole stacked	1.66[a]	2.26[a]	0.86[a]
Tomato sole unstacked	2.73[b]	2.33[a]	2.13[b]
S.Em. ±	0.27	0.44	0.33
C.D. (P = 0.05)	0.83	1.34	1.01

Table 3. Relative loss due to tomato fruit borer infestation during Aug–Nov., 2012

Farmscape treatments	Fruit loss		
	Mean No. s/plant	Mean weight (g)	Increased yield (%)
Tomato+marigold stacked	1.60[a]	51.84[a]	84.00
Tomato+marigold unstacked	2.80[a]	90.72[a]	72.00
Tomato sole stacked	7.20[b]	233.28[b]	28.00
Tomato sole unstacked	10.00[c]	324.00[c]	–
S.Em. ±	0.47	15.37	
C.D. (P = 0.05)	1.20	38.73	

of tomato plant with virus symptoms were significantly lower in tomatoes intercropped with *Tagetes erecta* as compared to control (sole). Similarly, Afifi *et al.* (1990) reported that numbers of adults of *B. tabaci* on tomato grown alone were higher than on either of the intercropping system. Infestation on tomato was reduced by 62 to 66 per cent when grown with onion and by 69 to 70 per cent when grown with garlic. Tomato intercropped with onion or garlic decreased the aphid population by 86 to 87 per cent. Piana *et al.* (1995) observed significant differences between treatments for *B. tabaci* when 3, 5, or 7 rows of tomato were intercropped with 2 rows of maize. Saha *et al.* (2000) observed lowest incidence of *B. tabaci* and *T. tabaci* when tomato was intercropped with Indian mustard. Togni *et al*. (2010) reported that tomato intercropped with coriander reduced the severity and damage caused by *B. tabaci*. Constitutive volatiles in coriander reduced the attractiveness of tomato volatiles, but no repellency to these volatiles was observed.

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