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An investigation on the management of early blight of tomato

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Abstract
Tomato (*Solanum lycopersicum* L.) is an important vegetable crop being used as vegetable as well as an ingredient. *Alternaria solani* causes early blight in tomato which is responsible for severe yield losses in the crop. In the dry climate of Sirohi region, tomato is an important crop taken by the farmers of this region. Various control measures have been introduced through decades to minimize the losses the crop is subjected due to early blight disease. Under present study a number of such methods have been tested against the *A. solani*. Various treatments included fungicide, bio control agent, organic amendment and the combination of all these. PDI was calculated under different treatments with standard score. The results clearly shown that the Integrated Pest Management is the most effective method to reduce the losses caused by this disease at field level. Yield was significantly.

Keywords: *Alternaria solani*, early blight, fungicide, *Trichoderma viridae* etc.

Introduction
Tomato (*Solanum lycopersicum* L.) is a popular vegetable and fruit crop in the Solanaceae family. It is a very versatile plant that is used in both natural (raw material) and as an ingredient in other products. Tomato yield in India is low when compared to other developed countries due to the attack of various diseases caused by fungi, bacteria, viruses, and nematodes. *Alternaria solani* is the fungus that causes early blight (Ellis and Martin). *A. solani* causes disease (leaf blight, stem rot, fruit lesions) and severe damage across the country at all stages of plant development. Small to irregular brown spots with a "bull eye" appearance on older plant leaves are symptoms. As these spots grow in size, they form concentric rings that are surrounded by other concentric rings surrounded by yellow halo under suitable environmental conditions. This pathogen also causes seedling, stem, blossom, and fruit drop symptoms. The disease is currently managed through the use of several conventional fungicides, but due to the development of resistance in most common pathogenic fungi against fungicides, as well as the factors of exposure risks, fungicide residues, and human health hazards, there has been a push for alternative control methods for *A. solani*. Control measures that are both ecologically sound and safe for the environment must be implemented. Natural products are considered to be the best alternative to synthetic chemicals in this regard due to their lower environmental impact. Many botanicals are used for this purpose, both to reduce spore production of foliar pathogens and to control disease development. Plant extracts also have antimicrobial activity that can be used to control early early blight of tomato. Aqueous extract of Decalepis hamiltonii exhibited antifungal activity against Fusarium, Aspergillus, Penicillium, Drechslera, and Alternaria species. Neem seed and leaf extracts exhibited antifungal activity and was also used as an insecticide to control agricultural insect pests. The current study aims to assess the antifungal activity of five plant extracts against *A. solani in vitro* using the food poison technique.
Sirohi is an aspirational district of Rajasthan, comprises of five block, each differs in their cropping pattern as well as in the climatic variables. District falls under Agoclimatic zone IIB and IVA. The annual average rainfall of the district is 622 mm. lacking behind in the technical awareness farmers in this region are still using chemical control for all the major diseases of the crops.

Technology transfer: A comparative study for the evaluation of various agents used to manage the early blight of tomato was done at farmer's field. Study was conducted for evaluating the management techniques. Fields were selected after conducting survey on the disease occurrence in the region. In each field for monitoring disease plants were tagged. Plant

disease intensity was calculated using following formula:

$$PDI = \frac{\text{Number of plants infected } * 100}{(\text{total number of plants assessed })}$$

In each field thus selected ten plants were tagged for evaluation of effectiveness of various management methods. The standard disease scale was used given below:

The standard disease scale was used given below:

Scale	Description of the symptoms
0	Leaves free from infection
1	Small irregular brown spots covering <5% leaf area
2	Small irregular brown spots with concentric rings covering 5.1 to 10% leaf area
3	Lesions enlarging irregular brown with covering 10.1 to 25% leaf area
4	Lesions coalesce to form irregular and appears as typical blight symptoms covering 25.1 to 50% of leaf area

Weekly observations were recorded for the accurate assessment. Farmers were given training on Integrated Pest management and various spraying technique in order to make the study useful for farming community. Various treatments included:

Table 1: Treatments

Sr no	Treatments	Details	Rate of application
1.	T1	Seed treatment with fungicide Propiconazole	0.1%
2.	T2	Seed treatment with *Trichoderma*	10g/kg of seeds
3.	T3	Soil application of organic amendments (neem cake)	500gm/sqm
4.	T4	Seed treatment with fungicide+ *Trichoderma* + Soil application of organic amendments (neem cake)	As mentioned above
5.	T5	Foliar application of fungicide Propiconazole	0.1%
6.	T6	Control	-

Results: Fields were selected on the basis of plant mortality rates as presented in the table (Table 2). Under different type of soils the rates vary when taken at two intervals.

Table 2: Survey results

S. No.	Different fields	Type of soil	Average plant mortality (%) day after sowing (DAS)		Pooled
			DAS		
			60	90	
1	Field 1	Loamy	52.00 (46.15)	56.00 (48.45)	55.50 (48.18)
2	Field 2	Loamy clay	40.00 (39.22)	46.00 (42.69)	45.00 (42.12)
3	Field 3	Sandy	64.00 (53.14)	69.50 (56.49)	67.75 (55.56)
4	Field 4	Sandy	66.00 (54.42)	71.50 (57.74)	70.75 (57.28)
5	Field 5	Loamy clay	46.00 (42.69)	52.00 (46.15)	51.00 (45.57)
6	Field 6	Loamy	62.00 (51.95)	66.00 (54.37)	65.00 (53.76)
7	Field 7	Loamy clay	34.00 (35.62)	36.00 (36.81)	35.50 (36.48)
		SEm±	3.7980	2.0654	2.1616
		CD at 5%	11.2844	6.1366	6.1999
		CV%	15.82	8.32	10.96

Plant population among various treatments was analyzed and the PDI was calculated separately for each treatment. The records were maintained throughout the study period. Farmers were included in data recording procedure so that they could know the effectiveness of various methods.

Table 3: Effectiveness of various control agents

Sr no	Treatments	Reduction in PDI as compared to control
1.	T1	61.70
2.	T2	45.3
3.	T3	66.3
4.	T4	86.2
5.	T5	70.1
6.	T6	-

Conclusion

The treatment including fungicide, bio control agent and the amendment was found most effective against early blight of tomato. Thousands of farmers of the region were convinced by the result demonstration at farmer's own field to use the IPM technique to control the disease. Benefit to cost ration proved that the method was also cost effective at field level. More number of such demonstrations should be given to farmers in order to achieve the goal of sustainable agriculture production.

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