

Original Research Article

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Effect of Soil Solarisation for the Control Soil Born Pathogen *S. rolf sii* Causing Stem Rot of Chilli (*Capsicum annuum* L.)

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ABSTRACT

Keywords

Chilli (*Capsicum annuum* L.), *Sclerosium rolf sii* Sacc, Soil solarisation and Stem rot.

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A field experiment was conducted to study, the effect of soil solarisation for the control of *S. rolf sii* pathogen causing stem rot of chilli. Solarisation is a covering the soil with transparent polythene sheet (400 gauges) for 6 week during hot summer months (May and June) showed an increase in the soil temperature (up to 4-6⁰C) and conservation of moisture (5%) when compare to unsolarised plot(as control). In a field experiment naturally infected soil with stem rot of chilli, with ten replication carried out during 2008-09, 2009-10 and found that a significant reduction disease incidence was recorded in solarised plot as against non solarised plot (control).The average soil temperature (50C) were increases (41.8-46.40C) which is lethal to soil pathogen and decreases disease incidence. A pot experiment were also conducted in net house during 2009-10 sowing 25 seeds per 30cm.diameter earthen pots having four treatment and three replications and found maximum disease incidence (100%) in control (uncovered with polythene and non-irrigated as compared to covered with polythene and irrigated pots(20%).

Introduction

The chilli (*Capsicum annuum* L.) also known as *Mircha* is an important spice and vegetable crop belonging to the family Solanaceae. In India, chillis are grown in almost all the states of the country.

In India, area, production and productivity of chilli were 767.23 million ha. 1202.94 million tones and 1.6 mt/ha, respectively (Parthasarathy and Kandiannan, 2010).

There are so many diseases responsible for lowering down the production and productivity of chilli. Among fungal diseases, stem rot of chilli caused by *Sclerosium rolf sii* Sacc. is an important disease in India.

This is the first report of *S. rolf sii* causing collar rot in chilli from Gujarat (Lukose *et al.*, 2003). The disease is also known as foot rot/ Southern blight/ white stem rot/ stem rot in different places of the country. Chilli is highly susceptible to the disease and causing 50 to 60 per cent seedling mortality (Lukose *et al.*, 2003).

The severe stem rot of chilli causing 30-40% seedling rot was observed in a 2.0 ha at farmer's field in Saurashtra (Gujrat) India (Bhoraniya *et al.*, 2002). It is a destructive plant pathogen with an almost unlimited host range. In chilli crop the yield product is the fruit which directly consumed by people.

Hence chemical controls are not recommended as the presence of residues in green fruit may lead to health hazards. Pathogen is soil born in nature and disease inoculum increases in proportion from year to year. Therefore soil solarisation was required for the controlling soil borne pathogen. Soil solarisation by mulching soil surface with plastic film during summer months raises soil temperature to a lethal level. This method has been successfully employed in eliminating several soil borne pathogens. Management of disease through this, environmentally safe method is present day need. The appropriate management of this disease before field condition was essential in laboratory and pot culture. Keeping in view importance of disease, present investigation was undertaken to find out the effect of soil solarisation in management against fungus *S. rolfsii* causing stem rot in chilli.

Materials and Methods

Soil solarisation (In field)

In order to find out the effect of soil solarisation, a field experiment in naturally infested soil with stem rot of chilli with ten replications were carried out during 2008-09 and 2009-10 to study the effect of soil solarisation on stem rot in chilli. The experiment was conducted during hot summer month (May to June). The soil of experimental field was sandy loam and treatments comprised of solarised and non-solarised (as control) plot with the size 4.0 x 2.50 m². For solarisation, plots were covered with clear transparent polythene sheet (400 gauges) for five weeks in the month of May and June (from 20th May to 20th June in both the years) following the procedure of Chauhan *et al.*, (1988). All the plots were uniformly irrigated to field capacity one day prior to imposing polythene mulch in treatment. Randomized block design was applied for

comparison between solarised and unsolarised (control) plots (8x3M) each treatment was replicated thrice. Soil temperature of solarised and unsolarised plots during solarisation period was recorded at 1400 h (2.00 pm) at a depth of 5 and 20 cm using soil thermometer. After expiry of date of solarisation, polythene sheets were removed and 25-30 days old chilli seedlings were planted. The data on disease incidence were recorded after two months of planting (Plate-3).

In pots

The experiment was conducted in the net house, Department of Plant Pathology during 2009-10. Earthen pots having diameter of 30 cm. were filled with 5 kg moist solarised soil. Sclerotia (5.0 g) were evenly distributed below the two cm. soil layer. Four treatments *i.e.* covered with polythene + irrigated, uncovered with polythene + irrigated, covered with polythene + none irrigated and uncovered with polythene + none irrigated with three replications were taken. Covered with polythene and uncovered with polythene irrigated treatments were given sufficient water before adding the inoculum.

The pots were tightly wrapped with clear transparent polythene sheet (400 gauges) and solarised for five weeks from May to June. Pots were directly exposed to sun light from 10.0 am to 4.00 pm every day. Temperature of solarised and non solarised pots were recorded at depth of 15 cm along with day temperature (maximum) after every 24 hrs at 2 p.m. for 40 days between May to June 2009-10. Sheet from pots was removed after completion of period of solarisation. Healthy 25-30 days old seedlings of chilli were planted in the month of July and 5-10 plants in each pot were maintained. Observations on disease incidence were recorded after 45 days of planting. The following formula was used for calculating disease incidence.

No. of diseased plants in sub plot
 Disease incidence
 (Stem rot) % = ----- x100
 Total No. of plants in sub plot

collar rot of chilli caused by *Sclerotium rolfsii* Sacc.

Result and Discussion

Effect of soil solarisation on disease severity (In field)

It is clearly indicated from the data presented in Table-1 and Figure 1 that a significant reduction in disease incidence was recorded in solarised plots as against non-solarised plots. Average soil temperature at 5 cm and 20 cm was 46.40⁰ C and 41.80⁰ C respectively and average disease incidence was 9 per cent and 66 per cent on solarised and non solarised plots respectively.

The plots covered with polythene had markedly higher average temperature (46.40⁰ C) as compared to non- covered plots (41.80⁰ C). The temperature more than 46.40⁰ C is in most of the causes lethal to maximum soil born pathogen. Rao and Mathur *et al.*, (2003) also reported that solar heating by polythene was effective for the control of

Rao and Maity (2003) evaluate solar heating by polyethylene mulching for the control of collar rot of chilli caused by *Sclerotium rolfsii* Sacc. The total elimination in the viability of sclerotial population to the total elimination in the viability of sclerotial population at 5 cm depth after 14 and at 10 cm depth after 21 days, while 56.67 % loss in viability was observed at 15 cm depth after 21days. The highest temperature recorded during the experimentation was 51.4⁰ C, 48.9⁰ C and 45.9⁰ C at 5, 10, and 15 cm depth, respectively while at same days ambient temperature was 37.4⁰ C.

Raj, *et al.*, (1997) also repoted that soil solarisation with transparent polythen multch was effective to control damping off pathogen of different vegetable crops in the nursery. Nursery bed soil was flood irrigated and then covered with transparent polythene sheet for 40 days. Mulching with polythene resulted in 13.50C higher temp. Killed the *Pythium* sp. and *Fusarium* spp. and recorded 18.3to 42.0% higher seed germination, lower incidence.

Table.1 Effect of soil solarisation on stem rot under field condition

Treatment	Avg. Soil temp. (max ⁰ C) at 5 & 20 cm. depth	Average air Temp. ⁰ C	Disease incidence (%)		Average disease incidence (%)	% reduction in disease incidence
			2009-10	2010-11		
Solarised	46.40	38.90	8.18 (16.57)	9.2 (17.64)	9	86.36
Non-solarised	41.80	-	63 (52.57)	72 (58.07)	66	-
CD at 0.5%			3.52	2.22		
S.E. m.			1.08	0.68		

Table.2 Effect of soil solarization on stem rot under glass house

Treatment	No. of seeds sown/pot	No. of affected plants	Disease incidence (%)	% reduction in disease incidence
Covered with Polythene + irrigated	25	03	12 (20.22)	88
Without covered polythene + irrigated	25	20	84 (66.47)	16
Covered with Polythene + none irrigated	25	06	24 (29.31)	76
Without covered polythene + none irrigated(control)	25	25	100 (86.05)	-
C.D. at 0.5%		4.27		
SE. m.		1.41		

Fig.1 Effect of soil solarisation on stem rot under field condition

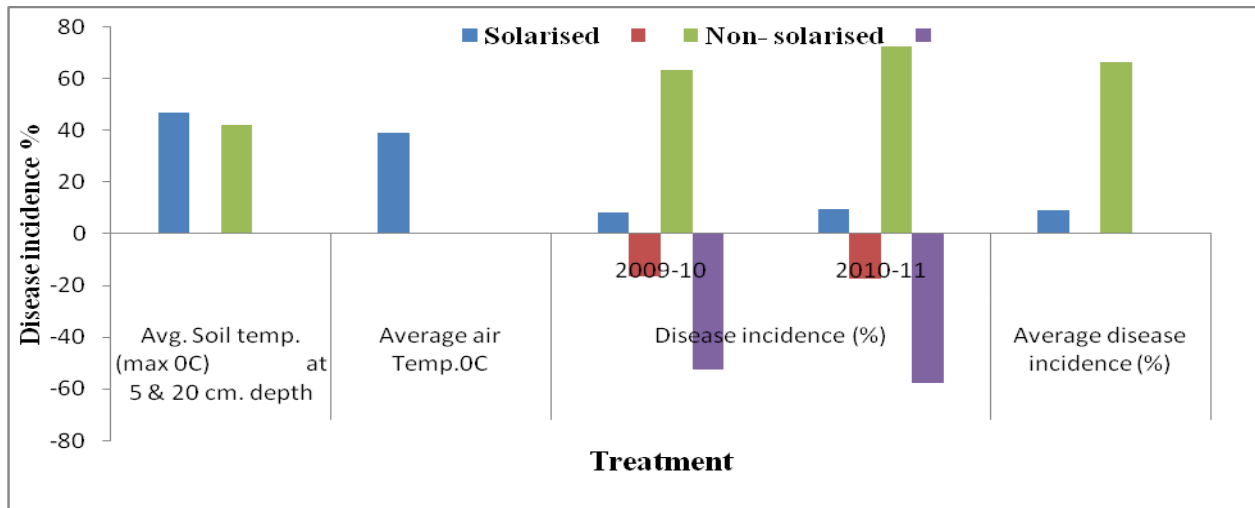
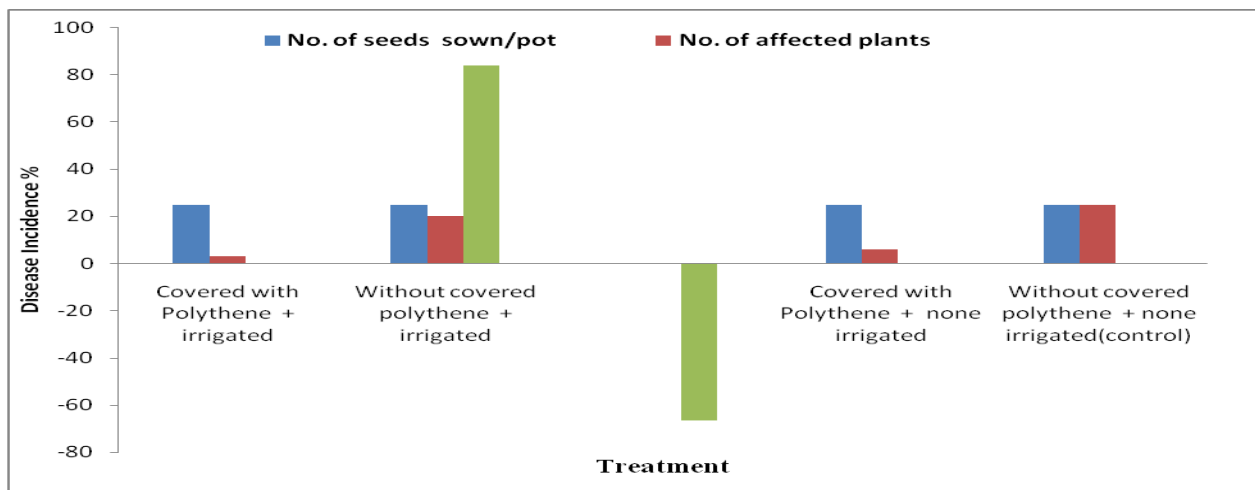


Fig.2 Effect of soil solarization on stem rot under glass house



In pots condition

The data presented in Table 2 and Figure 2 indicated that the pots covered with polythene

and irrigated showed 88 per cent reduction in disease incidence. However it was 76 per cent when pots were not irrigated. In non-covered and non-irrigated pots 100 per cent disease was

observed as 84 per cent disease was noticed in non-poly irrigated plots. Soil moisture was greatly affected in the sensitivity of resting structures of pathogen.

Tiwari, *et al.*, (1997b) also found that pots covered with transparent polythene sheet attained markedly higher temperatures compared with the uncovered control. The average soil temperature exceeded 50 °C and 45 °C, at 5 and 10 cm depths, respectively in solarized soils. Solarizations significantly decrease diseases in solarized pots were completely free from sclerotial root rot, when sclerotia were placed at 5 cm. depth. The chickpea crop was also disease free where sclerotia were placed at 5 and 10 cm. depth in pots with moist soil.

Deshpande *et al.*, (2007) also reported that all the betel vine cuttings planted in solarised pots were found free from collar rot (*S.rolfsii*) disease (mortality 0.00 per cent). Even then, in case of five days solarisation, all cuttings were found free from collar rot infection. Tiwari, *et al.*, (1997b) who has found that pots covered with transparent polythene sheet attained markedly higher temperature as compared with the uncovered which are lethal to pathogen.

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