Biological Forum – An International Journal 14(1): 1127-1130(2022)

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Performance of Integrated Weed Management Practices in *Rabi* Groundnut on Post Harvest Soil Analysis and Soil Enzymatic Activity

N. Charitha[1*], M. Madhavi[2], T. Ramprakash[3] and G. Pratibha[4]
[1]M.Sc. (Agronomy), PJTSAU, (Telangana), India.
[2]Senior Professor & Associate Dean, Agricultural college, Aswaraopet, (Telangana), India.
[3]Principal Scientist & Head, AICRP on Weed Management, (Telangana), India.
[4]Principal Scientist (Agro), CRIDA, Santhoshnagar, (Telangana), India.

(Corresponding author: N. Charitha)*
(Received 10 November 2021, Accepted 18 January, 2022)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: A test was carried out to examine the effect of included weed control practices on weed growth and yield of groundnut at College of Agriculture, Professor Jayashankar Telangana State Agricultural University, Hyderabad, during *Rabi* 2020-21. The test consisted of ten treatments laid out in randomised block layout replicated thrice. Different weed management practices had no effect on pH, EC, OC, available nitrogen, phosphorus and potassium in soil after harvest of groundnut. Among pre-emergence herbicides the urease and dehydrogenase activity was recorded highest with the diclosulam 86% WDG 26 g ha^{-1} *fb* intercultivation at 20 DAS and in the post-emergence treatments intercultivation *fb* hand weeding at 20 and 40 DAS recorded the highest activity in both 30 and 60 DAS. Acid and alkaline phosphatase was recorded highest with the pyroxasulfone 85 % WDG 127.5 g ha^{-1} *fb* intercultivation at 20 DAS among the pre-emergence herbicides and in the post-emergence treatments intercultivation *fb* hand weeding at 20 and 40 DAS recorded the highest activity in 30 DAS. At 60 DAS there was no significant difference in acid and alkaline phosphatase activity among the different weed management practices followed. The gradual increase in microbial counts may be attributed to their ability to temporarily mineralize and use herbicides as energy source. The study suggested that the herbicides cause transient impact on microbial populations and enzyme activities associated with the type of herbicides at recommended field application rate.

Keywords: Acid phosphatase, Alkaline phosphatase, Dehydrogenase, Microbial population and Urease.

INTRODUCTION

Weeds emerge rapidly and grow vigourosly competing with the crop severely for growth resources *viz.*, nutrients, moisture, sunlight and space (Isik *et al.*, 2009). Herbicides are applied to soil in the hope of obtaining season-long weed control. Use of pre-emergence herbicides would make the herbicidal weed control more acceptable to farmers as it will not change the agronomic practices but will control the weeds. Furthermore, application of herbicides to soil bring changes in the microbial population and their activities (Latha and Gopal, 2010; Ayansina and Oso 2006). Herbicides impact on soil microorganisms is determined by the chemical, its concentration, microbial species, and environmental factors. (Zain *et al*., 2013). The maintenance of soil biodiversity is very important for sustainable management of soil properties and plant productivity (Bagyaraj and Ashwin, 2016).

Groundnut is one of India's most important oil seed crops. Weeds are one of the most significant restrictions in the cultivation of groundnut as a single crop or in the finger millet-groundnut cropping combination, resulting in yield losses of up to 47 percent (Jat *et al*., 2011). Pendimethalin is a selective pre-emergence herbicide of dinitroaniline group extensively used for weed control (Ashwin *et al*., 2018). Diclosulam is also a pre-emergence herbicide commonly used for controlling annual grasses and broadleaf weeds. Imazethapyr is a herbicide used to suppress grasses, sedges and broad-leaved weeds before and after they emerge. Pyroxasulfone is also a pre-emergence herbicide commonly used for controlling annual grasses and broadleaf weeds. The post emergence herbicides like Propaquizafop, Imazamox, Sodium acifluorfen, Clodinafop propargyl were commonly used for controlling grasses and broad leaved weeds. In this paper the impact of these pre and post emergence herbicides on soil microbiological activities in groundnut rhizosphere was detailed.

MATERIAL AND METHODS

The field experiment took place at Professor Jayashankar Telangana State Agricultural University's College Farm in Rajendranagar, Hyderabad, Telangana State. The farm is located at an elevation of 542.3 metres above mean sea level in the Southern Telangana agro-climatic zone of Telangana, at 17°19' N latitude and 78°23' E longitude, and is categorised as semi-arid tropics (SAT) by Troll's categorization. The experiment was set up in a randomised block design with three replications of ten treatments: diclosulam 84 % WDG 26 g ha^{-1} PE *fb* intercultivation at 20 DAS (T_1), imazethapyr 2 % EC + pendimethalin 30 % EC 960 g ha^{-1} PE *fb* intercultivation at 20 DAS (T_2), pyroxasulfone 85% WDG 127.5 g ha^{-1} PE *fb* intercultivation at 20 DAS (T_3), propaquizofop 2.5 % + imazethapyr 3.75 % w/w ME 125 g ha^{-1} early PoE *fb* inter-cultivation at 40 DAS (T_4), imazethapyr 35% + imazomox 35% WG 70 g ha^{-1} early PoE *fb* intercultivation at 40 DAS (T_5), sodium acifluorfen 16.5 % EC + clodinafop propargyl 8 % EC 250 g ha^{-1} PoE *fb* intercultivation at 40 DAS (T_6), imazethapyr 10 % SL 100 g ha^{-1} PoE *fb* intercultivation at 40 DAS (T_7), intercultivation (20 and 40 DAS) (T_8), intercultivation *fb* hand weeding (20 and 40 DAS) (Weed-free) (T_9), and unweeded control (T_{10}). On the 8th of October 2020, a groundnut crop (variety kadiri-9) was sown at a spacing of 30*10 cm with a seed rate of 300 kg ha^{-1}. Herbicides were sprayed with a Knap sack sprayer with flat fan nozzle calibrated to deliver 500 litres of water per hectare. During the crop's growth stage, prescribed groundnut cultural techniques were implemented. The crop was given the recommended fertiliser dose of 20 kg N, 40 kg P_2O_5, and 50 kg K_2O ha^{-1} through urea, single super phosphate, and muriate of potash to all plots as a baseline fertilizer. At 25 DAS, a top dressing of 10 kg of nitrogen in the form of urea was applied. At 30 and 60 days after planting, soil parameters such as pH, EC, OC, N, P, and K were measured, as well as soil enzymatic activity (urease, phosphatase, and dehydrogenase). The crop was harvested on February 12th, 2021.

RESULT AND DISCUSSION

A. Post-harvest soil analysis

Available soil nutrient status and soil properties intial and final harvest of groundnut is presented in Table 1. After groundnut harvest, different weed control strategies had no effect on pH, EC, OC, available nitrogen, phosphorus, or potassium in the soil. The soil pH ranged from 7.62 to 7.92, indicating that it is neutral to slightly alkaline; the EC ranged from 0.44 to 0.55; and the OC ranged from 0.52 to 0.57 percent. After harvest, available nitrogen ranged from 170.53 to 189.16 kg ha^{-1}, available phosphorous from 58.54 to 65.85 kg ha^{-1} and available potassium from 311.73 to 319.57 kg ha^{-1} in the soil.

Table 1: Post harvest soil physico-chemical properties as influenced by weed management practices.

Treatment		pH	EC (ds m^{-1})	OC (%)	Available N	Available P_2O_5	Available K_2O
Initial soil status		7.72	0.54	0.55	185.10	53.58	308.22
T_1	Diclosulam 84% WDG 26 g ha^{-1}PE *fb* intercultivation at 20 DAS	7.81	0.55	0.53	174.94	58.54	317.33
T_2	Imazethapyr 2% EC+ pendimethalin 30% EC 960 g ha^{-1} PE *fb* intercultivation at 20 DAS	7.87	0.47	0.53	173.88	60.78	313.60
T_3	Pyroxasulfone 85 % WDG 127.5 g ha^{-1} PE *fb* intercultivation at 20 DAS	7.76	0.50	0.56	179.09	65.85	319.57
T_4	Propaquizafop 2.5% + imazethapyr 3.75% ME 125 g ha^{-1} Early PoE *fb* intercultivation at 40 DAS	7.73	0.49	0.53	188.35	60.78	314.35
T_5	Imazethapyr 35% + imazamox 35% WG 70 g ha^{-1} Early PoE *fb* intercultivation at 40 DAS	7.74	0.46	0.56	189.16	60.63	318.83
T_6	Sodium acifluorfen 16.5% EC + clodinafop propargyl 8% EC 250 g ha^{-1} PoE *fb* intercultivation at 40 DAS	7.83	0.44	0.57	170.53	64.35	317.33
T_7	Imazethapyr 10% SL 100 g ha^{-1} PoE *fb* intercultivation at 40 DAS	7.75	0.44	0.55	187.46	65.11	315.84
T_8	Intercultivation (20 and 40 DAS)	7.88	0.47	0.56	174.17	62.84	312.11
T_9	Intercultivation *fb* hand weeding (20 and 40 DAS) (Weed free)	7.92	0.54	0.54	176.27	63.51	315.47
T_{10}	Unweeded control	7.62	0.55	0.52	180.11	60.86	311.73
	S.Em ±	0.08	0.03	0.02	7.98	2.80	25.97
	CD (P = 0.05)	NS	NS	NS	NS	NS	NS

B. Enzyme analysis

Soil biological properties (soil enzymes) presented in Table 2, were recorded at 30 and 60 DAS. The urease activity in the soil at 30 DAS is high with intercultivation *fb* hand weeding at 20 and 40 DAS which was statistically on par with the intercultivation at 20 and 40 DAS. This was followed by unweeded control and was significantly superior to the all other treatments. Similar trend was recorded in the urease activity at 60 DAS.

Table 2: Soil urease, acid and alkaline phosphatase and Dehydrogenase activity as influenced by weed management practices in groundnut.

	Treatment	Soil urease activity (µg NH_4-N kg^{-1} soil 2 $hour^{-1}$)		(µg Pnp kg^{-1} soil $hour^{-1}$) Acid phosphatase activity		(µg Pnp kg^{-1} soil $hour^{-1}$) Alkaline phosphatase activity		Dehydrogenase activity (µg TPF kg^{-1} soil day^{-1})	
		30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS
T_1	Diclosulam 84% WDG 26 g ha^{-1} PE *fb* intercultivation at 20 DAS	35.60	62.10	59.20	82.20	45.20	56.50	2.47	4.87
T_2	Imazethapyr 2% EC+ pendimethalin 30% EC 960 g ha^{-1} PE *fb* intercultivation at 20 DAS	32.10	58.80	59.10	86.70	41.10	51.40	1.65	4.56
T_3	Pyroxasulfone 85 % WDG 127.5 g ha^{-1} PE *fb* intercultivation at 20 DAS	32.60	60.80	60.20	88.90	47.80	57.60	2.35	4.72
T_4	Propaquizafop 2.5% + imazethapyr 3.75% ME 125 g ha^{-1} Early PoE *fb* intercultivation at 40 DAS	28.80	50.40	51.20	90.20	25.40	51.20	1.62	4.42
T_5	Imazethapyr 35% + imazamox 35% WG 70 g ha^{-1} Early PoE *fb* intercultivation at 40 DAS	27.80	49.20	52.10	81.50	28.40	56.60	1.47	4.56
T_6	Sodium acifluorfen 16.5% EC + clodinafop propargyl 8% EC 250 g ha^{-1} PoE *fb* intercultivation at 40 DAS	24.20	57.80	47.20	82.60	28.60	57.40	1.87	4.87
T_7	Imazethapyr 10% SL 100 g ha^{-1} PoE *fb* intercultivation at 40 DAS	29.60	55.60	51.20	86.60	30.20	55.50	1.54	4.95
T_8	Intercultivation (20 and 40 DAS)	40.50	71.20	58.80	85.40	46.60	56.20	3.21	5.01
T_9	Intercultivation *fb* hand weeding (20 and 40 DAS) (Weed free)	42.40	74.20	60.20	87.50	44.40	57.40	3.42	5.47
T_{10}	Unweeded control	38.60	62.20	61.40	88.20	47.10	56.6	3.36	4.65
	S.Em ±	0.11	0.19	2.80	1.20	1.24	1.70	0.09	0.14
	CD (P = 0.05)	3.10	5.70	4.85	NS	3.60	NS	0.25	0.41

The pyroxasulfone PE *fb* intercultivation at 20 DAS had the highest acid phosphatase activity at 30 DAS among pre-emergence herbicides, which was statistically on par with diclosulam PE *fb* intercultivation at 20 DAS and imazethapyr + pendimethalin PE *fb* intercultivation at 20 DAS. Unweeded control had the highest microbial activity among post-emergence treatments, which was statistically comparable to intercultivation *fb* manual weeding at 20 and 40 DAS and intercultivation at 20 and 40 DAS. The pyroxasulfone PE *fb* intercultivation at 20 DAS had the highest alkaline phosphatase activity at 30 DAS among pre-emergence herbicides, which was statistically on par with diclosulam PE *fb* intercultivation at 20 DAS. Unweeded control had the highest microbial activity across post-emergence treatments, which was statistically comparable to intercultivation at 20 and 40 DAS and intercultivation *fb* manual weeding at 20 and 40 DAS. The acid and alkaline phosphatase activities were not significantly different at 60 DAS.

Dehydrogenase activity was significantly influenced by various weed management practices. At 30 DAS the highest dehydrogenase activity was recorded with intercultivation *fb* hand weeding at 20 and 40 DAS which was on par with unweeded control and intercultivation at 20 and 40 DAS. This was followed by diclosulam PE *fb* intercultivation at 20 DAS and pyroxasulfone PE *fb* intercultivation at 20 DAS which were statistically on par with each other and significantly superior to all other treatments. At 60 DAS the dehydrogenase activity recorded highest with the intercultivation *fb* hand weeding at 20 and 40 DAS which was followed by intercultivation at 20 and 40 DAS, imazethapyr PoE *fb* intercultivation at 40 DAS, diclosulam PE *fb* intercultivation at 20 DAS, sodium acifluorfen + clodinafop propargyl PoE *fb* intercultivation at 40 DAS, pyroxasulfone PE *fb* intercultivation at 20 DAS and unweeded control and were on par with each other.

Dehydrogenase activity was found to be inhibited by a herbicide in sandy loam soil (Dzantor and Felsot, 1991), while no effect was observed by Nakamura *et al.* (1990). Many studies reported that urease activity decreased due to herbicide application (Riah *et al.*, 2014; Saha *et al.*, 2016, Majumdar *et al.*, 2010). Majumdar *et al.* (2010) reported that early negative effect on acid phosphatase activity and alkaline phosphatase activity were observed due to application of quizalofop-p-ethyl. Some herbicides may inhibit acid phosphatase and stimulate alkaline phosphatase activity and vice versa (Cycon *et al.*, 2012).

CONCLUSION

After groundnut harvest, different weed control strategies had no effect on pH, EC, OC, accessible nitrogen, phosphorus, or potassium in the soil. The urease and dehydrogenase activity was best in pre-emergence herbicides with the diclosulam 86 percent WDG 26 g ha-1 fb intercultivation at 20 DAS, and in post-emergence herbicides with intercultivation fb manual weeding at 20 and 40 DAS in both 30 and 60 DAS. Among the pre-emergence herbicides, pyroxasulfone 85 percent WDG 127.5 g ha-1 fb intercultivation at 20 DAS recorded the highest activity, while among the post-emergence herbicides, intercultivation fb hand weeding at 20 and 40 DAS showed the highest activity. At 60 DAS there was no significant difference in acid and alkaline phosphatase activity among the different weed management practices followed.

FUTURE SCOPE

The future research should encompass the testing of new generation molecules of herbicide and herbicide mixtures for selective control of weeds and to best fit in the integrated approach under wide range of climate and cropping systems and also to analyse the soil micro-organisms and biological activity as affected by the different treatments.

Acknowledgement. Nalla Charitha and all the authors are thankful to Professor Jayashankar Telangana State Agricultural University, College Farm, Rajendranagar, Hyderabad, Telangana for providing resources for carrying out research work.

Conflict of Interest. None.

REFERENCES

Ashwin, R., Bagyaraj, D. J. and Sanjay, M. T. (2018). Impact of integrated weed management practices on soil microbiological activities in groundnut. *Journal of Soil Biology and Ecology*, *38* : 90-96

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

Bagyaraj, D. J. and Ashwin, R. (2016). Soil Biodiversity: Role in Sustainable Horticulture. In: *Biodiversity of Horticultural Crop*, Vol. V (Ed.) Peter, K.V., Astral Int. Pvt. Ltd. New Delhi, pp. 1-18.

Cycon, M., Piotrowska-Seget, Z and Kozdroj, J. (2012). Responses of indigenous microorganisms to a fungicidal mixture of mancozeb and dimethomorph added to sandy soils. *International Biodeterioration Biodegradation*, *64*: 316–323.

Dzantor, E.K and Felsot, A. (1991). Microbial response to large concentrations of herbicides in soil. *Environmental Toxicology and Chemistry*, *10*: 649-655.

Isik, D., Kaya, E., Ngouajio, M and Mennan H. (2009). Weed suppression in organic pepper with winter cover crops. *Crop Prot*., *28*: 356-363.

Jat, R. S., Meena, H. N., Singh, A. L., Surya, J. N. and Misra, J. B. (2011). Weed management in groundnut (*Arachis hypogaea* L.) in India-a review. *Agric. Rev*., *32*: 155-171.

Latha, P. C. and Gopal, G. (2010). Influence of herbicides on cellulolytic, proteolytic and phosphate solubilizing bacteria. *Int. J. Prot*., *3*: 83-88.

Majumdar, B., Saha, A. R., Sarkar, S., Maji, B. and Mahapatra, B. S. (2010). Effect of herbicides and fungicides application on fibre yield and nutrient uptake by jute (*Corchorus olitorius*), residual nutrient status and soil quality. *Indian Journal of Agricultural Sciences, 80*(10): 878–883.

Nakamura, T., Mochida, K., Ozon, Y., Ukawa, S., Sakai, M and Mitsugi S. (1990). Enzymological properties of three soil hydrolases and effects of several pesticides on their activities. *Journal of Pesticide Science*, *15*: 593-598.

Riah, W., Laval, K., Laroche-Ajzenberg, E., Mougin, C., Latour, X. and Trinsoutrot, G. I. (2014). Effects of pesticides on soil enzymes: a review. *Environmental Chemistry Letters*, *12*: 257–273.

Saha, A., Bhaduri, D., Pipariya, A and Jain, N. K. (2016). Influence of imazethapyr and quizalofop-p-ethyl application on microbial biomass and enzymatic activity in peanut grown soil. *Environmental Science and Pollution Research*, *23*: 23758–23771.

Zain, N. M. M., Mohamad, R. B., Sijam, K., Morsad, M. M and Awang Y. (2013). Effects of selected herbicides on soil microbial population in oil palm plantation of Malaysia: a microcosm experiment. *Afr. J. Microbiol. Res.*, *7*: 367-374.

How to cite this article: N. Charitha, M. Madhavi, T. Ramprakash and G. Pratibha (2022). Performance of Integrated Weed Management Practices in *Rabi* Groundnut on Post Harvest Soil Analysis and Soil Enzymatic Activity. *Biological Forum – An International Journal*, *14*(1): 1127-1130.