IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

IMPACT OF SELECTED PESTICIDES AND SAMPLE DRYING ON ENZYME ACTIVITY OF β-GLUCOSIDASE AND CELLULASE ENZYME IN SOIL OF FARRUKHABAD REGION (UP) INDIA

[1]Adarsh Kumar, Ranvir Singh and Bhanu Lal Singh

Department of chemistry, S.V. College (Dr. B.R.A. University Agra) Aligarh 202001

ABSTRACT

This research illustrated, pesticides are chemical compounds that are used to kill pests, including insects, fungi and unwanted plants (weeds). Impact of selected pesticides on enzyme activity of β-glucosidase and cellulase enzymes in soil of Farrukhabad region (U.P.). Soil were collected in summer season (June 2022) from Farrukhabad region viz., Kaimganj, Amritpur and Farrukhabad tahsil. Soil microbial diverseness is indispensible to maintain functional change and enzyme mediated critical soil process that detoxify soil from environmental pollutants like pesticides, due to excessive use of pesticides viz., Cypermethrin, Endosulfan and Mancozeb controlling the insects. The present study, India was carried out to assess the impact of different concentration of the pesticides. Results observed that the impact of selected pesticides on soil enzyme activity feable decreases while with out pesticides enzyme activity of β-glucosidase and cellulase increases in selected soil.

Keyword : Pesticides, Soil, β-glucosidase and Cellulase enzyme.

INTRODUCTION

Soil enzymes play key biochemical functions in the overall process of organic matter decomposition in the soil system.[1] They are important in catalysing several important reactions necessary for the life processes of micro-organisms in soils and the stabilization of soil structure, the decomposition of organic wastes, organic matter formation and nutrient cycling.[2] These enzymes are constantly being synthesized, accumulated, inactivated and/or decomposed in the soil, hence playing an important role in agriculture and particularly in nutrients cycling.[3] Pesticides are widely used in crop production and are known to cause major environmental problems. The interaction between soil components and selected pesticides influences the biochemical processes driven by microorganisms. The impact of selected

pesticides on soil micro-organism could be determined by the study of functional parameters such as carbon and nitrogen mineralization that are governed by enzymatic activities. Those activities, play an important role because all biochemical changes in soil depend on or are related to the presence of enzymes.[4]

β-glucosidase

β-glucosidase are the essential part of cellulase system and catalyze the last and final stage in cellulose hydrolysis. These are characteristically useful as a soil quality indicator, and may give a reflection of past biological activity. The capacity of soil to stabilise the soil organic matter, and can be used to detect management effect on soils. It is named according to the type of bond that it hydrolyses. This enzyme plays an important role in soils because it is involved in catalysing the hydrolysis and biodegradation of various β-glucosides present in plant debris decomposing in the ecosystem. Its final product is glucose, an important carbon energy source of life to microbes in the soil.[5]

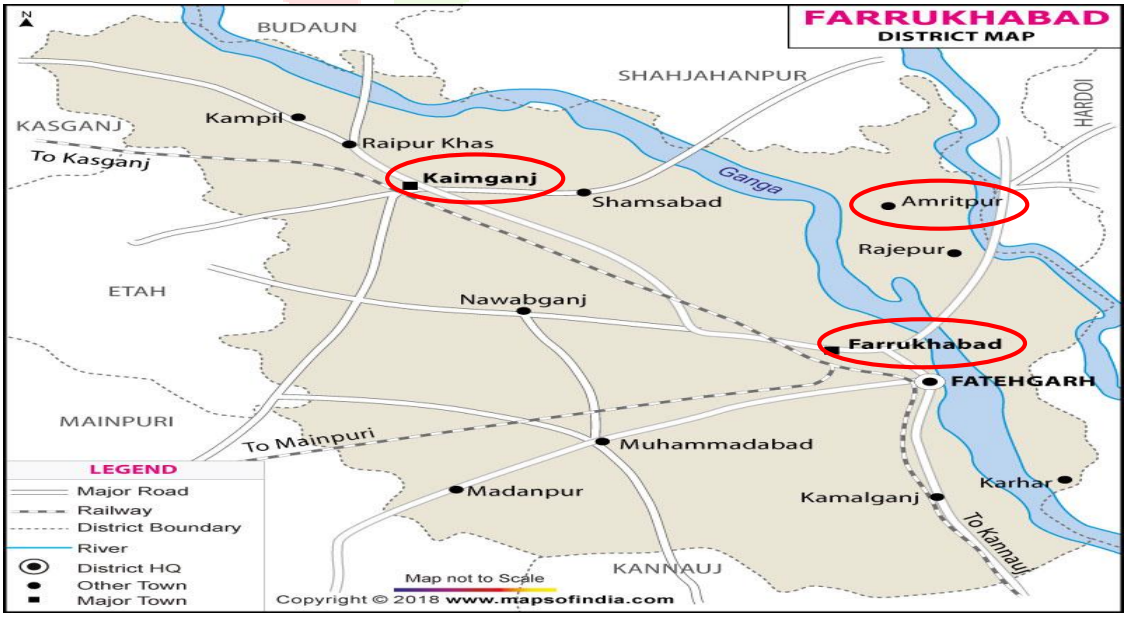
Cellulase

Celluloses are one of several enzymes produced chiefly by fungi, bacteria and protozoans. These important enzymes degrade cellulose and some related polysaccharides in soil, and are directly involved in the cycling of carbon compounds in soil. These enzymes are highly sensitive to anthropogenic factors such as pesticides thereby the soil fertility is greatly affected. Several insecticides, fungicides and herbicides have been assessed to understand their effects on soil cellulases. In most of these studies, it has been found that soil celluases were greatly affected by the pesticides.[6] Cellulases are a group of enzymes that catalyse the degradation of cellulase, polysaccharides build up of 1, 4 linked glucose units.[7]

MATERIALS AND METHODS

Collection of Soil Sample

The soil pertaining to the experimental setup were collected from the region of Farrukhabad U.P., India at different sample drying.



Site Map

Pesticides

Selected pesticides are cypermethrin (insecticides), endosulfan (insecticide) and mancozeb (fungicide). It were used techniques Flamphotometer, UV Vis spectrophotometer and X–ray differaction spectroscopy in proposed research work.

Soil Analysis

Physicochemical characteristics of soil (control) and selected pesticides were determined with soil of Farrukhabad Region. Parameters were determined such as pH, EC (Electric Conductivity), TOC (Total Organic Carbon), TKN (Total Kjeldahl Nitrogen), TP (Total Phosphorous), TK (Total Potassium) and TKN (Total Kjeldahl Nitrogen) from selected soil and include pesticides soil. It were used analytical procedures by total kjeldahl nitrogen (TKN) and total organic carbon (TOC) of the soil analysis were measured with the micro kjeldahl methods[8] and Walkely and Black's Rapid titration method (1934)[9] respectively, total phosphorous (TP) was determined spectrophotometrically[10] While total potassium (TK) was detected by flame photometer.[11]

Enzyme Analysis

- β-glucosidase activity was assessed by determination of the released p-nitro phenol after incubation of samples (1 gm fresh weight) with p-nitrophenolglucoside (0.025 m) for 1h at 37ºC in a microplate reader at 400nm.
- Cellulase activity was estimated by determination of released reducing sugars after incubation of samples (5 g fresh weight) with carboxymethylcellulase (CMC), sodium salt (0.7%) for 24 h at 50ºC in a microplate reader 690 nm.[12]

RESULT AND DISCUSSION

The impact of selected pesticides on soil enzyme activity feably decreases while with out pesticides enzyme activity of β-glucosidase and cellulase increases in selected soil.[13] β-glucosidase is characteristically useful as a soil quality indicator, and may give a reflection of past biological activity. The capacity of soil to stabilise the soil organic matter, and can be used to detect management effect on soils[14]. Understanding the dynamics of enzyme activities in these systems is crucial for predicting their interactions as their activities may, in turn, regulate nutrient uptake and plant growth. Cellulase enzymes play an important role in global recycling of the most abundant polymer, cellulose in nature, it would be of critical importance to understand this enzyme better so that it may be used more regularly as a predictive tool in our soil fertility programmes. Thus the impact of selected pesticides on enzyme activity of cellulase and β-glucosidase enzymes in soil of Farrukhabad region (Amritpur, Kaimganj and Farrukhabad) were observed in the present study, the observed results shown are given below:

TABLE 1

Physico-chemical characteristics of soil of Farrukhabad (Amritpur, Kaimganj and Farrukhabad) region in summer season (June 2022). The various physico-chemical properties were obtained from R.G. College of Pharmacy, Hathras.

pH (1:2.5)	EC (dS/m) 1:2.5	Organic carbon (%)	Available P_2O_5 (mg kg^{-1})	Available K_2O (mg kg^{-1})	Available Nitrogen (mg kg^{-1})	Sodium (%)
AMRITPUR REGION						
7.58	7.64	0.49	13.20	397.37	170.06	0.48
KAIMGANJ REGION						
7.46	7.77	0.48	12.93	402.48	173.55	0.54
FARRUKHABAD REGION						
7.50	7.59	0.49	14.33	411.37	161.38	0.63

TABLE 2
Cellulase Activity of Amritpur soil in summer season (June 2022)
(µg glucose g^{-1} hr^{-1})

Sample code	Treatment Name	Replicates	Activity	Mean	Mean ± Standard Deviation
1	S	1	14.94	14.90	14.90 ± 0.02
		2	14.90		
		3	14.88		
2	Sa	1	13.43	13.56	13.56 ± 0.09
		2	13.67		
		3	13.58		
3	Sb	1	12.05	12.12	12.12 ± 0.06
		2	12.10		
		3	12.21		
4	Sc	1	12.88	12.82	12.82 ± 0.10
		2	12.67		
		3	12.92		

S = soil; Sa = soil + cypermethrin;
Sb = soil + endosulfan; Sc = soil + mencozeb.

Figure 1 : Cellulase Activity of Amritpur soil in summer season (June 2022) (µg glucose g^{-1} hr^{-1})

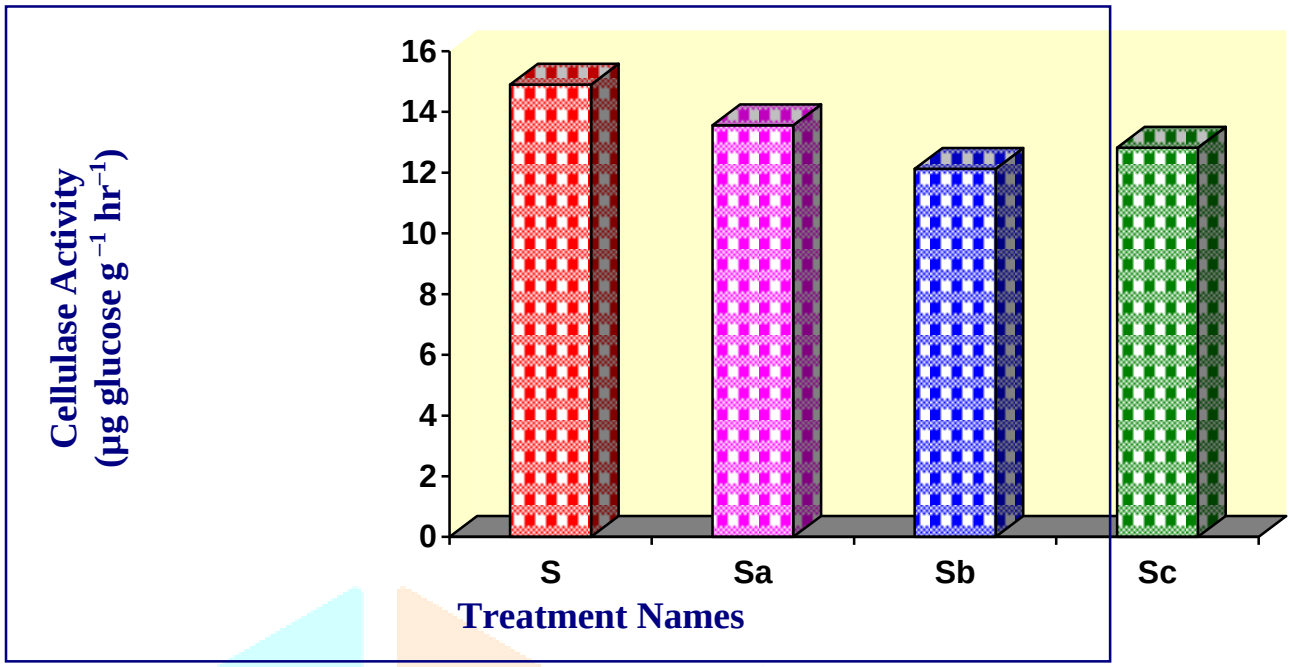


TABLE 3
Cellulase Activity of Kaimganj soil in summer season (June 2022)
(µg glucose g^{-1} hr^{-1})

Sample code	Treatment Name	Replicates	Activity	Mean	Mean ± Standard Deviation
1	S	1	37.85	37.67	37.67 ± 0.13
		2	37.53		
		3	37.64		
2	Sa	1	35.97	35.74	35.74 ± 0.19
		2	35.43		
		3	35.78		
3	Sb	1	25.84	25.80	25.80 ± 0.02
		2	25.77		
		3	25.81		
4	Sc	1	31.05	31.09	31.09 ± 0.02
		2	31.10		
		3	31.12		

S = soil; Sa = soil + cypermethrin;
Sb = soil + endosulfan; Sc = soil + mencozeb.

Figure 2 : Cellulase Activity of Kaimganj soil in summer season (June 2022) (µg glucose g^{-1} hr^{-1})

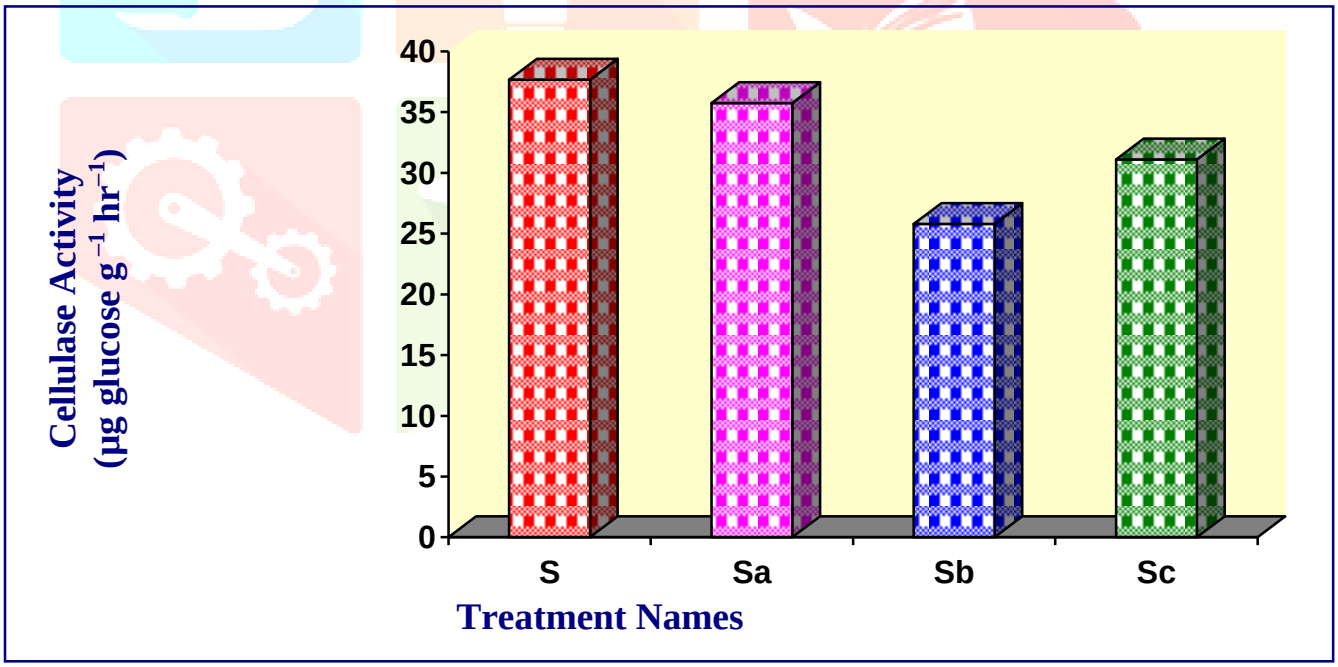


TABLE 4

Cellulase Activity of Farrukhabad soil in summer season (June 2022) (µg glucose g^{-1} hr^{-1})

Sample code	Treatment Name	Replicates	Activity	Mean	Mean ± Standard Deviation
1	S	1	51.48	52.08	52.08 ± 0.56
		2	51.94		
		3	52.83		
2	Sa	1	48.53	47.29	47.29 ± 2.63
		2	43.64		
		3	49.72		
3	Sb	1	36.97	36.76	36.76 ± 0.24
		2	36.42		
		3	36.91		
4	Sc	1	42.58	42.78	42.78 ± 0.14
		2	42.91		
		3	42.87		

S = soil; Sa = soil + cypermethrin;
Sb = soil + endosulfan; Sc = soil + mencozeb.

Figure 3 : Cellulase Activity of Farrukhabad soil in summer season (June 2022) (µg glucose g^{-1} hr^{-1})

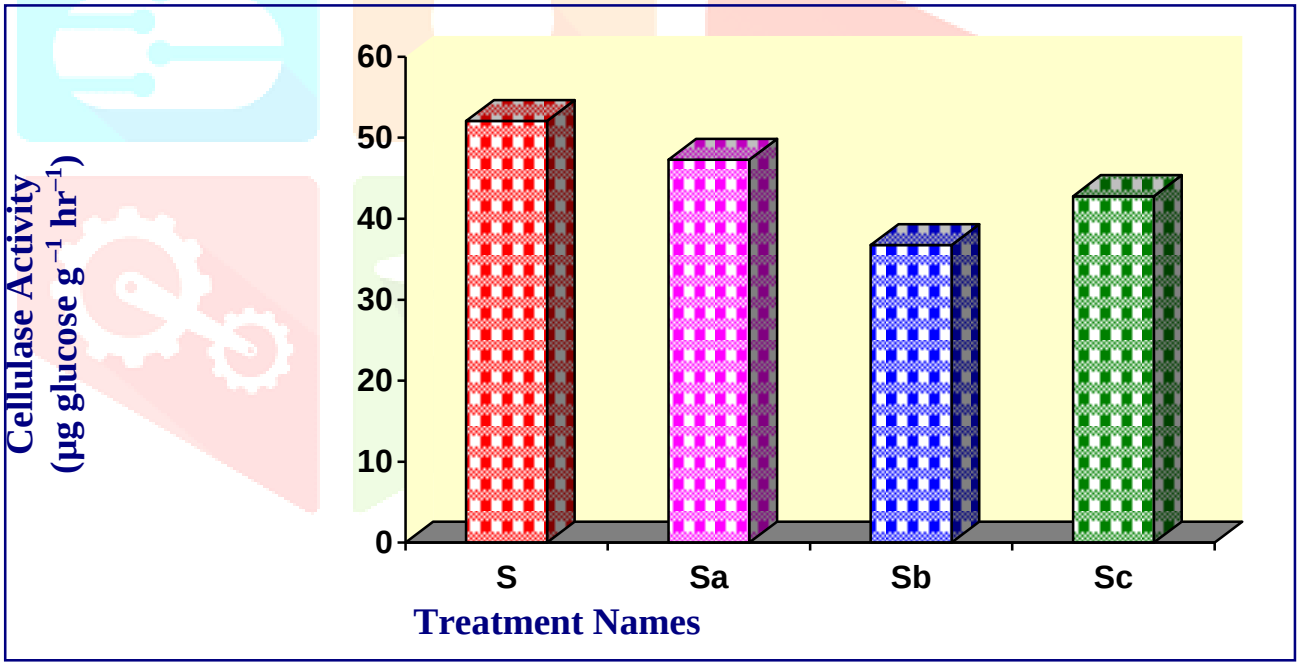


TABLE 5

β-glucosidase Activity of Amritpur soil in summer season (June 2022) (µg PNP g^{-1} hr^{-1})

Sample code	Treatment Name	Replicates	Activity	Mean	Mean ± Standard Deviation
1	S	1	16.02	15.94	15.94 ± 0.08
		2	15.83		
		3	15.98		
2	Sa	1	15.04	14.74	14.74 ± 0.25
		2	14.78		
		3	14.41		
3	Sb	1	12.41	12.73	12.73 ± 0.23
		2	12.94		
		3	12.85		
4	Sc	1	14.30	14.40	14.40 ± 0.19
		2	14.67		
		3	14.23		

S = soil; Sa = soil + cypermethrin;
Sb = soil + endosulfan; Sc = soil + mencozeb.

Figure 4 : β-glucosidase Activity of Amritpur soil in summer season (June 2022) (µg PNP g^{-1} hr^{-1})

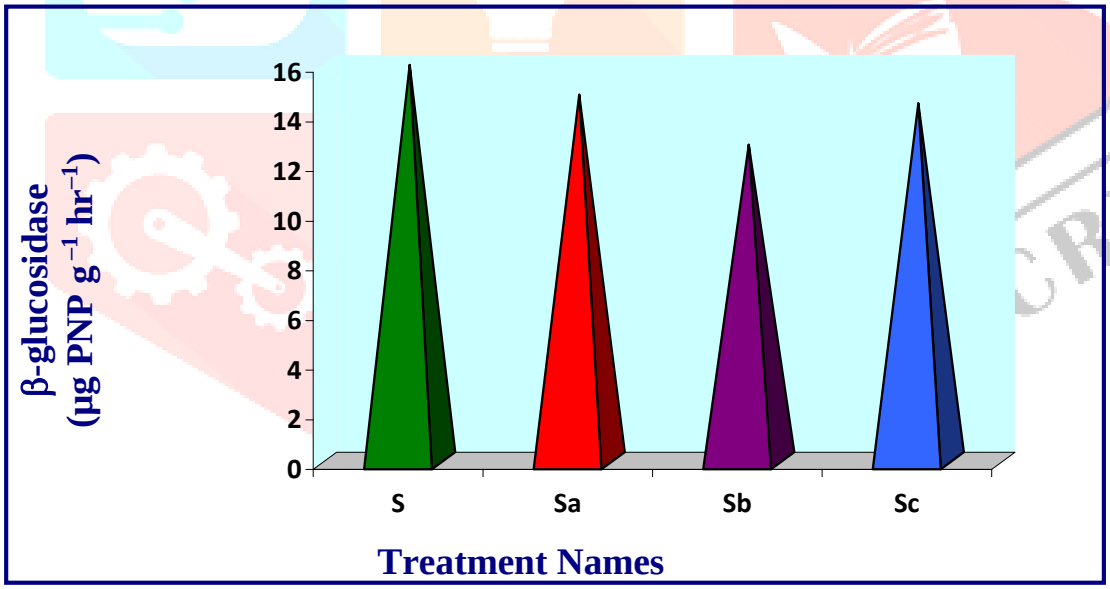


TABLE 6
β-glucosidase Activity of Kaimganj soil in summer season (June 2022)
(µg PNP g^{-1} hr^{-1})

Sample code	Treatment Name	Replicates	Activity	Mean	Mean ± Standard Deviation
1	S	1	18.78	18.89	18.89 ± 0.08
		2	18.92		
		3	18.98		
2	Sa	1	17.12	17.00	17.00 ± 0.08
		2	16.98		
		3	16.91		
3	Sb	1	12.97	12.91	12.91 ± 0.09
		2	12.98		
		3	12.98		
4	Sc	1	14.05	13.85	13.85 ± 0.20
		2	13.94		
		3	13.58		

S = soil; Sa = soil + cypermethrin;
Sb = soil + endosulfan; Sc = soil + mencozeb.

Figure 5 : β-glucosidase Activity of Kaimganj soil in summer season (June 2022) (µg PNP g^{-1} hr^{-1})

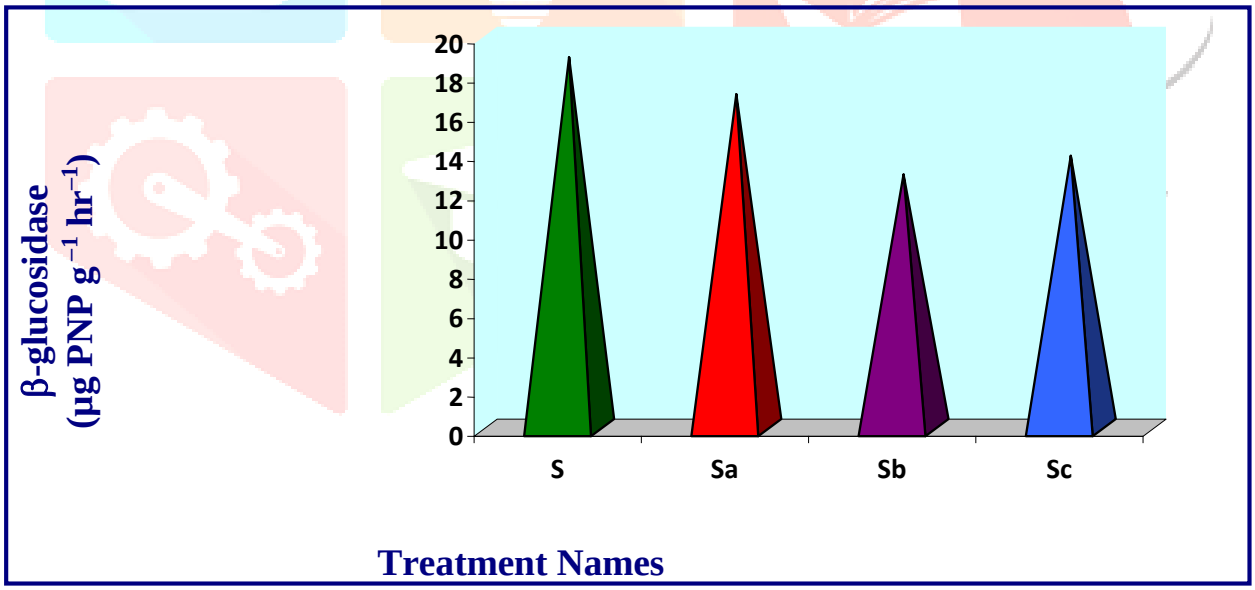


TABLE 7
β-glucosidase Activity of Farrukhabad soil in summer season (June 2022)
(µg PNP g^{-1} hr^{-1})

Sample code	Treatment Name	Replicates	Activity	Mean	Mean ± Standard Deviation
1	S	1	14.35	14.37	14.37 ± 0.21
		2	14.64		
		3	14.12		
2	Sa	1	12.41	12.47	12.47 ± 0.11
		2	12.63		
		3	12.37		

3	Sb	1	11.94	11.82	11.82 ± 0.09
		2	11.83		
		3	11.71		
4	Sc	1	12.54	12.81	12.81 ± 0.19
		2	12.93		
		3	12.97		

Figure 6 : β-glucosidase Activity of Farrukhabad soil in summer season (June 2022) (µg PNP g $^{-1}$ hr^{-1})

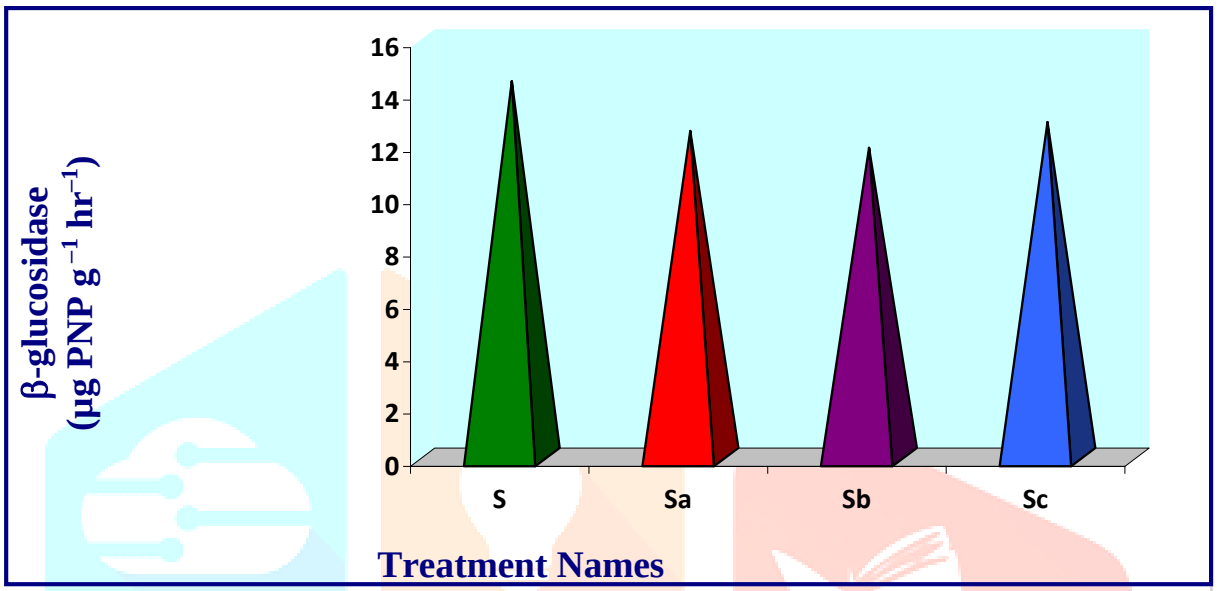


Figure 7 : Comparison of Cellulase Activity of Amritpur, Kaimganj and Farrukhabad soil in summer season (June 2022) (µg glucose g $^{-1}$ hr^{-1})

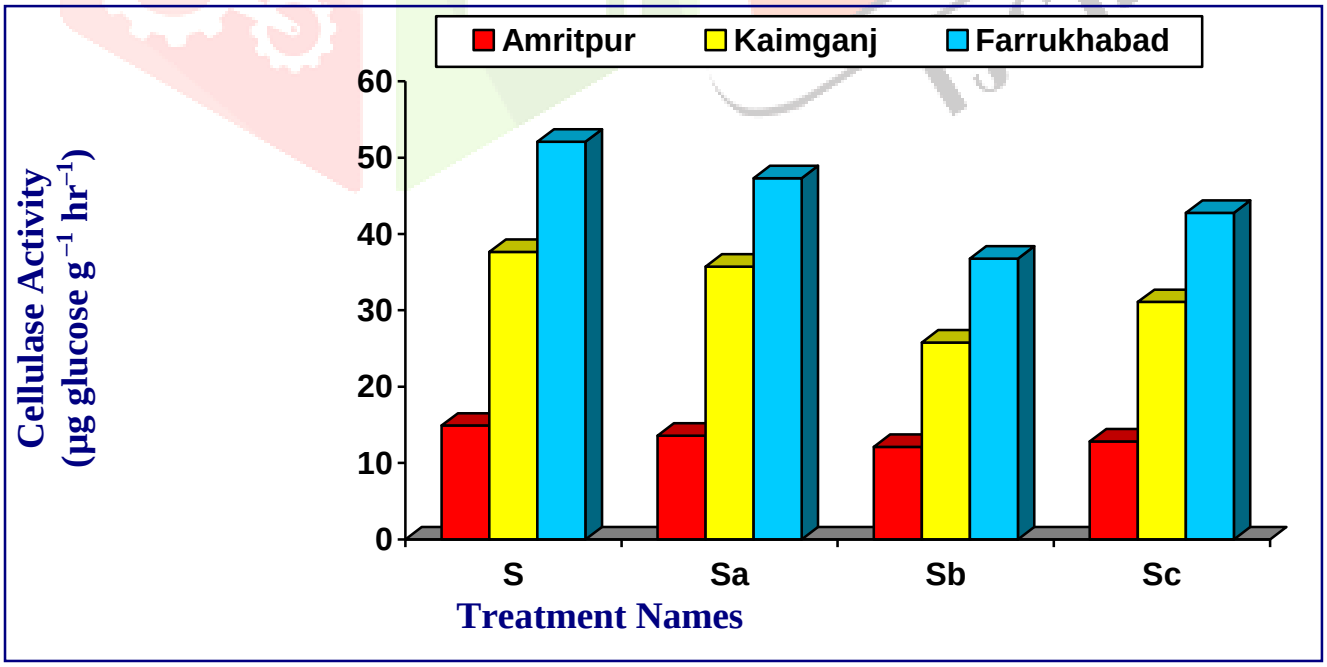
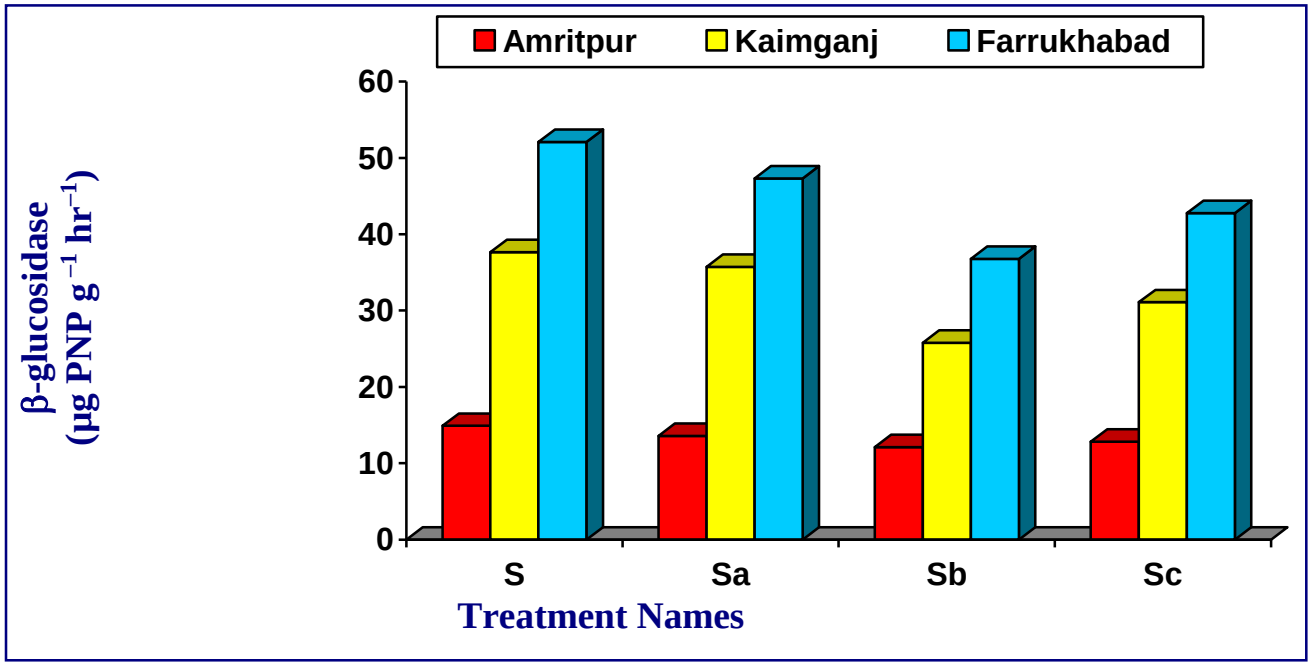


Figure 8 : Comparison of β-glucosidase Activity of Amritpur, Kaimganj and Farrukhabad soil in summer season (June 2022) (µg PNP g $^{-1}$ hr^{-1})



CONCLUSION

This research demonstrate that the pesticides were increasingly used in agriculture in order to limit crop diseases and increase food production in India. Hence, increases in the concentration of pesticides then decreases the rate of β-glucosidase and cellulase enzymes activity as compared to without pesticides soil of Farrukhabad region (U.P.) India.

ACKNOWLEDGEMENT

We acknowledge the technical support of the R.G. College of Pharmacy, Hathras to carryout this study.

REFERENCES

1. **Burns R.G. (1983).** *In: Microbes in Their Natural Environment pp.* 249-298. *Cambridge University Press, London.*
2. **Dick R.P., Sandor J.A., Eash N.S. (1994).** *Agric. Ecosyst. Environ.* **50**: 123 – 131.
3. **Tabatabai M.A. (1994).** *SSSA Book Series No.* **5**. *Soil Sci. Soc. Am. Madison, Wis., pp*. 775-833.
4. **Raith W., Laval K., Laroche-Ajzenberg E., Mougin C., Latour X., Trinsoutrot-Eattin I. (2014).** *Effects of pesticides on soil enzymes : A review. Environ Chem. Lett*.
5. **Ndiaye E.L. (2000).** *Am. J. Alterm Agric.*, **15**: 26-36.
6. **Maddela, N.R. (2018).** *Soil Microbiota Interactions,* 33-40
7. **White, A.R. (1982).** *Plenum Press, New York,* 489-509.
8. **Shaw J., Beadle, L.C. (1949).** *J. Exp. Biol*. **26**: 15-23.
9. **Walkely, J.A., Black, J.A. (1934).** *Soil Science*. **37**: 29-31.
10. **Fiske, C.H., Row Subha, Y. (1925).** *J. Biol. Chem*. **66**: 375-400.
11. **Person, R.W. (1952).** *J. Soil Science,* **74(4)**: 301-310.
12. **Schinner F., Vol Mersi W. (1990).** Soil Biol. Biochem. **22**: 511-515.
13. **Kumar A and Singh, R. (2023).** *Journal of survey in fisheries science,* 10(2S): 1310-1317.
14. **Ndiaye E.L. (2000).** *Am. J. Alterm Agric.*, **15**: 26-36.