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STUDY OF PESTICIDES EFFECTS ON ENZYME ACTIVITY OF AMYLASE AND PHOSPHATASE ENZYMES IN SOIL OF KANNAUJ REGION (U.P.) INDIA

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Abstract

Soil is an important component for all terrestrial ecosystem as well as main source of production in agriculture. Enzymes are the vital activators which play an important role in recycling of nutrients and maintaining soil health. Pesticides are the chemical agent that comes in routine in India to increase soil productivity. It have been reported that pesticides pollutes air, water and soil health. The present study deals with the effect of pesticides (such as atrazine, paraquat and fluridone) on enzyme activities of amylase and phosphatse soil enzymes in selected soil from different region of Kannauj U.P. (Tehsil: Tirwaganj, Chhibramau and Kannauj) in winter season. In the present study, It was observed that an effect of pesticides on enzyme activity of amylase and phosphatase mildly decreased as compared to control soil in selected region of Kannauj (U.P.).

Keywords : Soil, Pesticides, Amylase and Phosphatase.

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Introduction

Enzymes are the vital activators in life processes, likewise in the soil they are known to play a substantial role in maintaining soil health and its environment. The enzymatic activity in the soil is mainly of microbial origin, being derived from intracellular cell associated or free enzymes.

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 stabilisation of soil structure, the decomposition of organic wastes, organic matter formation and nutrient cycling[2]. These enzymes are constantly being synthesised, accumulated, inactivated and decomposed in the soil, hence playing an important role in agriculture and particularly in nutrients cycling[3].

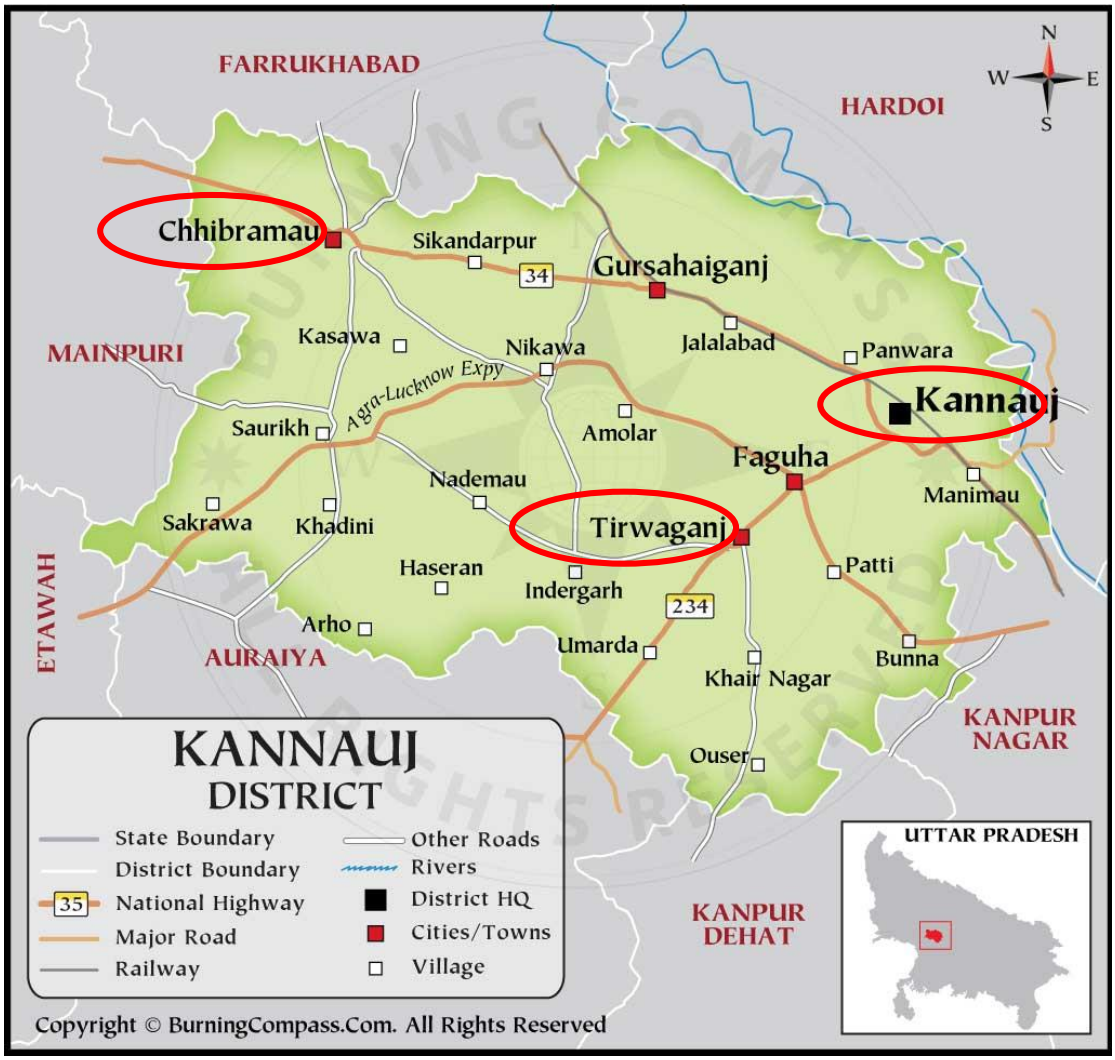
Amylase is a starch hydrolysing enzyme[4]. It is known to be constituted by α-amylase and β-amylase[5]. Studies have shown that α-amylase are synthesized by plants, animals and microorganisms where as β-amylase is mainly synthesized by plants[6]. This enzyme play a significant role in the breakdown of starch. Research evidence suggests that several other enzymes are involved in the hydrolysis of starch[7], but of major importance are α-amylase, which converts starch to glucose and β-amylase, which converts starch to maltose[8]. Studies have indicated that roles and activities of □-amylase and □-amylase enzymes may be influenced by different factors ranging from agricultural practices, type of vegetation environment and soil types[9].

Phosphatase enzyme are a broad group of enzymes that are capable of catalysing hydrolysis of esters and anhydrides of phosphoric acid. In soil ecosystem, these enzymes are believed to play critical roles in phosphorus cycles[10] as evidence shows that they are correlated to phosphorous stress and plant growth. Apart from being good indicators of soil fertility, phosphatase enzymes play key roles in the soil system[11].

MATERIALS AND METHODS

Collection of Soil Sample

The soil pertaining to the experimental setup will be collected from the different region of Kannauj U.P., India in winter season. The soil will be collected stored at room temperature.



Pesticides and Tools

Selected pesticides in proposed research work such as atrazine, paraquat and fluridone. Tools will be used for detection enzymatic activity are Flamphotometer, UV Vis spectrophotometer in proposed research work.

Analytical Procedure

Soil Analysis

To determine the Physicochemical characteristics of soil (control) and selected pesticides with soil of Kannauj Region. To determine the parameters such as pH, EC (Electric Conductivity), TOC (Total Organic Carbon), TP (Total Phosphorous), TK (Total Potassium) and TKN (Total Kjeldahl Nitrogen) from selected soil and include pesticides soil. It will be used analytical procedures by total kjeldahl nitrogen (TKN) and total organic carbon (TOC) of the soil analysis were measured with the micro kjeldahl methods[12] and Walkely and Black's Rapid titration method (1934)[13] respectively, total phosphorous (TP) was determined spectrophotometrically[14] While total potassium (TK) was detected by flame photometer[15].

Procedures for determination of enzymatic activities in soil

Amylase activity will be determined according to Tu CM method

A total of 5 g soil samples in test tubes were incubated with selected pesticides singly and in combination.

Duplicate soil samples were withdrawn after 10 days of incubation at room temperature (28 ± 4ºC) to determine the amylase activity. The method employed for determining amylase activity is the method adapted by Tu CM.

Soil samples were transferred in 200 ml erlenmeyer flasks and 1 ml of toluene was added. After 15 min., 6 ml of 0.2 M acetate-phosphate buffer (pH – 5.5) containing 2% of starch was added to the soil samples and the flasks were stoppered and held for 24 and 72 h at 30ºC. Soil extract were passed through Whatmann No. 1 filter paper and glucose content in the filtrate was assayed.

Activity of Phosphatase was determined according to Tabatabi and Bremner (1969)[16] and Eivazi and Tabatabi (1977)[17] using p-nitrophenyl phosphate solution as the subtrate. Clear yellow coloured solution formed as a result of the action of phosphatase on the substrate was analysed spectrophotometrically at a wavelength of 410 nm to measure the amount of p-nitrophenol released.

RESULTS AND DISCUSSION

Amylase and *Phosphatase* were the enzymes of choice in the soils of Kannauj region (U.P.) because of their paramount importance in biochemical functions in the overall process of organic matter decomposition in soil system. Since amylase enzymes play an important role in global recycling of starch, 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. To date, there have been few studies examining the influence of management options in the ecosystem on phosphatase activity in soil where most crops are grown. 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. In the present study, the observed facts are shown below :

TABLE 1 : Physico-chemical characteristics of soil of Kannauj (Tirwaganj, Chhibramau and Kannauj) region in winter season (January 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 (%)**
TIRWAGANJ REGION						
7.30	7.58	0.45	12.98	374.40	150.28	0.58
CHHIBRAMAU REGION						
7.50	7.41	0.43	13.66	366.77	171.49	0.57
KANNAUJ REGION						
7.41	7.61	0.46	12.09	339.06	181.22	0.56

TABLE 2

Phosphatase Activity of Tirwaganj soil in winter season (January 2022) (µg PNP g $^{-1}$hr^{-1})

Sample code	Treatment Name	Replicates	Activity	Mean	Mean ± Standard Deviation
1	S	1	15.01	15.36	15.36 ± 0.65
		2	14.81		
		3	16.28		
2	Sa	1	13.26	13.15	13.15 ± 0.12
		2	12.98		
		3	13.21		
3	Sb	1	13.98	13.31	13.31 ± 0.46
		2	12.96		
		3	13.01		
4	Sc	1	12.68	12.25	12.25 ± 0.58
		2	12.65		
		3	11.43		

S = soil; Sa = soil + atrazine;

Sb = soil + paraquat; Sc = soil + floridone.

Figure 1 : Phosphatase Activity of Tirwaganj soil in winter season (January 2022) (µg PNP g^{-1} hr^{-1})

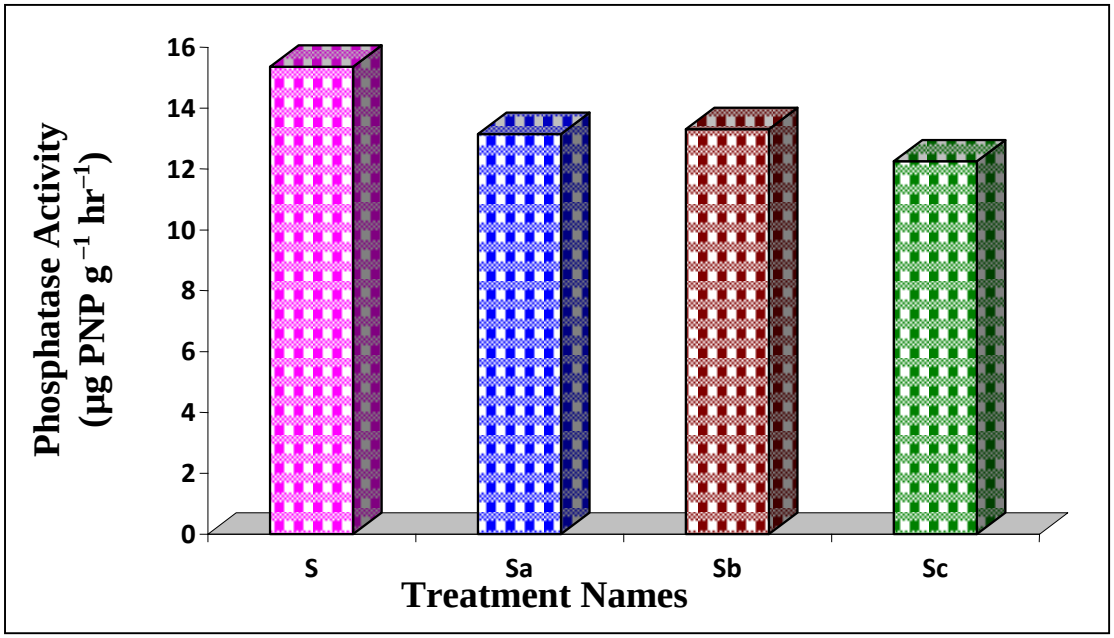


TABLE 3

Phosphatase Activity of Chhibramau soil in winter season (January 2022) (µg PNP $g^{-1}hr^{-1}$)

Sample code	Treatment Name	Replicates	Activity	Mean	Mean ± Standard Deviation
1	S	1	17.21	16.63	16.63 ± 0.59
		2	16.86		
		3	15.82		
2	Sa	1	15.49	14.87	14.87 ± 0.48
		2	14.82		
		3	14.30		
3	Sb	1	13.92	13.25	13.25 ± 0.47
		2	12.85		
		3	12.98		
4	Sc	1	11.66	11.37	11.37 ± 0.20
		2	11.25		
		3	11.20		

S = soil; Sa = soil + atrazine;

Sb = soil + paraquat; Sc = soil + floridone.

Figure 2 : Phosphatase Activity of Chhibramu soil in winter season (January 2022) (µg PNP g^{-1} hr^{-1})

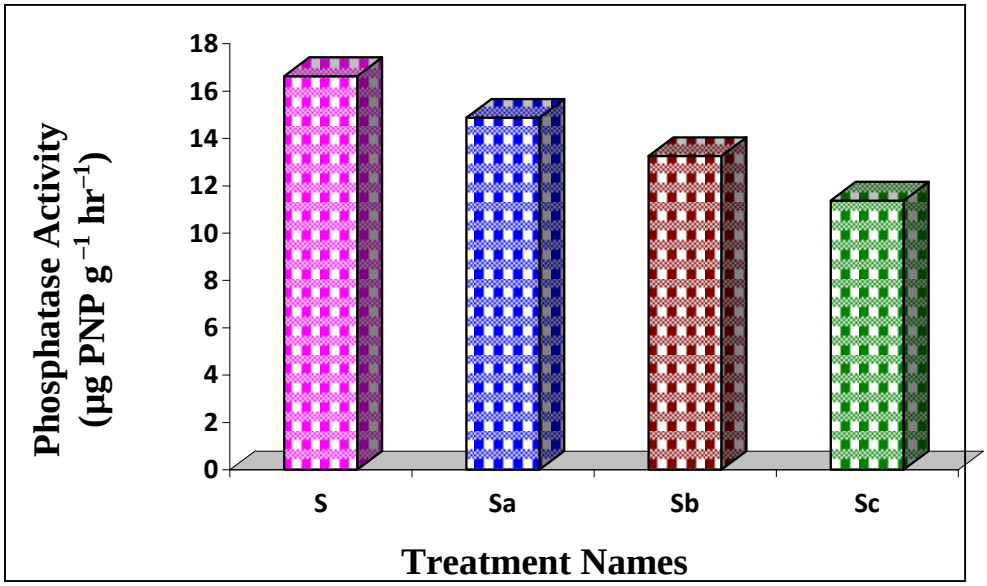


TABLE 4

Phosphatase Activity of Kannauj soil in winter season (January 2022)

(µg PNP g $^{-1}$hr^{-1})

Sample code	Treatment Name	Replicates	Activity	Mean	Mean ± Standard Deviation
1	S	1	18.25	17.82	17.82 ± 0.42
		2	17.98		
		3	17.25		
2	Sa	1	13.96	14.05	14.05 ± 0.13
		2	14.25		
		3	13.96		
3	Sb	1	15.65	15.29	15.29 ± 0.27
		2	15.25		
		3	14.98		
4	Sc	1	16.72	16.62	16.62 ± 0.27
		2	16.89		
		3	16.25		

Figure 3 : Phosphatase Activity of Kannauj soil in winter season (January 2022) (µg PNP g^{-1} hr^{-1})

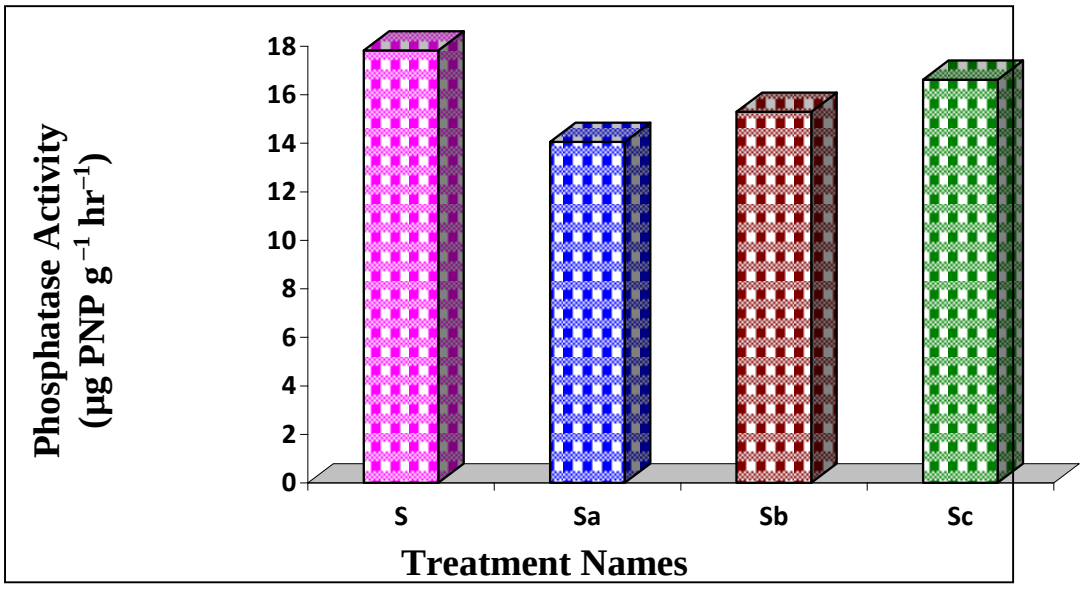


TABLE 5

Amylase Activity of Tirwaganj soil in winter season (January 2022)

(µg starch $g^{-1}hr^{-1}$)

Sample code	Treatment Name	Replicates	Activity	Mean	Mean ± Standard Deviation
1	S	1	25.18	24.49	24.49 ± 0.63
		2	23.65		
		3	24.63		
2	Sa	1	18.95	17.32	17.32 ± 1.17
		2	16.79		
		3	16.23		
3	Sb	1	20.25	19.53	19.53 ± 0.61
		2	19.60		
		3	18.75		
4	Sc	1	21.32	19.59	19.59 ± 1.28
		2	19.20		
		3	18.25		

S = soil; Sa = soil + atrazine;

Sb = soil + paraquat; Sc = soil + floridone.

Figure 4 : Amylase Activity of Tirwaganj soil in winter season (January 2022) (µg starch $g^{-1} hr^{-1}$)

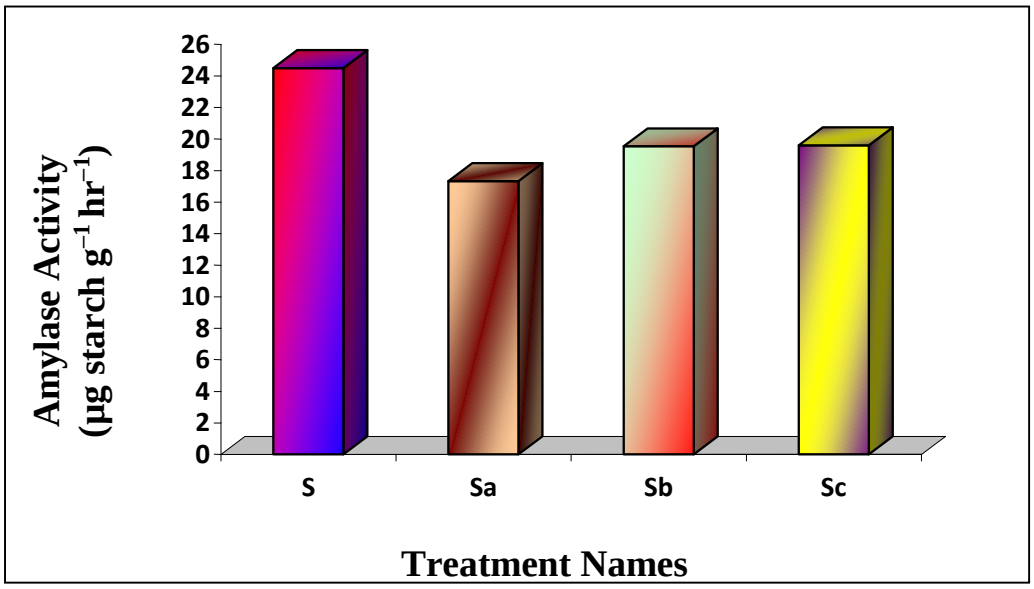


TABLE 6

Amylase Activity of Chhibramau soil in winter season (January 2022)

(µg starch $g^{-1}hr^{-1}$)

Sample code	Treatment Name	Replicates	Activity	Mean	Mean ± Standard Deviation
1	S	1	27.81	27.80	27.80 ± 0.91
		2	28.91		
		3	26.68		
2	Sa	1	24.48	24.32	24.32 ± 0.34
		2	24.65		
		3	23.85		
3	Sb	1	24.25	23.86	23.86 ± 0.27
		2	23.65		
		3	23.70		
4	Sc	1	22.65	22.17	22.17 ± 0.40
		2	22.22		
		3	21.65		

S = soil; Sa = soil + atrazine;

Sb = soil + paraquat; Sc = soil + floridone.

Figure 5 : Amylase Activity of Chhibramau soil in winter season (January 2022) (µg starch g^{-1} hr^{-1})

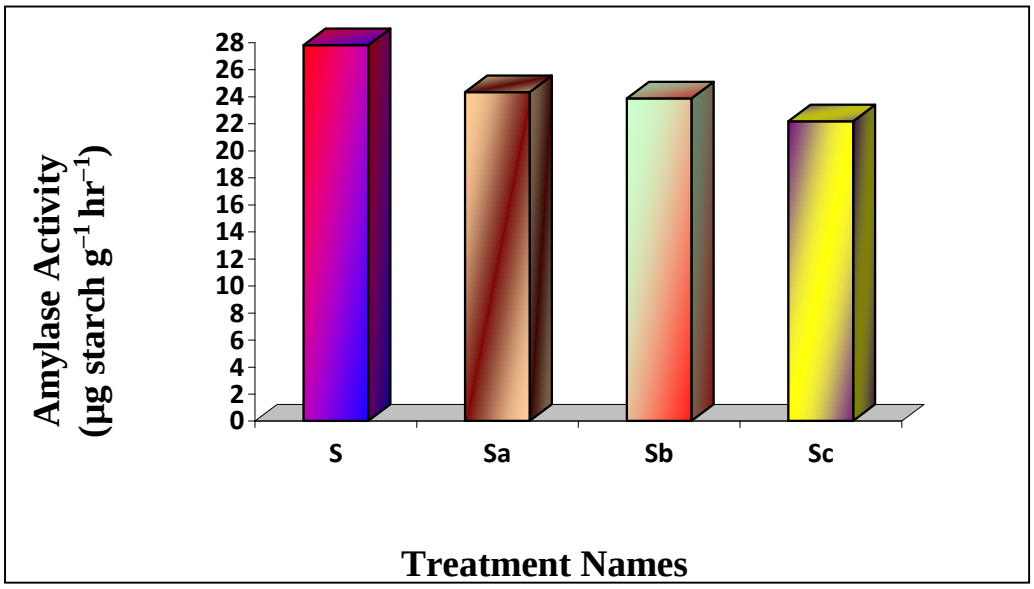


TABLE 7

Amylase Activity of Kannauj soil in winter season (January 2022)

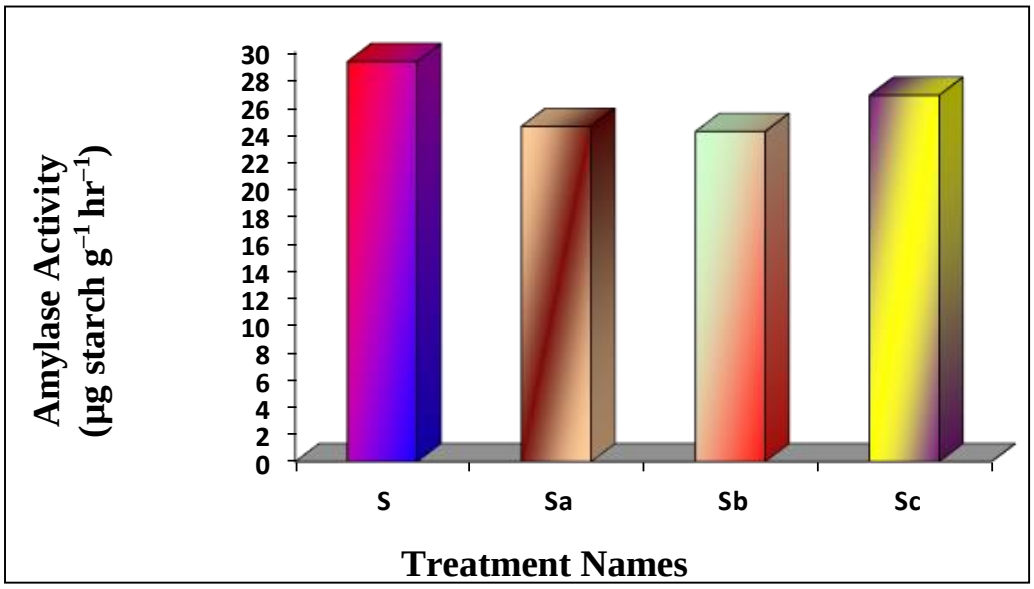
(µg starch $g^{-1}hr^{-1}$)

Sample code	Treatment Name	Replicates	Activity	Mean	Mean ± Standard Deviation
1	S	1	28.91	29.32	29.32 ± 0.30
		2	29.40		
		3	29.65		
2	Sa	1	25.10	24.57	24.57 ± 0.65
		2	24.98		
		3	23.65		
3	Sb	1	24.68	24.19	24.19 ± 0.66
		2	24.65		
		3	23.25		
4	Sc	1	27.32	26.85	26.85 ± 0.54
		2	27.15		
		3	26.09		

S = soil; Sa = soil + atrazine;

Sb = soil + paraquat; Sc = soil + floridone.

Figure 6 : Amylase Activity of Kannauj soil in winter season (January 2022) (µg starch g^{-1} hr^{-1})



CONCLUSION

From the present research study, It was concluded that the effects of pesticides (Atrazine, Paraquate and Floridone) on enzymatic activity of amylase and phosphatase feebly decreases as compared to control soil in selected region of Kannauj (Tirwaganj, Chhibramau and Kannauj) U.P. India.

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