Indian Journal of Weed Science **44**(2): 122–123, 2012

Short communication

Effect of soil solarization on weed seed bank in soil

Asha Arora* and S.S. Tomar
College of Agriculture, RVSKVV, Gwalior, Madhya Pradesh 474 002

Received: 1 March 2012; Revised: 29 May 2012

Key words : Green manuring, Mulching, Solarization, Stale seedbed, Weed seed bank

Weeds are self grown plants which appear simultaneously with crop plant and result in intense crop-weed competition and cause reduction in yield varying from 27-71% depending upon type and intensity of weeds and their time of occurrence. Effective weed management requires knowledge of weed seed bank dynamics, germination pattern and environmental conditions suitable for seedling emergence (Fraud-William *et al.* 1984). Weed seed bank affects the weed flora and its density because of the good relationship between the weed flora and the weed seed bank in the soil (Sousa *et al*. 2003). Soil solarization is a special technique in which moist soil is covered by polyethylene (PE) film and heated by solar radiation for several weeks. Northern India has high air temperature in summer therefore high soil temperature (50-60^{0}C) can be developed in soil covered with transparent polyethylene sheets (Kumar *et al*. 1993). A field experiment was done to asses the effectiveness of soil solarization for a period of 45 days on weed dynamics in pearl millet-wheat cropping system

An experiment on evaluation of soil solarization on weed seed bank of soil was conducted in summer season of 2004 at Research farm, College of Agriculture, Gwalior. The experiment was laid out in randomized block design with six non-chemical agronomical weed management practices *viz.*, solarized, non-solarized, stale seed bed, deep ploughing, green manuring and mulching by green biomass replicated thrice. For soil solarization, transparent poly ethylene sheets of 30 µm thickness were used. Before spreading the polyethylene sheets to the field, one light irrigation was given to all the plots. The temperature of the soil in each treatment was recorded every day at 10 and 15 cm depth. The polyethylene sheets in the solarized plots were spread, on 18th May 2004 and they were removed on 2nd July 2004 with minimum disturbance.

Soil samples (0-15 cm) were collected from each treatment to find out the weed seed accumulation. After drying and sieving with 2 mm sieve, the soil samples were spread over shallow trays followed by watering to encourage the emergence of weeds. The species wise weed population was recorded 3-4 times after flushes of weed emergence.

The soil temperatures recorded under solarized conditions were 43.9^{0}C and 43.8^{0}C at 10 and 15 cm depth, respectively and it was 4.6^{0}C and 4.5^{0}C higher than non-solarized soil. The increase in temperature of solarized soil was 1.9–10.4^{0}C and 2.1 to 10.5^{0}C at 10 and 15 cm depth, respectively as compared to different agronomic practices (Table 1). The weeds emerged were, two grassy weeds namely *Echinochloa crusgalli* and *Commelina benghalensis*, four broad leaved weeds *viz., Digera arvensis, Trianthema mongoyna, Chenopodium album* and *Phylanthus niruri* and one sedge *Cyperus rotundus* (Table 2). In general, the number of *E. crusgalli* were highest followed by *C. rotundus* and *C. album*. In solarized soil total number of grassy, broad leaved and sedges weeds was lowest, while highest grasses were reported in non-solarised soil. Total numbers of weeds were highest in non-solarized soil followed by green manuring, stale seed bed, mulching, deep ploughing and solarized soil. The factors involved in soil solarization are soil temperature, moisture and probably gases (Horowitz *et al*. 1983). High temperature may cause damaging changes in enzyme activity,

Table 1. Mean soil temperature (^{0}C) under different agronomical practices

Agronomic practice	Temperature (^{0}C) at depth	
	10 cm	15 cm
Solarized	43.9	43.8
Non-solarized	39.3	39.3
Stale seed bed	38.0	37.8
Deep ploughing	42.0	41.7
Green manuring	36.8	36.7
Mulching by weeds	33.5	33.3
Increase in temperature of solarized vs non-solarized	4.6	4.5
Increase in temperature of solarized vs other practices	1.9-10.4	2.1-10.5

***Corresponding author:** ashaaroragwl@gmail.com

Table 2. Weed seed bank in soil after solarization and other agronomical practices (no./100 g soil)

Weeds	Solarized	Non-solarized	Stale seed bed	Deep ploughing	Green manuring	Mulching
Grasses						
Echinochloa crusgalli	0.06	3.19	2.17	2.08	2.58	1.16
Commelina benghalensis	0.00	0.06	0.00	0.00	0.00	0.00
Total	0.06	3.25	2.17	2.08	2.58	1.16
Broad leaved						
Digera arvensis	0.00	0.08	0.25	0.17	0.00	0.19
Trianthema monogyna	0.08	0.12	0.08	0.00	0.00	0.12
Chenopodium album	0.00	0.25	0.06	0.00	0.08	0.06
Phyllanthus niruri	0.00	0.00	0.08	0.00	0.06	0.06
Total	0.08	0.45	0.47	0.17	0.14	0.43
Sedges						
Cyperus rotundus	0.06	0.19	0.25	0.12	0.33	1.17
Total	0.20	3.89	2.89	2.37	3.05	2.76

membrane structure and protein metabolism. As a result, soil solarization reduces the number of weed seedling and weed biomass of heat sensitive species. Sundari and Kalaisuderson (2005) also reported off-season soil solarization effective in reducing the infestation of all the dominant weed species in irrigated cotton soil. In view of growing concern for environmental safety and sustainability of agricultural production, integration of solarization practices would provide an eco-friendly and sustainable system.

SUMMARY

An experiment on evaluation of soil solarization on weed seed bank of soil was conducted in 2004 at College of Agriculture, Gwalior, in randomized block design with six non chemical agronomical weed management practices *viz.*, solarized (45 days) non-solarized, stale seed bed, deep ploughing, green manuring and mulching by green biomass. The soil temperature recorded under solarized conditions were 43.9^{0}C and 43.8^{0}C at 10 and 15 cm depth and it was 4.6^{0}C and 4.5^{0}C higher than non-solarized soil respectively. In solarized soil total number of grassy, broad leaved and sedges weeds waslowest, while highest grasses were reported in non-solarised soil. Total number of weeds was highest in non solarized soil followed by green manuring, stale seed bed, mulching, deep ploughing and non-solarised soil. Thus soil solarization was found to be the best non chemical agronomical practice for weed management methods used resulting to lowest weed seed bank.

REFERENCES

Horowitz M, Regev Y and Herzlinger G. 1983. Solarization for weed control. *Weed Science* **31**: 170–179.

Kumar B, Yaduraju ND, Ahuja KN and Prasad D. 1993. Effect of soil solarization on weeds and nematodes under tropical Indian conditions. *Weed Research* **33**: 423–429.

Sousa E, Caixinhas L, Rocha F, Bekker RM , Forcella F, Grundy AC, Jones NE, Marshal EJP and Murdoch AJ. 2003. Seed banks : Determination, dynamics and management. *Aspects of Applied Biology* **69**: 47–54.

Sundari A and Kalaisuderson S. 2005. Weed management in irrigated cotton. Extended summaries, *National Biennial Conference, Indian Soceity of Weed Science,* held at PAU, Ludhiana, April: 6–9.