

## EFFECT OF INTERCROPPING OF SPICES, CEREAL AND ROOT CROPS ON THE INCIDENCE OF *HELICOVERPA ARMIGERA* (HUB.) IN TOMATO

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### Summary

An experiment was conducted during 2006-07 and 2007-08 to study the impact of seven intercropping system of non-host plants with tomato on the incidence of fruit borer at Dehradun, Uttarakhand. The results obtained from study indicated that the incidence of fruit borer *Helicoverpa armigera* (Hub.) was found minimum when tomato intercropped with coriander, *Coriandrum sativum*, kasuri fenugreek, *Trigonella foenum-graecum*, barley, *Hordeum vulgare*; carrot, *Daucus carota*; mustard, *Brassica campestris* and dill, *Anethum sowa* in 2:1 row ratio. Among the intercrops, minimum incidence was noticed in tomato + coriander (0.94 larvae plant<sup>-1</sup>), tomato + mustard (1.09 larvae plant<sup>-1</sup>) and tomato + fenugreek (1.26 larvae plant<sup>-1</sup>) over sole (3.68 larvae plant<sup>-1</sup>). Lower fruit damage was observed in tomato + mustard (24.49% w/w and 25.32% n/n), tomato + coriander (25.63% w/w and 26.61% n/n) and tomato + fenugreek (26.12% w/w and 27.30n/n) over sole (37.35% w/w and 38.29 n/n). However, highest tomato equivalent yield was recorded in tomato + coriander (296.66 qha<sup>-1</sup>), tomato + barley (211.07qha<sup>-1</sup>) and tomato + mustard (209.61qha<sup>-1</sup>) intercropping systems as compared to sole tomato (199.48 qha<sup>-1</sup>).

### सारांश

कुछ मसाले, अन्न तथा जड़ वाली फसलों का प्रभाव टमाटर के फल छेदक कीट के प्रकोप पर इनके प्रभाव की जानकारी के लिए एक प्रयोग किया गया। जिसके अन्तर्गत धनियाँ, कसूरी मेंथी, सोवा, सरसों, जौ, गाजर को अन्तःफसल के रूप में उगाया गया। इनसे प्राप्त परिणामों के आधार पर टमाटर + धनियाँ, टमाटर + सरसों तथा टमाटर + कसूरी मेंथी में अन्य अन्तःफसलों एवं टमाटर की एकल फसल की अपेक्षाकृत कीट की संख्या व फलों के नुकसान में कमी, तथा समतुल्य उपज में वृद्धि दर्ज की गयी।

### Introduction

Monoculture is often highly productive and efficient, but criticized for their genetic uniformity and increased pest susceptibility. On the other hand intercropping with non-host plant had some suppressing effects on most of the insect-pest through the changed cropping canopy and resultant change in micro climate (Jayaraj, 2002 and Prasad *et al.*, 1987). Tomato crop is prone to many insect pests including devastating fruit borer, *Helicoverpa armigera* (Hub.) which is a major havoc to this crop in almost each and every cropping season. Dehradun is the major belt of tomato production in Uttarakhand where it is grown as season and off season vegetable crop and occupied 999 ha area with 16226 metric tons production (Anonymous, 2008). Intensive cropping of tomato and indiscriminate use of pesticides are annihilating natural enemies. Keeping these facts in view, an attempt was made to evaluate tomato based intercropping system with some non-host plants including cereal, root and spices crops to study the pest incidence and damage under agro climatic zone of Uttarakhand.

### Materials and Methods

A field trial was conducted in Randomized Block Design with three replication under the field condition of Doon Valley during 2006-07 and 2007-08. There were Six intercrops were selected as per season and farmers interest in particular region. Treatments comprised of six intercrops and sole crop, viz., T<sub>1</sub>, tomato + coriander (*Coriandrum sativum*); T<sub>2</sub>, tomato + kasuri fenugreek (*Trigonella foenum-graecum*); T<sub>3</sub>, tomato + barley (*Hordeum vulgare*); T<sub>4</sub>, tomato + carrot (*Daucus carota*); T<sub>5</sub>, tomato + mustard (*Brassica campestris*); T<sub>6</sub>, Tomato + dill (*Anethum sowa*) and T<sub>7</sub>, tomato sole. The seedlings of tomato were transplanted during first week of November in both the years. Plot size was kept 3.60 m x 3.00 m. Row to row and plant to plant distance was maintained 60 x 50 cm. The intercrops were sown one week later of transplanting of tomato in the ratio of 2:1. Thinning in intercrops was done 25-45 days after sowing to maintain the proper plant to plant distance. No plant protection measure was applied during the entire period of experimentation.

The incidence of fruit borer was recorded at 7 days intervals from appearance of insect to crop maturity by counting number of larvae/5 tagged plant in each plot. Total number of fruits and damaged fruits were counted and weighed from same five tagged plant and per cent damage was computed on the number and weight basis. The fresh fruits and intercrops yields were recorded from various intercropping system to convert into tomato equivalent yield ha<sup>-1</sup> based on market value of each commodity (Prasad, et. al. 2007). The experimental data in respect of pest incidence, fruit damage and yield were analysed stastically.

## Results and Discussion

### Effect of intercrops on the incidence of tomato fruit borer :

During 2006-2007. The population density of larva was however, significantly influenced by the intercrops. During the first year, significant impact of intercrops was observed on larval population which was superior over sole crop. The maximum larval population was recorded in control (3.96 larvae /plant) and the minimum in tomato + coriander (1.19). The next lowest pest population was recorded in tomato + mustard (1.33 larvae). followed by tomato fenugreek. Among the intercrops, tomato + carrot recorded highest larval population (1.80). Almost similar trend was found during 2007-08. All the intercrops were found significantly superior over sole crop of tomato. While, among intercrops tomato + coriander harbored lowest population of borer (0.70) which was

significantly different with tomato + mustard (0.85). It was followed by tomato + fenugreek (1.03), which was found significant different with tomato + carrot (1.03) while remaining intercrops were found at par (Table.1).

Based on pooled analysis all the treatments were found significantly different over sole cup. The mean larval population was varied from 0.94 to 3.67plant<sup>-1</sup>. The maximum larval population was registered in sole tomato crop. All the intercrops were found at par among themselves. Maximum reduction of larvae was found under those intercropping system which belongs to spices crop i.e. coriander, mustard and fenugreek. (Table.1) According to Patil, et. al., 1997, when tomato intercropped with coriander reduced the incidence of *H. armigera*. Similarly Pandher et. al., 2006 reported that mustard crop produced some allelochemicals and repeled the generalist insect. Gupta, et al., 2008 also reported similar findings.

**Effect of intercrops on fruit damage (w/w):** Result on mean damage (%) on weight basis under various intercrops during 2006-07 revealed significant reduction as compared to sole crop. The maximum fruit damage (39.30%) was found in sole and the minimum (27.60%) in tomato + mustard. It was followed by tomato + coriander (28.13) and tomato + fenugreek (28.71) . All the treatments were found at par among themselves. During 2007-08 per cent fruit damage reduced significantly. The highest fruit damage (35.40%) was recorded in sole and lowest (21.37%) in tomato + mustard, while coriander and fenugreek also recorded lower damage over rest intercrops. Pooled mean fruit damage (%) was recorded significantly different. The perusal of data on per cent fruit damage under various intercrops revealed .The maximum per cent fruit damage (37.35 ) in sole crop and the minimum (24.49) in tomato + mustard followed by tomato + coriander (25.63%) and tomato + fenugreek (26.12 %), while remaining intercrops were found at par with each other.

### Effect of intercrops on per cent fruit damage (n/n):

The perusal of data during 2006-07 revealed that fruit damage varied between highest (39.92 %) in tomato sole and lowest of (28.15%) in tomato + mustard. All the intercrops were found significantly lower damage over sole. The mustard, coriander and fenugreek as an intercrops shared lowest fruit damage as compared to remaining treatments. During cropping season

Table 1. Effect of intercropping on population of fruit borer in tomato crop during 2006-07 and 2007-08

Crop combinations	larvae Population (plants <sup>-1</sup> )			% reduction over control
	2006-07	2007-08	Mean	
T <sub>1</sub> Tomato+ Coriander	1.18 (1.29)	0.70 (1.09)	0.94 (1.20)	74.45
T <sub>2</sub> Tomato+ Fenugreek	1.62 (1.45)	0.90 (1.83)	1.26 (1.32)	58.76
T <sub>3</sub> Tomato+ Barley	1.80 (1.51)	1.22 (1.31)	1.51 (1.41)	58.96
T <sub>4</sub> Tomato+ Carrot	1.75 (1.45)	1.03 (1.23)	1.39 (1.37)	62.22
T <sub>5</sub> Tomato + Mustard	1.33 (1.35)	0.85 (1.16)	1.09 (1.25)	70.38
T <sub>6</sub> Tomato + Dill	1.65 (1.46)	1.22 (1.27)	1.38 (1.37)	62.22
T <sub>7</sub> Tomato sole	3.96 (2.11)	3.40 (1.97)	3.68 (2.05)	-
SEM±	0.31	0.41	0.21	
CD 5%	0.96	0.12	0.67	

The figures in parentheses are transformed as  $\sqrt{x+0.5}$

Table 2. Influence of intercrops on the fruit damage of tomato during 2006-07 and 2007-08

Crop combinations	% fruit damage (w/w)			% fruit damage (n/n)		
	2006-07	2007-08	Mean	2006-07	2007-08	Mean
T <sub>1</sub> Tomato + Coriander	28.13 (32.03)	23.13 (28.73)	25.63 (30.41)	29.33 (32.75)	23.90 (29.26)	26.61 (30.04)
T <sub>2</sub> Tomato + Fenugreek	28.71 (32.32)	23.53 (29.00)	26.12 (30.72)	29.72 (33.02)	24.89 (29.90)	27.30 (31.50)
T <sub>3</sub> Tomato + Barley	29.63 (32.96)	25.50 (30.30)	27.57 (31.65)	30.35 (33.41)	26.85 (31.20)	28.60 (32.32)
T <sub>4</sub> Tomato + Carrot	28.87 (33.09)	26.61 (31.04)	28.24 (32.07)	30.52 (33.51)	25.80 (30.48)	28.16 (32.01)
T <sub>5</sub> Tomato + Mustard	27.60 (31.67)	21.37 (27.52)	24.49 (29.65)	28.15 (31.99)	22.48 (28.27)	25.32 (30.18)
T <sub>6</sub> Tomato + Dill	28.93 (32.53)	24.50 (29.66)	26.38 (30.90)	29.90 (33.41)	25.23 (30.15)	27.58 (31.66)
T <sub>7</sub> Tomato sole	39.30 (38.81)	35.40 (36.50)	37.35 (37.66)	39.92 (39.17)	36.67 (37.26)	38.29 (38.22)
SEM±	0.59	0.77	0.66	1.15	0.81	0.76
CD 5%	1.81	2.39	1.86	3.57	2.51	2.36

Figures in parentheses are angular transformed value

2007-08. The highest damage (36.67%) was recorded in tomato sole and lowest (22.48 %) in tomato + mustard. Almost similar trend was recorded in 2007-08 where mustard coriander and fenugreek recorded better response in terms of damage to remaining crop combinations. Pooled mean damage of fruits (n/n) was found significant. Highest fruit damage (38.29%) was recorded in sole crop and lowest damage (25.32 %) found in tomato + mustard. It was followed by tomato + coriander (26.61%) and tomato + fenugreek (27.30%). All the intercrops were found comparable and significantly superior over sole crop in terms of reduction of fruit damage. The results of present study are in accordance with the findings of Patil, et al., (1997), Pandher et al. (2006) and Gupta, et al. (2008).

**Effect of intercrops on mean tomato equivalent yield (TEY) :** The tomato equivalent yield was significantly higher in tomato intercropped either with coriander, barley or mustard during 2006-07. While in the year 2007-08, tomato equivalent yield was significantly higher in tomato + coriander, tomato + fenugreek followed by tomato + mustard and tomato + barley. Mean tomato equivalent yield was significantly highest (229.66 q ha<sup>-1</sup>) in tomato + coriander followed by tomato + barley (211.07 q ha<sup>-1</sup>), tomato + mustard (209.62 q ha<sup>-1</sup>) and tomato + fenugreek (209.57 q ha<sup>-1</sup>) cropping system as compared to tomato sole (199.48 q ha<sup>-1</sup>). The higher price of seeds of coriander as well as high yield of barley was responsible for their higher tomato equivalent yield. Similar results are reported by Patil, et al., 1997; Gupta et al., 2008. Lower

Table 3. Effect of intercrops on tomato equivalent yield (q/ha) during 2006-07-2007-08

Crop combinations	Yield of base crop (q/ha)			Yield of intercrops(q/ha)			Tomato equivalent yield(q/ha)		
	2006-07	2007-08	Mean	2006-07	2007-08	Mean	2006-07	2007-08	Mean
T <sub>1</sub> Tomato+ Coriander	195.20	199.55	197.37	5.11	7.78	6.44	220.91	238.40	229.66
T <sub>2</sub> Tomato+ Fenugreek	191.62	194.45	193.03	3.55	7.53	5.54	202.72	216.42	209.57
T <sub>3</sub> Tomato+ Barley	190.43	194.18	192.30	18.71	17.11	17.91	209.15	213.00	211.07
T <sub>4</sub> Tomato+ Carrot	191.47	196.66	194.06	3.63	4.13	3.88	198.29	205.3	202.95
T <sub>5</sub> Tomato + Mustard	194.08	197.10	195.59	4.66	6.56	5.61	205.02	213.51	209.62
T <sub>6</sub> Tomato + Dill	190.98	196.75	193.87	3.79	4.70	4.24	202.64	209.91	206.37
T <sub>7</sub> Tomato sole	198.20	202.29	200.24	0.00	0.00	0.00	196.66	202.28	199.48
SEM±	0.77	1.13	0.70	0.41	0.36	0.34	0.57	1.56	1.07
CD 5%	2.38	3.49	2.16	1.23	1.11	1.06	1.76	4.83	3.13

incidence of insect pests in intercropping systems proved to be successful barrier in checking the incidence of fruit borer. Intercropping influences the immigrating insects in such a way that crop colonization is delayed, thus lower population level of these species are found in the intercropped vegetable (Costello, 1995).

## References

- Anonymous (2008). Annual report of vegetable production in Dehradun district. Directorate of Horticulture and Food Processing, Govt. of Uttarakhand.
- Costello MJ (1995). Spectral reflectance from a broccoli crop with vegetation or soil as background: Influence of immigration by *Brevicoryne brassicae* and *Myzus persicae*. Entomol. Exp. Et. Appl. 75: 109-118.
- Gupta MP, Nayak MK, Sharma AK and Marabi RS (2008). Effect of spices as intercrops with chickpea (*Cicer arietinum*) on the incidence of pod borer (*Helicoverpa armigera*). Indian J. Agril. Sci. 78 (10): 903-904.
- Jayaraj S (2002). Prudent suppression of pests. The Hindu Survey of Indian Agriculture. 187-190.
- Pandher S, Singh D and Dilavari VK (2006). Effect of simulated damage of crucifers on oviposition and fruit damage by *Helicoverpa armigera* (Hubner) on tomato. J. Insect Sci. 19(2):160-165.
- Patil S, Katikal YK, Revanappa and Patil DR (1997). Effect of intercropping tomatoes (*Lycopersicon esculentum* Mill) on the infestation of tomato fruit boerer, *Helicoverpa armigera* (Hubner). Adv. in Agril. Res. India. 8: 141-146.
- Prasad D, Singh KM, Katiyar RN and Singh RN (1987). Impact of intercropping on the plant growth, pest incidence and crop yield of pea (*Pisum sativum* L.). Indian J. Entomol. 49(2): 153-172.
- Prasad A, Purohit S, Syed N and Jain M (2007). Comparative field potential of microbials over synthetic insecticide against *Helicoverpa armigera* (Hubner) infesting tomato crop in South Rajasthan. Pestology. XXXI (2): 24-28.