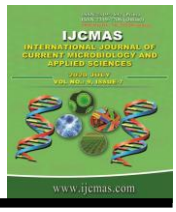
Int.J.Curr.Microbiol.App.Sci (2020) *9*(7): 3611-3619

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 9 Number 7 (2020)**
Journal homepage: http://www.ijcmas.com



Original Research Article https://doi.org/10.20546/ijcmas.2020.907.421

Activity of Soil Enzyme and Microorganisms in Rhizosphere Soil of Maize (*Zea mays* L.) as Influenced by Different Weed Management Practices

Arunkumar*, R. B. Negalur, A. S. Halepyati, G. S. Yadahalli and M. N. Nagaraj

Department of Agronomy, University of Agricultural Sciences, Raichur, College of Agriculture, Raichur – 584 104, India

**Corresponding author*

Keywords

Maize, Atrazine, Tembotrione, Topramezone, Dehydogenase, Phosphatase and Halosulfuron

Article Info

Accepted:
22 June 2020
Available Online:
10 July 2020

A B S T R A C T

A field experiment was conducted during *kharif,* 2017 at the Main Agricultural Research Station, agriculture college farm, Raichur to study the "Activity of soil enzyme and microorganisms in rhizosphere soil of maize (*Zea mays* L.) as influenced by different weed management practices". The experiment was laid out in Randomized Complete Block Design with three replications and twelve treatments. It was evident that before sowing, the soil enzyme activity was on par in all the treatments. At flowering and at harvest, dehydogenase and phosphatase activity in soil differed significantly by different weed management practices. Hand weeding twice and weedy check recorded higher dehydrogenase and phosphatase activity of (28.32, 19.85 µg TPF g^{-1} soil day^{-1} and 32.94, 19.05 µg PNP g^{-1} soil $hour^{-1}$, respectively) and (28.00, 19.45 µg TPF g^{-1} soil day^{-1} and 32.60, 18.34 µg PNP g^{-1} soil $hour^{-1}$, respectively) and were significantly superior over rest of the treatments. Whereas, within herbicidal treatments sequential application of atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb tembotrione 34.4 % SC @ 125 g a.i. ha^{-1} (POE) at 30 DAS recorded significantly higher dehydrogenase and phosphatase activity (27.64, 19.15 µg TPF g^{-1} soil day^{-1} and 32.25, 18.14 µg PNP g^{-1} soil $hour^{-1}$, respectively) in soil and it was found to be on par with application of atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb topramezone 33.6 % SC @ 75 g a.i. ha^{-1} (POE) at 30 DAS and atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb halosulfuron 75 % WDG @ 90 g a.i. ha^{-1} (POE) at 30 DAS. Similar, was the trend with respect to N_2 fixers, Phosphate solubilising microorganisms (PSM) and total bacterial population recorded.

Introduction

Among the cereals grown in India, maize is gaining significant importance on account of its growing demand for diversified uses, especially as animal feed and industrial raw material. Maize crop has multiple uses. The kernel contains about 77 per cent starch, two per cent sugar, nine per cent protein, two per cent ash on water free basis. Maize oil has higher poly unsaturated fatty acid content and low in linoleic acid (0.7%) and contains high level of natural flavor.

Maize crop is grown in warm weather condition and it is grown in wide range of

climatic conditions. About 85 per cent of the total acreage under maize is grown during monsoon, because in *kharif*, the optimum temperature for maize growth is prevalent and the crop stops growing if the night temperature falls below 15.6º C or 60º F. High temperature more than 40 ºC particularly at anthesis is also not favourable for maize. In India, maize is grown in all the seasons *i.e*., *kharif, rabi* and *summer*. Of these three seasons, nearly 90 per cent of the production is from *kharif* season, 7-8 per cent during *rabi* season and remaining 1-2 per cent during summer season. Maize is a dual-purpose crop. The grain is used both for human and livestock consumption and stover is solely fed to the livestock. In India, its current consumption is as poultry-pig-fish feed (52%), human diet (24%), cattle feed (11%) and seed and brewery industry (1%) (Yakadri *et al.,* 2015). It has high nutritive value as it contains about 7.7-14.6% protein, crude fibre (0.8-2.32%), carbohydrates (69.7-74.5%), fats (3.2- 7.7%) and ash (0.7-1.3%). About 50-55% of total maize production is used as food in developing countries (Anjum *et al.,* 2014).

Use of pre-emergent and post-emergent herbicides would make the herbicidal weed control more acceptable to farmers, which will not change the existing agronomic practices, but will allow for complete control of weeds. Usage of pre-emergence herbicides assumes greater importance in the view of their effectiveness from initial stages and post emergence herbicides at about 40-45 DAS may help in avoiding the problem of weeds at later stages. The farmers are seldom using pre-emergent herbicides. Even though the farmers used pre-emergent herbicides, in many instances early weed control may not be sufficient because the weed flourishes even after critical period of crop-weed competition and many times, it is difficult to control these weeds by cultural operations due to incessant rains. Further, they interfere in harvesting operations. Therefore, there is a need to apply post emergence (20–25 days after sowing) herbicides for effective control of weeds. Hence, the study was undertaken to know the effect of different weed management practices on dynamics of soil microorganisms and soil enzyme activity.

Materials and Methods

Field experiment was carried out at New Farm, AICRP on Weed Management, Main Agricultural Research Station, College of Agriculture, University of Agricultural Sciences, Raichur,during *kharif, 2*017. The soil type of experimental plot was vertisols (medium deep blacksoil) whicht was medium in available nitrogen (298.65 kg/ha), available phosphorus (24.50 kg/ha) and available potassium (225.72 kg/ha) and having a pH of 8.21. The experiment was laid out in a Randomized Complete Block Design with 12 treatments. Hybrid NK-6240 of maize was sown with recommended spacing of 60 x 20 cm. The dehydrogenase activity in the soil samples was determined by following the procedure as described by Casida *et al.,* (1964). Ten gram of soil and 0.2 g $CaCO_3$ were thoroughly mixed and dispensed in the conical flasks. Each flask was added with 1.0 ml of 1.5 per cent, 2, 3, 5-triphenyl tetrazolium chloride (TTC), 1.0 ml of one per cent glucose solution and eight ml of distilled water to leave a thin film of water above soil layer. The flasks were stoppered with rubber bunks and incubated at 30^0C for 24 hours. At the end of incubation, the contents of the flask were rinsed down into small beaker and slurry was made by adding 10 ml of methanol. The slurry was filtered through Whatman No. 42 filter paper. Repeated rinsing of soil with methanol was continued till the filtrate ran free of red colour. The filtrate was made up to 50 ml with methanol in volumetric flask. The intensity of red colour was measured at 485

nm against a methanol blank using spectrometer. The results were expressed as μg of TPF formed per g of soil per day.

Phosphatase activity of soil samples was determined by following the procedure of Evazi and Tabatabai (1979). One gram of soil sample was placed in a 50 ml Erlenmeyer flask to which 0.2 ml toluene followed by 4 ml of modified universal buffer (pH 7.5) was added. One ml of P-nitrophenol phosphate solution made in modified universal buffer was added to the flasks and contents of the flasks were mixed by swirling for two minutes. The flasks were stoppered and incubated at 37°C for one hour. After incubation, one ml of 0.5 M $CaCl_2$ and four ml of 0.5 M NaOH were added to the flask, swirled and filtered through Whatman No. 42 filter paper.

The intensity of yellow colour developed was measured at 420 nm against the reagent blank using Graphicord Shimadzu UV-visible Spectrophotometer (Model UV-240).Controls were maintained for each soil sample and were analyzed by following the same procedure described above except that the paranitro phenol phosphate solution was added after the addition of 0.5 M $CaCl_2$ and 0.5 M NaOH and just before filtration. The phosphatase activity in the soil samples was expressed as g paranitrophenol formed per gram soil per hour. Enumeration of N_2 fixer From the collected soil samples, one g was taken and serially diluted using sterile distilled water up to 10^{-4} dilutions. One ml of diluted sample from 10^{-4} dilutions was taken, and 0.1ml of aliquot was inoculated in petriplates containing sterilized N free bromothymol blue medium under aseptic conditions. The petriplates were be incubated at 30ºC for a period of one week and petriplates that show growth (white, translucent, undulating, subsurface pellicles) of N_2 fixers will be selected for isolation and all the samples were serially diluted by fifth fold series and analysed for the N_2 fixers by Most probable number (MPN method) using N free bromothymol blue media.

The phosphate solubilizing microorganisms (PSM) was been isolated by dilution plating technique on Pikovskaya's agar medium (Pikovskaya's, 1948) containing tricalcium phosphate (TCP). The plates were be incubated at 28 ± 2 ºC for two to seven days. Phosphate solubilizers produce clear hallo zones around the microbial colonies on media supplemented with insoluble mineral phosphates such as tricalcium phosphate or hydroxyapatite. Further, the Enumeration of total bacteria was done by sieving each soil sample through the 1000 micromesh to remove the bigger particles and debris and was used for isolation of bacteria by serial dilution agar plate technique using nutrient agar medium. The 10^{-6} dilution of soil suspension was used for isolation. The plates were incubated for 24 h at 28 ºC. The colonies that appeared on nutrient agar media were enumerated and expressed in terms of cfu g^{-1} of soil on dry weight basis.

Results and Discussion

The major weeds noticed in the experimental field at all the stages of observation were *Cyperus rotundus* among sedges, *Alternanthera sessilis, Commelina benghalensis, Digera arvensis, Euphorbia hirta, Euphorbia geniculata, Phyllanthus fraternus, Parthenium hysterophorus* and *Portulaca oleracea* among broad leaf weeds, *Cynodon dactylon, Brachiaria eruciformis* and *Dinebra retroflexa* as grassy weeds. The data on the effect of different herbicides on soil dehydrogenase activity, Soil phosphatase activity, N_2 fixers, Phosphate solubilising microoraganisms (PSM) and total bacterial population were recorded.

Table.1 Dehydrogenase and phosphatase activity in soil as influenced by different weed management practices in maize

Treatment	Dehydrogenase (µg TPF g^{-1} soil day^{-1})			Phosphatase (µg PNP g^{-1} soil $hour^{-1}$)		
	Before sowing	At flowering stage	At harvest	Before sowing	At flowering stage	At harvest
T_1: 2,4-D sodium salt 80 % WP @ 2000 g a.i. ha^{-1} at 20 DAS	6.81	22.81	15.40	8.06	27.16	14.73
T_2: Atrazine 50 % WP @ 1000 g a.i. ha^{-1} at 20 DAS	7.04	22.04	14.70	8.17	26.54	14.20
T_3: Tembotrione 34.4 % SC @ 125 g a.i. ha^{-1} at 20 DAS	7.15	23.77	16.27	8.40	28.48	15.77
T_4: Halosulfuron 75 % WDG @ 90 g a.i. ha^{-1} at 20 DAS	6.68	23.15	15.65	7.93	27.52	15.15
T_5: Topramezone 33.6 % SC @ 75 g a.i. ha^{-1} at 20 DAS	6.82	23.21	15.71	8.07	27.71	15.21
T_6: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb 2,4-D 80 % WP @ 2000 g a.i. ha^{-1} (POE) at 30 DAS	6.92	25.66	17.39	8.10	30.06	16.84
T_7: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb Atrazine 50 % WP @ 1000 g a.i. ha^{-1} (POE) at 30 DAS	6.82	24.54	16.41	8.07	29.04	15.86
T_8: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb Tembotrione 34.4 % SC @ 125 g a.i. ha^{-1} (POE) at 30 DAS	7.05	27.64	19.15	8.17	32.25	18.14
T_9: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb Halosulfuron 75 % WDG @ 90 g a.i. ha^{-1} (POE) at 30 DAS	6.49	27.07	18.53	7.74	31.57	17.73
T_{10}: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb Topramezone 33.6 % SC 75 g a.i. ha^{-1} (POE) at 30 DAS	6.76	27.11	18.97	8.00	31.61	18.17
T_{11}: Hand weeding twice at 25 and 50 DAS	7.28	28.32	19.85	8.48	32.94	19.05
T_{12}: Weedy check	7.07	28.00	19.45	8.20	32.60	18.34
S.Em. ±	0.15	0.30	0.27	0.14	0.34	0.29
C.D. (P=0.05)	NS	0.89	0.79	0.42	1.01	0.84

PRE= pre-emergence POE = post emergence DAS= days after sowing fb= followed by
WP= Wetteble powder WDG= Water dispersible granule SC= Soluble concentrate

Table.2 N_2 fixers and Phosphate solubilising microorganisms (PSM) in rhizosphere soil as influenced by different weed management practices in maize

Treatment	N_2 fixers ($\times 10^4$ cfu g^{-1})			PSM population ($\times 10^4$ cfu g^{-1})		
	Before sowing	At flowering stage	At harvest	Before sowing	At flowering stage	At harvest
T_1: 2,4-D sodium salt 80 % WP @ 2000 g a.i. ha^{-1} at 20 DAS	13.50	21.16	17.46	12.40	29.05	20.55
T_2: Atrazine 50 % WP @ 1000 g a.i. ha^{-1} at 20 DAS	9.83	20.78	17.22	9.60	28.11	19.50
T_3: Tembotrione 34.4 % SC @ 125 g a.i. ha^{-1} at 20 DAS	12.83	24.40	20.84	11.73	37.26	26.32
T_4: Halosulfuron 75 % WDG @ 90 g a.i. ha^{-1} at 20 DAS	12.59	23.30	19.74	11.49	35.71	25.36
T_5: Topramezone 33.6 % SC @ 75 g a.i. ha^{-1} at 20 DAS	12.77	23.80	20.06	11.67	36.06	26.38
T_6: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb 2,4-D 80 % WP @ 2000 g a.i. ha^{-1} (POE) at 30 DAS	12.66	27.22	23.66	11.56	39.67	28.13
T_7: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb Atrazine 50 % WP @ 1000 g a.i. ha^{-1} (POE) at 30 DAS	10.50	26.16	22.60	9.40	38.06	27.97
T_8: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb Tembotrione 34.4 % SC @ 125 g a.i. ha^{-1} (POE) at 30 DAS	13.17	32.73	28.57	12.07	43.67	31.67
T_9: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb Halosulfuron 75 % WDG @ 90 g a.i. ha^{-1} (POE) at 30 DAS	13.67	31.28	27.72	12.33	41.97	29.95
T_{10}: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb Topramezone 33.6 % SC 75 g a.i. ha^{-1} (POE) at 30 DAS	12.53	32.33	28.31	11.43	42.11	30.41
T_{11}: Hand weeding twice at 25 and 50 DAS	12.81	35.70	31.78	11.71	44.37	33.17
T_{12}: Weedy check	10.17	34.00	29.20	9.82	43.10	32.67
S.Em. ±	0.94	0.54	0.65	0.73	0.59	0.72
C.D. (P=0.05)	NS	1.59	1.92	NS	1.73	2.12

PRE= pre-emergence POE = post emergence DAS= days after sowing fb= followed by

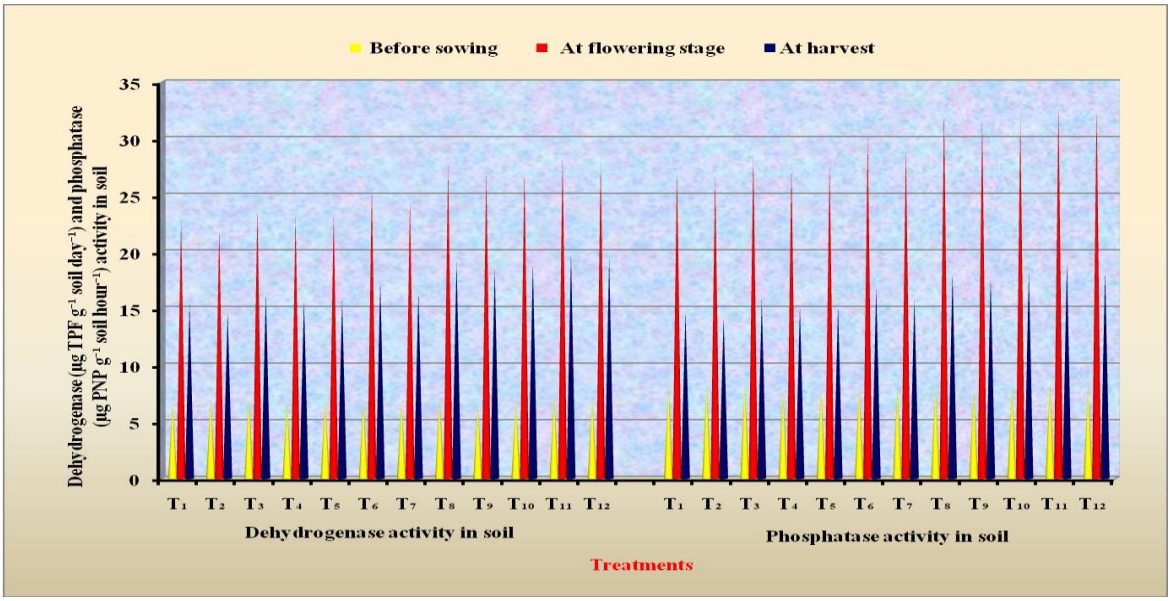
WP= Wetteble powder WDG= Water dispersible granule SC= Soluble concentrate

Table.3 Total bacterial population in soil as influenced by different weed management practice in maize

Treatment	Total bacterial population (× 10^6 cfu g^{-1})		
	Before sowing	At flowering stage	At harvest
T_1: 2,4-D sodium salt 80 % WP @ 2000 g a.i. ha^{-1} at 20 DAS	18.77	45.95	28.08
T_2: Atrazine 50 % WP @ 1000 g a.i. ha^{-1} at 20 DAS	15.48	44.92	27.66
T_3: Tembotrione 34.4 % SC @ 125 g a.i. ha^{-1} at 20 DAS	18.48	49.28	33.07
T_4: Halosulfuron 75 % WDG @ 90 g a.i. ha^{-1} at 20 DAS	18.24	47.78	32.11
T_5: Topramezone 33.6 % SC @ 75 g a.i. ha^{-1} at 20 DAS	18.27	48.31	33.13
T_6: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb 2,4-D 80 % WP @ 2000 g a.i. ha^{-1} (POE) at 30 DAS	18.31	55.93	35.26
T_7: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb Atrazine 50 % WP @ 1000 g a.i.ha^{-1} (POE) at 30 DAS	16.15	52.60	34.72
T_8: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb Tembotrione 34.4 % SC @ 125 g a.i. ha^{-1} (POE) at 30 DAS	18.82	59.59	39.00
T_9: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb Halosulfuron 75 % WDG @ 90 g a.i. ha^{-1} (POE) at 30 DAS	18.43	58.10	37.33
T_{10}: Atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb Topramezone 33.6 % SC 75 g a.i. ha^{-1} (POE) at 30 DAS	18.18	58.61	37.85
T_{11}: Hand weeding twice at 25 and 50 DAS	18.46	65.27	39.92
T_{12}: Weedy check	16.57	63.43	37.33
S.Em. ±	0.90	0.56	0.72
C.D. (P=0.05)	NS	1.64	2.12

PRE= pre-emergence POE = post emergence DAS= days after sowing fb= followed by
WP= Wetteble powder WDG= Water dispersible granule SC= Soluble concentrate

Fig.1 Dehydrogenase (µg TPF g^{-1} soil day^{-1}) and phosphatase (µg PNP g^{-1} soil $hour^{-1}$) activity in soil as influenced by different weed management practices in maize



Effect of different weed management practices on soil enzyme activity in maize

In the present study, at different growth stages of maize the enzyme activity in soil significantly influenced by different treatments due to the use of various herbicides (Table 1). Before sowing, the soil enzyme activity was on par with each other in all the treatments. At flowering and at harvest, dehydogenase and phosphatase activity in soil differed significantly by different weed management practices. Among the different treatments, hand weeding twice and weedy check recorded higher dehydrogenase and phosphatase activity of (28.32, 19.85 µg TPF g^{-1} soil day^{-1} and 32.94, 19.05 µg PNP g^{-1} soil $hour^{-1}$, respectively) and (28.00, 19.45 µg TPF g^{-1} soil day^{-1} and 32.60, 18.34 µg PNP g^{-1} soil $hour^{-1}$, respectively) and these treatments were significantly superior over rest of the treatments under study. Whereas, within the herbicide treatments, sequential application of atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb tembotrione 34.4 % SC @ 125 g a.i. ha^{-1} (POE) at 30 DAS recorded significantly higher dehydrogenase and phosphatase activity (27.64, 19.15 µg TPF g^{-1} soil day^{-1} and 32.25, 18.14 µg PNP g^{-1} soil $hour^{-1}$, respectively) in soil and was found to be on par with application of atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb topramezone 33.6 % SC @ 75 g a.i. ha^{-1} (POE) at 30 DAS (27.11, 18.97 µg TPF g^{-1} soil day^{-1} and 31.61, 18.17 µg PNP g^{-1} soil $hour^{-1}$, respectively) and atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb halosulfuron 75 % WDG @ 90 g a.i. ha^{-1} (POE) at 30 DAS (27.07, 18.53 µg TPF g^{-1} soil day^{-1} and 31.57, 17.73 µg PNP g^{-1} soil $hour^{-1}$, respectively). This might be due to the reduced harmful effect of these applied herbicides by microbial degradation at later stages of crop growth. Similar results were obtained by Shukla (1997) and Ankush *et al.*, (2017). Among single herbicides usage, post-emergence application of atrazine 50 % WP @ 1000 g a.i. ha^{-1} at 20 DAS (22.04, 14.70 µg TPF g^{-1} soil day^{-1} and 26.54, 14.20 µg PNP g^{-1} soil $hour^{-1}$, respectively) and 2,4-D sodium salt 80 % WP @ 2000 g a.i. ha^{-1} at 20 DAS (22.81, 15.40 µg TPF g^{-1} soil day^{-1} and 27.16,

14.73 µg PNP g^{-1} soil $hour^{-1}$, respectively) recorded significantly lowest dehydrogenase and phosphatase activity in soil as compared to rest of the treatments. The results are in conformity with Nirmalnath *et al.,* (2009), Sebiomo *et al.,* (2011), Nur Masirah *et al.,* (2013) and Parvathraddi (2017).

Effect of different weed management practices on microorganisms in rhizosphere soil of maize

Among the various weed management treatments, the N_2 fixers, PSM and total bacterial population in rhizosphere soil at flowering and at harvest stage differed significantly (Table 2 and 3). Before sowing, the soil microbial activity was on par with each other in all the treatments. At flowering stage, among the different treatments, hand weeding twice recorded significantly higher N_2 fixers, PSM and total bacterial population (35.70×10^4, 44.37×10^4 cfu g^{-1} and 65.27×10^6 cfu g^{-1}, respectively) in maize rhizosphere soil and was found to be on par with weedy check (34.00×10^4, 43.10×10^4 cfu g^{-1} and 63.43×10^6 cfu g^{-1}, respectively) as compared to rest of the treatments. Among the different weed management treatments, sequential application of atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb tembotrione 34.4 % SC @ 125 g a.i. ha^{-1} (POE) at 30 DAS recorded significantly higher N_2 fixers, PSM and total bacterial population (32.73×10^4, 43.67×10^4 cfu g^{-1} and 59.59×10^6 cfu g^{-1}, respectively) in maize rhizosphere soil and it was found to be on par with application of atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb topramezone 33.6 % SC @ 75 g a.i. ha^{-1} (POE) at 30 DAS (32.33×10^4, 42.11×10^4 cfu g^{-1} and 58.61×10^6 cfu g^{-1}, respectively) and atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb halosulfuron 75 % WDG @ 90 g a.i. ha^{-1} (POE) at 30 DAS (31.28×10^4, 41.97×10^4 cfu $g^{-1}$and 58.10×10^6 cfu g^{-1}, respectively). Significantly lowest N_2 fixers, PSM and total bacterial population in maize rhizosphere soil was recorded by post-emergence application of atrazine 50 % WP @ 1000 g a.i. ha^{-1} at 20 DAS (20.78×10^4, 28.11×10^4 cfu g^{-1} and 44.92×10^6 cfu g^{-1}, respectively) and 2,4-D sodium salt 80 % WP @ 2000 g a.i. ha^{-1} at 20 DAS (21.16×10^4, 29.05×10^4 cfu g^{-1} and 45.95×10^6 cfu g^{-1}, respectively) alone as compared to rest of the treatments. Similar was the trend with respect to N_2 fixers, PSM and total bacterial population in maize rhizosphere soil at harvest was noticed. It is clear that the effect of herbicides on soil microbes is only temporary. The adverse effects of herbicides, if at all were gradually reduced with passage of time and practically, there was no adverse effect of tembotrione, topramezone and halosulfuron herbicides on soil microbial activities in terms of N_2 fixers, PSM and bacterial population in maize rhizosphere soil both at flowering stage and at harvest of maize crop. Similar results were also revealed by Ayansina and Oso (2006).

It is concluded that among the herbicide treatments, application of atrazine 50 % WP @ 500 g a.i. ha^{-1} (PRE) at 0-3 DAS fb tembotrione 34.4 % SC @ 125 g a.i. ha^{-1} (POE) at 30 DAS was found to be most effective for controlling complex weeds and there was no adverse effect of tembotrione, topramezone and halosulfuron herbicides on soil enzyme activity of dehydrogenase and phosphatase and soil microbial activities in terms of N_2 fixers, PSM and bacterial population in maize rhizosphere soil both at flowering stage and at harvest of maize crop.

References

Anjum, S.A., Ehsanullah A. U., Tanveer, M., Qamar, R. and Khan, I., 2014, Morphological and phenological attributes of maize affected by different tillage practices and varied sowing

methods. *American J. Plant Sci.*, 5: 1657-1664.

Ankush, K., Rana, M. C., Neelam, S. and Rana, S. S., 2017, Effect of Post-Emergence Herbicide -Tembotrione on Yield, Soil Dehydrogenase Activity and Its Phytotoxicity on Maize (*Zea mays* L.) under Mid Hill Conditions of Himachal Pradesh, India. *Intl. J. Curr. Microbiol. App. Sci*., 6(8): 2297-2303.

Ayansina, A. D. V. and Oso, B. A., 2006, Effect of two commonly used herbicides on soil microflora at two different concentrations. *African J. Biotechnol*., 5 (2): 129-132.

Casida, L. E., Klein, D. A. and Santoro, T., 1964, Soil dehydrogenase activity. *Soil Sci*., 98: 371-376.

Nirmalnath, P. J., Patil, C. R., Agasimani, C. A. and Doddagoudar, C. K., 2009, Soil microbial activity as influenced by long term application of herbicides. *"Natn. Symp. Weed Threat to Environment, Biodiversity and Agriculture Productivity",* August 2-3, 2009, *Tamil Nadu Agric. Univ.,* Coimbatore: 129.

Nur Masirah, Z., Rosli, B. M., Kamaruzaman S., Mahbub, M and Yahya, A., 2013, Effects of selected herbicides on soil microbial populations in oil palm plantation of Malaysia: A microcosm experiment. *African J. Microbiol. Res.*, 7 (5): 367-374.

Parvathraddi, 2017, Evaluation of new post-emergence herbicides and their combinations in irrigated hybrid maize (*Zea mays* L.). *M. Sc. (Agri.) Thesis*, Univ. of Agric. Sci., Raichur, Karnataka (India).

Sebiomo, A., Ogundero, V. W. and Bankole, S. A., 2011, Effect of four herbicides on microbial population, soil organic matter and dehydrogenase activity. *African J. Biotechnol.,* 10 (5): 770-778.

Yakadri, M., Rani, P. L., Prakash, T.R., Madhavi, M. and Mahesh, N., 2015, Weed management in zero till-maize. *Indian J. Weed Sci.*, 47(3): 240-245.

Shukla A. K., 1997. Effect of herbicides butachlor, fluchloralin, 2, 4- D and oxyfluorfen on microbial population and enzyme activities of rice field soil. *Indian J. Eco.*, 24(2): 189-192.

How to cite this article:

Arunkumar, R. B. Negalur, A. S. Halepyati, G. S. Yadahalli and Nagaraj, M. N. 2020. Activity of Soil Enzyme and Microorganisms in Rhizosphere Soil of Maize (*Zea mays* L.) as Influenced by Different Weed Management Practices. *Int.J.Curr.Microbiol.App.Sci.* 9(07): 3611-3619.
doi: https://doi.org/10.20546/ijcmas.2020.907.421