

## **Intercropping of African marigold with tomato for better productivity, pest control and economic returns in Arunachal Pradesh**

### **ABSTRACT**

**This study was carried out during Rabi season of 2017-18 and 2018-19 respectively in Tirap district of Arunachal Pradesh to find out the best line combination of marigold with tomato. Total three treatments (T1- 3 rows of Tomato with 1row of marigold, T2- 3 rows of Tomato with 1row of marigold and T3- Control (tomato sole crop) were planted with three replications under Randomized block design. T1 recorded minimum infestation of tomato fruit borer (5.47 %), maximum fruit yield (16.32 t/ha), maximum net return (Rs. 1,53,000), Best B:C ratio (3:1) while T3/control recorded least (18.32%, 14.27 t/ha, rs.1,17,780 and 2:43 respectively).**

### **INTRODUCTION**

*The tomato fruit borer (*Helicoverpa armigera*)* is most destructive pests of field crops worldwide. It is widely disseminated in different agroclimatic conditions, high mobility, having good survival rate under adverse conditions too and have capacity to complete several generations in a year. It's also having ability to develop resistance against insecticides, polyphagy in nature; by which it survives in better way during lacking of major food instead of mortality. The several studies have reported that its outbreak led the development of insecticide resistance due to heavy spray of insecticides, which are known to have detrimental effect on populations of its natural enemies and bioclimatic factors in host plants (Fitt *et al.*, 1995; Naseri *et al.*, 2009). The several studies have proven that light trap can also use to control of *Helicoverpa armigera* (Kumar *et al.*, 2012). Being the movement from one crop to others, these insects exposed to many applications of pesticides and as the result; they became pesticide resistant. According to Puri, 1995, the 55% spray of insecticides consumed by *Helicoverpa armigera*. The residual effect of insecticides in human health are the discussion points in present era due to occurrence of so many disease and health issues in human kind. Thus, the minimization of chemical spray for better health as well as reduction the production cost is the demand of moment. Thus, the significance of trap plants increases. Utilizing plants in a cropping area to draw oviposition away from the primary crop is known as trap cropping. Trap crops protect the main crop from pests that would otherwise wipe it off. To keep the field safe, trap crops might be sown all the way around it or sporadically, like every ninth row. Plant alfalfa and mustard next to strawberries to draw lygus bugs and place Pelargonium geranium among rose bushes to deter Japanese beetles from eating the geranium, which is poisonous to them.

In order to keep pests from getting to the main crop, trap crops divert them away or concentrate them in specific field products where they may be readily stopped or managed. Trap crops serve an additional purpose for natural enemies and have an important property that makes them noticeably more attractive to pests (Pats *et al.*, 1997). The use of marigold as a trap crop against tomato fruit borer on tomatoes was therefore the study's primary focus and it was examined in a variety of cropping combinations. The marigold and tomato companion planting are a tested is true technique, used by researcher and gardeners from hundreds of years. Different studies have showed that marigold planting between tomato crop protects from damaging nematodes that causes damage in soils. The aromatic scent of marigold plant is also act as repellents against different insect's like- aphids, thrips, fruit borers, fruit flies and against rabbits too. In different studies reported that marigold also reduced early blight in these ways- Allelopathic effect on *A. solanai* development, reducing humidity level in field caused unfavorable microenvironment for pathogens, behaved as physical barrier against pathogens.

The mostcommonly method for the control of this pest is to have a film of a persistent effective pesticide over the foliage and fruiting bodies. As tomatoes are picked at short intervals maintenance of insecticidal film is hazardous and uneconomic too. Now indiscriminate use of insecticide has disturbed the ecology and resulted the pesticides resistance among insects. The trap crop provides protection from by preventing the by reaching the main crop and pest diverted away from main crop. The trap crops have more attractive to pest than main crop and has additional functions against destructive insects.

## **MATERIALS AND METHODS**

Krishi Vigyan Kendra - Tirap, Arunachal Pradesh conducted On Farm Trials on” Intercropping of African marigold with tomato” to assess the scale of insect control in tomato plant; in Rabi season, 2017-18 and 2018-19 respectively in Noitong, Soha, Doidum villages. Tomato; variety- Pusa Sadabahar and African Marigold, variety- Pusa Narangi were planted under Randomized block design with three treatments-

T1- 3 rows of Tomato with 1row of marigold

T2- 3 rows of Tomato with 1row of marigold

T3- Control (tomato sole crop).

The selected farmers were well educated through village level training about scientific cultivation practices of tomato with marigold as an intercrop. The total three (03) farmers were selected from these villages. The total area of the trial was 0.10 ha (0.033 ha size plot of each farmer). The seeds of Pusa narangi variety of African marigold

were sown in Nursery at KVK Tirap on 10<sup>th</sup> October, 2017 and 2018 respectively. And seeds of tomato; variety- Pusa sadabahar were sown in nursery of KVK on 25<sup>th</sup> October, 2017 and 2018 respectively. All the cultural practices were followed scientifically. The 25 days old tomato seedlings weretransplanted at the spacing of 90 cm (row to row) x 45 cm (plant to plant) and 35 days old seedlings of marigold planted.

The Observation on population of tomato fruit borerplant<sup>-1</sup> was recorded from the selected plants on both tomato and marigold at 40, 60 and 85 days after transplanting. The percentage of fruit damage was also calculated at 40, 60 and 85 days after transplanting.

The fruit damage percentage was calculated bythe following formula:

$$\text{Percent fruit damage} = \frac{\text{No. of Fruit damage}}{\text{No. of fruit damage}}$$

### Results and Discussions-

The pooled data on effect of marigold on infestation on tomato fruit borer during 2017-18 and 2018-19 clearly indicating that the closer spacing was resulted positively on tomato yield. The average fruit damage was 5.47 to 18.32 in different treatments. The T1 yielded minimum damage 7.99, 4.94 and 3.48 % respectively after 50 days, 65 days and 80 days after transplanting. While the T2 damage level were 9.11, 6.28 and 3.49 % respectively after 50 days, 65 days and 80 days after transplanting. And T3 was the recorded poorest: 16.87, 18.42 and 19.68 % respectively after 50 days, 65 days and 80 days after transplanting.

The uses of marigold as a trap crop in different ratios has proven its utility. According to Shrinivasan *et al.* (1994), marigold produces huge number of green leaves and flowers; which feeder by fruit borers during the cropping season of tomato. The larvae feed quickly and has no option to move towards tomato crops. In this result, the fruit damage was significantly recorded lesser over control. The T1 had maximum density of marigold yielded 5.47% fruit damage while T2 had medium density of marigold; yielded 6.29% of fruit damage. And Control resulted 18.32 % fruit damage; due to lack of marigold crop. Shrinivasan *et al.* (1994) and Virk *et al.* (2004) have also mentioned that marigold crop is a good natural repellent of tomato fruit borers in different

agroclimatic conditions and this study has also proved that marigold can be used as a natural repellent in climatic conditions of Arunachal Pradesh.

**Table -1: Effect of marigold on infestation on tomato fruit borer (during 2017-18 and 2018-19 : pooled data)**

Parameters	50 days	65 days	80 days	Average
T1	7.99	4.94	3.48	5.47
T2	9.11	6.28	3.49	6.29
T3	16.87	18.42	19.68	18.32
CD (5%)	1.51	1.29	0.76	

**Table-2: Result of marigold intercropping with tomato (pooled data of 2017-18 and 2018-19)**

Parameters	T1	T2	T3
Plant height (cm)	60.23	58.26	57.44
No of fruits/plant	37.89	31.65	29.76
Total fruit yield(t/ha)	19.64	17.81	14.27
Marketable fruit yield (t/ha)	16.32	14.18	11.28
Unmarketable fruit yield (t/ha)	3.32	5.70	8.19
Net return (Rs/ha)	1,53,000	1,38,000	1,12,780
B:C ratio	3:11	2:84	2.43

The plant height of T1, T2 & T3 (60.23, 58.26 and 57.44 cm respectively) were closely similar, very minor differences were reported. The total number of fruits per plant of tomato was higher with T1 (37.89) followed by T2 (31.65). T3 was the least. This showed that the positive effect of marigold intercropping with tomato (Kakar *et al.* 1980). This might be due to protection of different external factors like frost, insect pest and other environmental factors that resulted in more fruits being produced. The total fruit yield was also reported higher with T1 (19.64 t/ha), followed by T2 (17.81) and control (14.27 t/ha).

Because intercropping of marigold served as a trap crop and acted as a barrier against insect pests. Regarding total marketable fruit yield (t/ha) T1 reported significantly better (16.32 t/ha) followed by T2 (14.18 t/ha) and control was the least (11.28 t/ha). This might be due to the better use of solar radiation attributed to increased interception of photosynthetically active radiation resulting in better solar radiation use efficiency (Hussain and Billan, 2007, Sarate *et*

al. 2012). The unmarketable fruit yield recorded higher with control (5.70 t/ha) over T1 (3.32t/ha). This proved that the marigolds protect to tomato crop in better way against insects and root knotnematodes; which resulted in maximum number of good quality fruits. Hence the economics was also higher with T1 followed by T2 and minimum with T3 (Rs. 1,53,000, 1,38,000 and 1,12,00 and 3:1, 2.84 and 2.43 respectively).

The T1 (3 rows of Tomato with 1row of marigold) resulted best in all parameters- minimum infestation of tomato (5.47 %), maximum no of fruits/plant (37.89), maximum fruit yield (19.64 t/ha), maximum marketable fruit yield (16.32 t/ha), maximum net return (Rs. 1,53,000/ha) and Best B:C ratio (3:11). Thus, it can be suggested to farmers of Arunachal Pradesh that use marigold as trap crop in tomato farming for better production, yield and economics.

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