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Effect of solar heating of soil on the dynamics of soil mycoflora

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Solar heating of soil is a natural, non-chemical phenomenon for controlling the population of soil microorganisms and soil-borne pathogens by increasing the temperature of soil by mulching with transparent polythene sheet over moist soil surface in summer. Transparent thin polythene sheets (30 μ) were much effective in solar treatment of soil. After 45 days of incubation, the minimum number of fungi was recorded from mulched soil compared to non-mulched soil (contro) Solar treatment was less effective at 15 cm depth. Maximum temperature of mulched soil was 54.5°C at 5 cm depth. *Trichoderma viride, Aspergillus niger, A. luchuensis, Rhizopus nigricans* and *Penicillium citrinum* were frequently isolated from mulched soil at 0-5 cm depth.

Key words : Solar heating of soil, Soil mycoflora, Mulching.

In recent years, solar heating of soil has been employed in tropical countries for the control of soil-borne pathogens and weeds (Katan, 1981 ; Mihail and Alcorn, 1982 ; Katan *et al.*, 1983 ; Pullman *et al.*, 1984 ; Kassaby, 1985). The present paper describes the effect of solar heating of soil on population dynamics of soil mycoflora.

MATERIALS AND METHODS

Two plots of equal size (1 m x 1 m) were selected in a crop field, Banaras Hindu University. One of them was covered with transparent polythene sheet (30 μ) and the other remained as such in sunlight without mulching (control). Both mulched and non-mulched plots were watered regularly to maintain soil moisture by drip irrigation method. Polythene sheet of mulched plot was removed after 45 days of solar treatment. Soil temperature at 5, 10 and 15 cm depths was recorded by soil thermometer. Air temperature was also noted on the sampling date from the Metereological section' Dept. of Geophysics of this University.

Soil sampling with sterilized spatula in sterilized ploythene bags was done from both the plots at 5, 10 and 15 cm depths. Ten g soil from each sample was taken separately in 250 ml Erlenmeyer flasks containing 100 ml sterilized distilled water. The flasks were shaken on an electric shaker to get homogeneous suspension and thereafter 10^3 dilution was prepared in sterilized distilled water. One ml soil suspension was poured separately into sterilized Petri plates containing 15 ml autoclaved and cooled down Martin medium (Martin, 1950). The plates were incubated at 25 ± 1 °C for a week and number of fungal colonies appeared was recorded and fungi were identified.

RESULTS AND DISCUSSION

The soil temperature varied at different depths in mulched and non-mulched plots. The maximum soil temperature was recorded as 54.5°C at 5 cm depth in mulched soil, while minimum (37°C) was recorded from non-mulched soil at 15 cm depth (Table 1). Overall, the temperature decreases as soil depth increases in both the plots.

Table 1 : Soil temperature recorded during solar heating of soil (1987)*

Depth (Cm)	Soil temperature (°C)	
	Mulched	Non-mulched
5	54.5	42.0
10	50.0	41.5
15	45.0	37.0

*Air temperature 45°C (on 27th June, 1987).

A total number of 15 fungi was screened from mulched and non-mulched soil among which the minimum number was recorded from mulched soil at 0-5 cm depth, while the maximum from non-mulched soil. *Aspergillus* spp. were dominant in non-mulched and mulched soil at 11-15 cm depth, while *Rhizopus nigricans* and *Cephalosporium roseo-griseum* were frequently isolated from non-mulched soil (Table 2). A total number of six fungi was isolated from mulched soil at 0-5 cm depth. Amongst them *Aspergillus niger* was frequently isolated in mulched soil. Some other fungi viz., *A. flavus*, *A. nidulans*, *A. fumigatus*, *Cephalosporium roseo-griseum*, *Rhizopus nigricans*, *Penicillium citrinum*, *P.regulosum*

Table 2 : Percent occurrence of soil mycoflora after 45 days of solar treatment

Name of fungi	Mulched plot Soil depth (cm)			Non-mulched plot Soil depth (cm)		
	0-5	6-10	11-15	0-5	6-10	11-15
Acrophialophora fusispora	—	18	—	—	—	16
Aspergillus flavus	10	—	8	16	10	—
A. fumigatus	—	—	14	10	12	—
A. luchuensis	12	—	6	18	—	—
A. nidulans	—	6	18	—	20	8
A. niger	18	14	16	—	14	6
A. terreus	—	22	—	8	—	18
Cephalosporium roseo-griseum	12	4	—	8	6	12
Fusarium oxysporum	—	—	12	—	6	8
Penicillium citrinum	15	—	12	—	—	8
P. funiculosum	—	4	4	—	—	—
P. javanicum	—	—	10	14	14	—
P. regulosum	—	—	—	—	—	14
Rhizopus nigricans	34	20	—	18	10	10
Trichoderma viride	—	10	—	8	6	—

P. funiculosum were randomly isolated from different depths. Population of *A terreus* and *Rhizopus nigricans* was found rather higher than that of other fungi. Increase in temperature during solar heating of soil in the present study agrees with the magnitude of temperature reported by some workers in other countries (Katan, 1981 ; Gristein *et al.*, 1979 ; Kassaby, 1985). In general, the population of soil fungi decreased in mulched soil as compared to non-mulched. Two antagonists viz., *Trichoderma viride* and *Aspergillus* sp. were dominant in both the trials due to their tolerance capacity against adverse conditions caused by solar treatment of soil which is more or less similar to the findings of Pullman *et al.* (1984). Sufficient soil moisture is necessary in both plots which increases heat conductivity of moist soil and lowers the ability of fungi due to high temperature (Katan *et al.*, 1976 ; Pullman *et al.*, 1979). It involves biological phenomenon, physical effect of heat (Elad *et al*, 1980 ; Mihail and Alcorn, 1984) and significant reduction in the soil-borne disease, thereby increasing plant growth and crop yield (Stepleton and DeVay, 1982).

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