

# Studies on Effect of Weedicides on Microbial Population in Soil and Yield of Soybean

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## SUMMARY

The application of herbicide influenced the soil biological activities. All the herbicides were found to be more effective inhibitors against bacteria. Fungal population was also affected while actinomycetes had negligible effect. Two hand weeding in soybean increased yield without affecting microbial population in soil. Post emergence weedicides were found to be effective against weed control and also had less effect on soil microbial population than other weedicides.

## Key words :

Weed control,

Weedicides,

Micro-organisms

soybean

Soybean (*Glycine max*) is one of the important pulse and oilseed crops of the world. It became the miracle crop of the 20<sup>th</sup> century and often designated as 'Golden bean'. Among all oilseed crops, soybean occupied third position in the edible oil scenario of India next to groundnut and rapeseed. Soybean is grown on large area of Madhya Pradesh, Uttar Pradesh, Rajasthan, Himachal Pradesh, Bihar, Karnataka, Maharashtra and Andhra Pradesh. The area and production of soybean in Maharashtra was 2.92 lakh hectares and 4.8 lakh tonnes, respectively. Productivity was 1644 kg/ha in 2006 (Anonymous, 2007).

In Maharashtra soybean is mainly grown in the *kharif* season. In this season, weed control is serious problem. As per an estimate of the total annual loss of agriculture produce from various pests, weeds account for about 45 per cent, insect 30 per cent, diseases 20 per cent and other pests 5 per cent (Yaduraju, 2005). Complete mechanical and manual weeding may not be possible and cost effective. Under such conditions chemical weed control may be better alternative (Prasad and Rafey, 1995). There is an increase in use of weedicides for controlling weeds.

Microorganisms living in surface horizons play a vital role in cultivated soils. Many microorganisms like bacteria, fungi,

actinomycetes are associated with soybean crop in soil. Among these, some microorganisms are beneficial to crop by fixing atmospheric nitrogen and by solubilizing phosphorus etc. The continuous use of herbicides may have non target effect on soil microflora and microfauna. With this view the present investigation was planned with the objective to study the effect of weedicides on microbial population in soil.

## MATERIALS AND METHODS

The experimental work was conducted on the Instructional Farm of Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri during *kharif* season of 2007. The experiment with eight treatments were laid out in Randomized Block Design with three replications. The treatment consisted of T<sub>1</sub> weedy check, T<sub>2</sub>-two hand weeding, T<sub>3</sub> - Persuite @ 1 to 1.5 kg a.i./ha as post emergence, T<sub>4</sub> - Glyphosate @ 1 to 2 kg a.i./ha as post emergence, T<sub>5</sub> - Oxyflurofen @ 0.1 to 0.125 kg a.i./ha as pre emergence, T<sub>6</sub> - Paraquate @ 0.4 to 1 kg a.i./ha as post emergence, T<sub>7</sub> - Pendimethalin @ 0.75 to 1.25 a.i./ha as pre emergence, T<sub>8</sub> -Fluchloraline @ 1.25 to 1.75 kg a.i./ha as PPI.

Soil samples were collected from experimental field before sowing, 30 days after

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sowing (DAS), 60 DAS and 90 DAS, respectively for analysis of microbial population. Microbial population was counted by serial dilution and pour plate method. For this purpose, specific medium was used for specific microorganism *i.e.* for bacteria- Nutrient agar, for fungi - PDA, for Actinomycetes -Kenknight medium.

## RESULTS AND DISCUSSION

The results obtained from the present investigation are presented below :

### *Bacterial population in soil:*

The results (Table 1) revealed that application of various weedicides in soybean affected the bacterial population in soil. Bacterial population of weedy check plot increased from  $14.10 \times 10^4$  to  $14.67 \times 10^4$ . While in hand weeded plot it showed significant increase from  $13.96 \times 10^4$  to  $14.86 \times 10^4$ . All the plots treated with weedicide showed decrease in bacterial population.

Results indicated that weedicides have depressing effects on bacterial population. But it regained its lost population up to the harvesting of crop (Mukhopadhaya, 1980, Ponnuswamy *et al.*, 1997).

### *Fungal population in soil:*

The result (Table 2) revealed that fungal population in weedy check increased from  $16.25 \times 10^4$  to  $20.03 \times 10^4$  per gram of soil. Results indicated that Persuite and Glyphosate showed small increase in fungal population *i.e.* from  $15.44 \times 10^4$  to  $16.81 \times 10^4$  and  $12.10 \times 10^4$  to  $14.11 \times 10^4$  per gram of soil, respectively. Oxyflurofen, Paraquate, Pendimethalin and Fluchloraline showed decrease in fungal population from  $17.88 \times 10^4$  to  $14.96 \times 10^4$  per gram of soil. All the plots treated with weedicides gave depressing fungal population in first few days of application and regained its population after long period. Similar observations were recorded by Ponnuswamy *et al.* (1997), Mukhopadhyay (1980), and Anonymous (1971).

**Table 1 : Bacterial population in soil as influenced by various treatments in soybean**

Treatment	Bacterial population in soil (CFU at $10^4$ /g of soil)				
	0 DAS	30 DAS	60 DAS	90 DAS	At harvest
T <sub>1</sub> : Weedy check	14.10 (3.81)	14.36 (3.78)	14.83 (3.77)	15.00 (3.87)	14.67 (3.83)
T <sub>2</sub> : Hand weeding	13.96 (3.80)	14.23 (3.87)	14.90 (3.95)	15.06 (3.88)	14.86 (3.85)
T <sub>3</sub> : Persuite (Post emergence)	13.60 (3.75)	9.52 (3.16)	9.82 (3.19)	10.10 (3.24)	11.66 (3.48)
T <sub>4</sub> : Glyphosate (Post emergence)	16.23 (4.08)	8.91 (3.06)	9.46 (3.14)	9.11 (3.09)	10.33 (3.29)
T <sub>5</sub> : Oxyflurofen (Pre emergence)	15.83 (4.04)	10.44 (3.27)	10.10 (3.25)	11.10 (3.39)	11.33 (3.43)
T <sub>6</sub> : Paraquate (Post emergence)	15.26(3.96)	12.20 (3.55)	11.74 (3.49)	11.73 (3.49)	10.66 (3.33)
T <sub>7</sub> : Pendimethaline (Pre emergence)	15.93 (4.04)	11.93 (3.52)	11.30 (3.43)	10.33 (3.29)	11.00 (3.39)
T <sub>8</sub> : Fluchloraline PPI	16.26 (4.09)	13.14 (3.69)	12.93 (3.61)	11.40 (3.44)	12.00 (3.53)
S.E. $\pm$	0.43 (0.05)	0.55 (0.03)	0.40 (0.06)	0.59 (0.05)	0.60 (0.06)
C.D. (P=0.05)	1.31 (0.16)	1.67 (0.11)	1.23 (0.18)	1.81 (0.15)	1.82 (0.20)

Note : Figures in parentheses indicate square root transformed values

**Table 2 : Fungal population in soil as influenced by various treatments in soybean**

Treatment	Fungal population in soil (CFU at $10^4$ /g of soil)				
	0 DAS	30 DAS	60 DAS	90 DAS	At harvest
T <sub>1</sub> : Weedy check	16.75 (4.19)	18.00 (4.29)	17.70 (4.25)	14.33 (4.31)	20.03 (4.52)
T <sub>2</sub> : Hand weeding	13.33 (4.32)	14.33 (3.84)	18.00 (4.29)	16.48 (4.44)	21.86 (4.72)
T <sub>3</sub> : Persuite (Post emergence)	15.44 (3.97)	15.14 (3.95)	15.44 (3.98)	15.76 (3.97)	16.81 (4.15)
T <sub>4</sub> : Glyphosate (Post emergence)	12.10 (3.49)	13.00 (3.67)	13.20 (3.69)	15.33 (3.68)	14.11 (3.82)
T <sub>5</sub> : Oxyflurofen (Pre emergence)	17.88 (4.28)	16.55 (4.12)	16.48 (4.11)	16.40 (4.05)	14.96 (3.66)
T <sub>6</sub> : Paraquate (Post emergence)	17.55 (3.98)	16.64 (4.13)	16.14 (4.07)	16.00 (3.94)	15.21 (3.97)
T <sub>7</sub> : Pendimethaline (Pre emergence)	17.03 (4.17)	16.73 (4.14)	16.53 (4.12)	16.40 (4.05)	15.21 (3.95)
T <sub>8</sub> : Fluchloraline PPI	15.44 (4.56)	14.10 (3.81)	14.03 (3.80)	15.96 (3.81)	15.88 (4.04)
S.E. $\pm$	1.40 (0.41)	0.78 (0.09)	0.76 (0.09)	1.08 (0.08)	0.40 (0.09)
C.D. (P=0.05)	N.S.	2.38 (0.29)	2.32 (0.28)	3.28 (0.26)	1.23 (0.29)

Note : Figures in parentheses indicate square root transformed values

**Table 3 : Actinomycetes population in soil as influenced by various treatments in soybean**

Treatment	Actinomycetes population in soil (CFU at 10 <sup>4</sup> /g of soil)				
	0 DAS	30 DAS	60 DAS	90 DAS	At harvest
T <sub>1</sub> : Weedy check	4.33 (2.17)	4.36 (2.18)	4.50 (2.22)	4.86 (2.30)	4.86 (2.30)
T <sub>2</sub> : Hand weeding	3.66 (2.03)	4.03 (2.12)	5.13 (2.37)	5.03 (2.28)	4.63 (2.26)
T <sub>3</sub> : Pursuete (Post emergence)	4.26 (2.17)	4.43 (2.22)	4.53 (2.24)	4.60 (2.25)	5.10 (2.36)
T <sub>4</sub> : Glyphosate (Post emergence)	4.96 (2.32)	4.53 (2.24)	4.70 (2.29)	4.86 (2.31)	4.40 (2.21)
T <sub>5</sub> : Oxyflurofen (Pre emergence)	4.96 (2.32)	5.00 (2.33)	4.93 (2.32)	5.03 (2.34)	4.66 (2.27)
T <sub>6</sub> : Paraquate (Post emergence)	4.96 (2.31)	5.00 (2.33)	4.80 (2.30)	4.80 (2.30)	4.47 (2.22)
T <sub>7</sub> : Pendimethaline (Pre emergence)	3.96 (2.11)	4.26 (2.17)	4.53 (2.23)	4.66 (2.26)	4.66 (2.26)
T <sub>8</sub> : Fluchloraline PPI	4.23 (2.17)	4.50 (2.23)	4.96 (2.33)	4.96 (2.33)	4.86 (2.33)
S.E. ±	0.49 (0.11)	0.40 (0.09)	0.27 (0.05)	0.26 (0.05)	0.25 (0.05)
C.D. (P=0.05)	N.S.	N.S.	N.S.	N.S.	N.S.

Note : Figures in parentheses indicate square root transformed values

### ***Actinomycetes population in soil:***

Results indicated non-significant difference in actinomycetes population. The increase in actinomycetes population was noted in hand weeded and weedy check plots but was found to be very minute change. Results also indicated that some herbicides like Oxyflurofen, Glyphosate, Paraquate stimulated actinomycetes population, but generally it was found that weedicides exerted neither adverse nor favourable effect on actinomycetes population (Mukhopadhyay, 1980; Pathak *et al.*, 1988; Ponnuswamy *et al.*, 1997; Deshmukh and Shrikhande, 1974 and Anonymous, 1971).

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