



Effects of different tillage systems and herbicide on soil microflora of *Lablab* bean rhizosphere

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ABSTRACT

A long term field study was conducted at the Agronomy Farm, Department of Agronomy, Dr. B.S. KKV, Dapoli (Maharashtra) in *Rabi* season *lablab* bean crop to evaluate the effect of different tillage systems *vis-à-vis* different weed control measures on the survival and growth of total bacteria, total fungi, total free living nitrogen fixers and total phosphate solubilizers in rhizosphere soil. Four types of tillage systems were evaluated, *viz.* (i) Conventional-conventional (ii) Conventional-zero (iii) Zero-conventional and (iv) Zero-zero tillage systems. Among weed control measures, comparative effects of hand weeding and recommended herbicides application (oxadiargyl as pre-emergence) were tested along with weedy check. The results of the investigation revealed that tillage systems did not significantly influence microbial population. The marginal growth of different microorganisms was observed in conventional-conventional tillage system, whereas minimum was in zero-tillage system. There were no adverse effects of herbicide use on all the estimated microbial population at all the stages of the crop. In short use of recommended herbicide oxadiargyl at 0.12 kg/ha had no long term adverse effects on rhizosphere microflora of *lablab* bean crop.

Key words: Bacteria, Free living nitrogen fixers, Fungi, Herbicide, *Lablab* bean, Phosphate solubilizers, Tillage

The adoption of intensive cropping systems has resulted in a large-scale use of agro chemicals. Weeds as one of the groups of pest are the major biological constraints for many crop and cropping system. The lack of suitable ecofriendly weed control alternatives has led to increase in reliance on herbicides in many crops all over the world as they are less expensive, convenient than manual labour and very effective and easy to use. Generally herbicides are not harmful when applied at recommended rates (Selvamani and Sankaran 1993) but some herbicides may affect non-target organisms including microorganisms (Latha and Gopal 2010) such as bacterial population (Rajendran and Lourduraj 1999) and fungal population (Shukla 1997). These effects on non-target organisms may reduce the performance of important and critical soil functions such as organic matter decomposition, nitrogen fixation and phosphate solubilization which support the soil health, plant growth and in turn crop productivity. Nonetheless, some herbicide may even stimulate the growth and activities of the microflora (Wardle and Parkinson 1990). Most of the studies were focused on effects of single application of herbicides on soil microorganisms for a short period, which may not provide a realistic evaluation of such effects (Haney *et al.* 2000). Therefore, knowledge about effects of long term application of herbicides on soil microbes is highly essential. Hence, present investigation to

study the long term effects of different tillage systems and application of weedicide such as oxadiargyl treatment for *Rabi Lablab* bean cropping system was carried out to find out the effects on survival and growth of total bacterial population, total fungal population, total free living nitrogen fixers and total phosphate solubilisers in the rhizosphere soil. The present paper deals with study related to rhizosphere soil of *Rabi Lablab* bean crop.

MATERIALS AND METHODS

The field experiment was conducted under AICRP on Weed Control for eight years during 2003 to 2011 at the Agronomy Farm, College of Agriculture, Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli, Maharashtra, India.

The experiment was conducted on *Kharif* rice (*Ratnagiri-1*) and *Rabi Lablab* bean (*Kelshi-Wal*) cropping system which included eight treatment combinations laid out in a split plot design with three replications. The main plot treatments included tillage system, *viz.* zero-zero tillage (Z-Z tillage), zero-conventional tillage (Z-C tillage), conventional-zero tillage (C-Z tillage), conventional-conventional tillage (C-C tillage) while the sub-plot treatments included weed control measures such as hand weeding at 20 and 40 DAS, oxadiargyl at 0.12 kg/ha (pre-emergence), weedy check.

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Rhizosphere soils were collected at 30, 50 days after sowing (DAS) and at harvesting stage of *Rabi Lablab* bean by uprooting four plants from each plot and keeping the soil around root system intact. After removing the bits of plant roots and other debris, the soil strongly adhered to the roots was immediately used without drying for determination of biological property of rhizosphere soil. The total bacterial population, total fungal population, free living nitrogen fixers and total phosphate solubilizers of rhizosphere soil were determined.

Enumeration of microorganisms

The colony forming units (CFU) of bacteria were enumerated on agar plates containing appropriate media following serial dilution technique and pour plate method. The media used were nutrient agar media for total bacterial population, Martin's rose Bengal agar media for total fungal population (Martins 1950), Noories N-free media for total free living nitrogen fixers (Noories 1959) and Pikovskaya's agar medium for total phosphate solubilizing microorganisms (Pikovskaya 1948).

RESULTS AND DISCUSSION

Effect of tillage system

The data regarding treatment effects on total population of bacteria, fungi, free living nitrogen fixers and phosphate solubilizers in the rhizosphere soil of *Rabi Lablab* observed at different growth stages of crop during *Rabi* hot weather season of 2011-12 are presented in (Table 1). Data revealed that various tillage system under the study did not significantly influ-

ence the total bacterial population, total fungal population, total free living nitrogen fixers and also total phosphate solubilizers at 30 DAS, 50 DAS and harvesting stage of *Lablab* bean crop during the *Rabi* season.

Effect of weed control measures

The total population of bacteria, fungi, free living nitrogen fixers and phosphate solubilizers due to use of pre-emergence application of herbicide oxadiargyl was at par with weedy check treatment at 30, 50 DAS and at harvesting stage which indicate indirect stimulation of microbial population in the rhizosphere due to the former treatment at all the stages. Such a stimulation in microbial population showed that major part of the microflora could tolerate the herbicide and possibly utilize the herbicide as a nutrient source, as reported by Wardle and Parkinson (1990). Lata and Gopal (2010) also reported that adverse effect of herbicide towards bacteria, fungi and phosphate solubilizing bacteria decreases due to microbial adaptation to these chemicals or due to their degradation. It can also be due to the microbial multiplication on increased supply of nutrients available in the form of microorganism killed by the herbicides. This shows that herbicide oxadiargyl have no adverse effect on the estimated microflora of the soil.

The estimated microbial population such as bacterial free living nitrogen fixers and phosphate solubilizers in the rhizosphere of *Rabi Lablab* bean was significantly superior due to the treatment of hand weeding treatment twice at 20 and 40 DAS as compared to the application of herbicide oxadiargyl at 0.12kg/ha. These results are in conformity with those

Table 1. Effects of tillage systems and weed control measures on total population of bacteria, fungi, freelifving nitrogen fixers and phosphate solubilizers during *Rabi* season 2011 in *Lablab* bean

Treatment	Bacteria (CFU x10 ⁶ /g of soil)			Fungi (CFU x10 ⁴ /g of soil)			Free living nitrogen fixers (CFU x10 ³ /g of soil)			Phosphate solubilisers (CFU x10 ³ /g of soil)		
	30 DAS	50 DAS	At harvest	30 DAS	50 DAS	At harvest	30 DAS	50 DAS	At harvest	30 DAS	50 DAS	At harvest
<i>Tillage system</i>												
Z-Z	39.6	42.4	43.1	19.5	21.8	24.8	24.2	26.4	29.8	22.4	24.6	26.9
Z-C	40.2	42.1	46.2	21.5	25.7	27.1	25.4	26.8	30.9	22.7	25.8	28.2
C-Z	40.7	43.3	46.6	22.3	25.6	30.3	25.8	28.0	31.3	24.4	27.1	29.1
C-C	41.2	43.6	47.2	26.3	28.7	32.0	26.2	29.3	32.0	25.0	27.6	30.2
LSD (P= 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
<i>Weed control measure</i>												
HW at 20 and 40 DAS	43.4	45.9	48.9	23.8	28.5	30.5	27.9	31.2	33.7	26.1	28.5	31.1
Oxadiargyl at 0.12 kg/ha (PE)	37.9	41.0	42.8	20.7	22.4	26.6	22.9	24.3	28.8	21.2	24.1	27.1
Weedy check	39.9	41.7	45.7	22.7	25.4	28.6	25.3	27.5	30.5	23.5	26.1	27.6
LSD (P= 0.05)	2.97	3.58	3.16	NS	NS	NS	3.12	3.68	3.13	2.46	3.35	2.56
<i>Interaction effect</i>												
LSD (P= 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

of Singh and Tarafdar (2002) who reported that manual weeding helps to build up the microbial population. While Bhale *et al* (2012) reported that hand weeding allows pulverization of soil and better soil aeration which ultimately increase the microbial population in the soil.

On the basis of results of the present long term investigation for about eight years, it is concluded that various tillage system under study had no remarkable effects on microbiological properties of rhizosphere soil of *Rabi Lablab* bean crop and the use of oxadiargyl as a pre-emergence application at 0.12 kg/ha did not cause any long term adverse effect on rhizosphere microflora of *Lablab* bean crop at the given recommended dose even after its continuous application for eight years.

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