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Effect of tillage and weed management practices on soil microbial population in chickpea

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Abstract
A field experiment was conducted during rabi season of 2013-14 and 2014-15 at the research farm Jawaharlal Krishi Vishwa Vidyayala, Jabalpur M.P. to studied of tillage and weed management practices on soil microbial population in chickpea. The result revealed this was no any significant changes in soil bacteria, fungi and actionomycetes in the post harvest soil due to applied tillage practices and herbicides like pendimethalin, imazethapyr and oxyfluorfen as well as due to treatment intractions. However, bacteria were found higher under zero and reduced tillage and under pendimethalin and dual herbicides application. Fungi were found higher under conventional tillage and dual herbicides application. Similarly actinomycetes were found higher under zero and reduced and conventional tillalge and under pendimethalin and dual herbicide application.

Keywords: weed management, soil microbial, chickpea

Introduction
Chickpea is the most important *rabi* pulse crop of India. In the World, it occupies an area of 13.54 million hectares with an annual production of 13.31 million metric tons and the average productivity of 971 kg ha-1, whereas in India, it occupies an area of 8.52 million hectares with an annual production of 8.83 million metric tons and the average productivity of 1036 kg ha-1. In Madhya Pradesh, it is cultivated in 3.31 million hectares of land with an annual production of 3.81 million metric tons and productivity of 1219 kg ha-1, whereas in Jabalpur district, it is cultivated in 0.61 million hectares of land with an annual production of 0.84 million metric tons and productivity of 1376 kg ha-1. Gram seeds, leaves and straw are used in many ways *viz.*, as dal, besan, crushed or whole grain, sweet making, green leaves and grain as vegetables. Its seeds are considered to have medicinal effects and are used for blood purification. The seed contains 21 % protein, 61.5 % carbohydrates, and 4.5 % fat and also rich in calcium, iron and niacin. Germinated seeds are recommended to cure scurvy. Soaked seeds and husk are fed to horses and cattle as concentrate and rough ages, respectively. Malic and oxalic acids collected from green leaves are prescribed for intentional disorders. Straw forms an excellent fodder for cattle. Out of the several factors responsible for higher productivity of chickpea tillage practice and weed management are more crucial and assumes great importance for successful cultivation of chickpea. Tillage practice plays a vital role in increasing the crop production. It has recently emerged as the most potential resource conservation technology in Indo-Gangetic plains of North West India under rice-wheat cropping system. Raised bed planting of cereals, pulses and vegetable, on average increased yield by 24.2%. Several workers have reported the positive response of seed yield of chickpea to tillage practices. Chickpea seed yield can be increased by providing suitable tillage practices. Weeds are a serious constraint in increasing production and easy harvesting in chickpea. Chickpea is a poor competitor to weeds because of slow growth rate and limited leaf area development at early stage of crop growth and establishment. Keeping the above facts in view, the present investigation was undertaken with the object to find out effect of tillage and weed management practices on soil microbial population in chickpea.

Material and Methods
The field experiment was conducted at the Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during *rabi* seasons of 2013-14 and 2014-15 to study the tillage and weed management methods on growth, productivity and energy analysis of chickpea. The experiment was laid out in split-plot design with three replications. Main plot treatment consisted of five tillage practices *viz.*, T1- Zero tillage, T2- Reduced tillage, T3- Conventional tillage, T4-Broadcasting and T5-Bed planting. There were four sub-plot treatments of weed management *viz.*, W1-Pendimethalin PE @ 1 kgai./ha, W2-Pendimethalin + Imazethapyr

(Vellor) @ 1 kg ai./ha PE, W3-Oxyfluorfen @ 100 gai./ha PE, and W4-Unweeded check. Chickpea var. JG14 was shown on 15 December in both the years in rows 30 cm. apart keeping a seed rate of 80 Kg./ha.

Isolation procedures

Serial dilution technique was used to isolate soil bacteria, soil fungi, and actinomycetes. Isolation was done using pour plate method. Rose Bengal was used for isolation of sil fungi. Actinomycetes were isolated by using glucose asparagine agar media. Incubation for bacteria was at 27-30 C for 24-48hr. for actinomycetes, and fungi was at 27-30 C for 3-5 days. To assess the effect of herbicides on nitrogen fixing bacteria three malure plants were collected and washed in running water and number of nodules per plant was counted. The average number of colony forming units per gram of soil of bacteria, fungi and actinomycetes of three replicates were recorded using colony sounter and the average number of nodules per plant of three replicates per plot were obtained. Effect on microbial population bacteria, fungi and ectinomycetes, no of nodules & growth of crop were workout.

Results and Discussion

It would be observed from the data that different among the treatments for bacterial fungal and actinomycetes microbial property of post harvest soil

Bacterial population

The data reveal that the bacterial population was found to deviate non- significantly due to tillage practices and herbicidal treatments in both the years. The treatment interactions were also found to be non- significant. Zero and Reduced tillage recorded maximum bacterial population in soil (43.36 to 43.63 cfu x 10^6/g) and then broadcasting (42.61 cfu x 10^6/g). Bed planting and conventional tillage recorodoed the lowest population (40.17 to 40.53 cfu x 10^6/g).In case of herbicidal treatments, pendimethalin application recorded maximum population of bacteria in soil (43.45 cfu x 10^6/g), followed by dual herbicides (42.62 cfu x 10^6/g) and then oxyfluorfen (41.85 cfu x 10^6/g). The control treatment recorded the lowest population of becteria in soil (40.31 cfu x 10^6/g).

Fungi population

The data reveal that the fungi population was found to deviate non- significantly due to tillage practices and herbicidal treatments in both the years. The treatment interactions were also found to be non- significant. Conventional tillage maximum fungi population (5.02 cfu x 10^6/g) followed by (pendimethalin and then oxyfluorfen 4.87 to 4.90 cfu x 10^6/g). The control treatment recorded the losest population (4.47 cfu x 10^3/g). As regards with the treatment interactions although non- significant, each of the tillage practices with dual herbicides resulted in fungi population in the maximum range (5.13 to 5.68 cfu x 10^3/g). On the other hand, the fungi population in the lowoer range (4.36 to 4.57 cfu x 10^3/g) was observed in each of the tillage practices without herbicides.

Actinomycetes population

The data reveal that the actionomy was found to deviate non-significantly due to tillage practices and herbicidal treatments in both the years. The treatment interactions were also found to non- significant. Zero tillage recorded maximum actinomycets population (41/75 cfu x 10^3/g). followed by reduced tillage and then conventional tillage. Broadcasting and bed planting recorded population in the lower ragne (40.32 to 40.58 cfu x 10^3/g). In case of herbicidal treatments, pendimethalin + imazethapyr recorded maximum population (42.76 cfu x 10^3/g). Followed by pendimethalin and then oxyfluorfen. The control treatment recorded the lowest actinomycetes population (39.80 cfu x 10^3/g).

There was no any significant changes in soil bacteria fungi and actionomycetes in the post harvest soil due to applied tillage practices and herbicides like pendimethalin, imazethapyr and oxyfluorfen as well as due to treatment interactions. However, bacteria were found higher under zero and reduced tillage and under pendimethalin and dual herbicides application. Fungi were found higher under conventional tillage and dual herbicides application. Similarly actinomycetes were found higher under zero and reduced and conventional tillage and under pendimethalin and dual herbicide application.

The enzyme activity in th erhizosphere soil was directly related with microbial population. In the present investigation, zero tillage and reduced recorded non-significantly higher bacteria at post harvest stage of crop growth as compared to conventional tillage and was on par with minimum tillage. This was due to less soil ldisturbance, mulching, root exudates from plants, availability of soil moisture and nutrients encouraged higher population of bacteria fungi and actinomycets. Decomposition of added material which increased organic carbon content and improved aggregate stability due to higher microbial multiplication. Besides, root exudates and mulching material acts as sources of organic carbon to microorganisms which results in higher microbial population. These findings are in accordance with those of Deng and Tabatabai (1997) and Roldan *et al*. (2005). Whereas, weed management practices showed through herbicides less difference with respect to microbial population in post harvest soil. However, zero tillage with application of dual herbicides resulted in higher microbial population as compared to the rest of the treatment combinations.

Application of herbicides showed higher microbial population in post harvest soil as compared to unweeded check. This may be due to higher soil moisture content, lower weed density and increased microbial activity in root zone of crop. However, zero tillage with application of herbicides combined practice recorded higher microbial population as compared to the rest of the treatment combinations.

Microbiological properties of post harvest soil as influenced by tillage practices and herbicides

Treatments	Bacteria (cfu x 10^6/g)			Fungi (cfu x 10^6/g)			Actinomycetes (cfu x 10^6/g)		
	2013-14	2014-15	Mean	2013-14	2014-15	Mean	2013-14	2014-15	Mean
Tillage practices									
Zero	45.20	42.06	43.63	4.84	4.89	4.86	41.72	41.77	41.75
Reduced	44.06	42.66	43.36	4.92	4.95	4.94	41.51	41.53	41.52
Conventional	38.92	42.14	40.53	5.00	5.04	5.02	42.03	41.25	41.64
Broadcasting	42.96	42.26	42.61	4.96	4.99	4.97	40.30	40.33	40.32
Bed planting	39.34	41.00	40.17	4.92	4.95	4.93	40.56	40.60	40.58

C D (P= 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Herbicides									
Pendimethalin	42.84	44.07	43.45	4.88	4.91	4.90	41.25	41.27	41.26
Pendi+ imaze	42.71	42.54	42.62	5.53	5.56	5.55	42.75	42.79	42.76
Oxyfluorfen	42.10	41.60	41.85	4.85	4.89	4.87	40.79	40.84	40.81
Control	40.74	39.88	40.31	4.45	4.48	4.47	40.12	39.49	39.80
CD (P= 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS
Initial	41	40	40.5	4	4.5	4.25	40	40	40

Conclusions

The result revealed this was no any significant changes in soil bacteria, fungi and actionomycetes in the post harvest soil due to applied tillage practices and herbicides like pendimethalin, imazethapyr and oxyfluorfen as well as due to treatment intractions. However, bacteria were found higher under zero and reduced tillage and under pendimethalin and dual herbicides application. Fungi were found higher under conventional tillage and dual herbicides application. Similarly actinomycetes were found higher under zero and reduced and conventional tillage and under pendimethalin and dual herbicide application.

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