Indian Journal of Advanced Botany (IJAB)
ISSN: 2582-9475 (Online), Volume-1 Issue-1, April 2021

Role of a Zolla Pinnata R.Br. On Alteration of Physicochemical and Elemental Content of Soil

Rosa Priyadarshini, Atia Arzoo, Bhagyeswari Behera

Abstract: ***Now a day's the toxic waste of soil and water by chemical fertilizer is a major problem, which leads to negative effect on crop production. Application of organic fertilizers is the only alternative approach to get better soil quality and future agricultural productivity. In this study, Azolla pinnata R.Br was taken as experimental plant and collected from Azolla tank of CUTM garden, dried and grinded into its powdered form and soil samples were collected from a garden of Centurion University of Technology and Management, BBSR, Odisha at depths of 15-30 cm. and elemental analysis was done by using X-Ray Fluorescence. A number of elements/compound was found to be present in both plant and soil sample. Among those, Silicon dioxide the initial soil was 67.203% and in final after 15 days of treatment it was found to be the value was decreased that was 53.21%.(Table-2) In this present study Ca found in initial soil was 4.236%. After 15 days study, Ca found in treated soil sample was found to be increased to 6.758%. (Table-2) In case of minor elements*** V_2O_5, Cr_2O_3, ***NiO, CuO, ZnO,etc. are present in both plant and soil sample. Like CuO, SrO was also found to be increased from 32.9 to 158.5ppm in final soil sample after treated with Azolla pinnata. It can be concluded that after mixing with Azolla pinnata R.Br on soil, the feritility potency was increased.***

Key words: Soil, Azolla pinnata, Biofertilizer, Elemental analysis.

I. INTRODUCTION

Environmental pollution with toxic metals has increased tremendously after growth of industrialization Voegelan *et. al*., 2003[1].The primary sources of environmental pollution includes mining, industrialization, urbanization, burning of fossil fuels and smelting of metalliferous ores, municipal wastes, fertilizers, pesticides and sewage. Now a day's the contamination of soil and water by chemical fertilizer is a significant problem, which leads to changes of both soil and water characteristics. Adverse effects are observed with the use of chemical fertilizers on long term soil fertility and soil productivity Kannaiyan, 1997[2]. In this regard, recent efforts have been directed more towards the production of 'nutrient rich high quality food' for sustainable living with special emphasis on bio-safety.

Manuscript received on 27 March 2021 | Revised Manuscript received on 01 April 2021 | Manuscript Accepted on 15 April 2021 | Manuscript published on 30 April 2021.
***** Correspondence Author
Rosa Priyadarshini, Department of Botany and School of applied Science, Centurion University of Technology and Management, Odisha, India.
Atia Arzoo, Departmentof Environmental Science School of applied Science, Centurion University of Technology and Management, Odisha, India.
Bhagyeswari Behera*, Department of Botany and School of applied Science, Centurion University of Technology and Management, Odisha, India. Email id: bhagyeswari.behera@cutm.ac.in

To improve the soil organic carbon for enhancing the soil quality and increase in agriculture productivity , organic manures especially bio-fertilizers is one of the practice to ensure good yield of cultivated crops.It was reported that, the organic nitrogen content of the soil increased significantly due to continuous application of *Azolla pinnata* R.Br. by Kannaiyan and Kalidurai in1995[3]. Significant increase in nitrogen content has been reported in wet land rice by applying *Azolla* spp. as the green manure Galal, 1997[4]. So in this study *Azolla pinnata* R.Br fern. was used as biofertilizer to show the impact of *Azolla pinnata* R.Br. on garden soil.

II. MATERIALS AND METHODOLOGY

Collection of Soil samples: Soil samples were collected randomly from the field of Centurion University campus below depths of 15-30 cm using stainless steel soil auger. Soil samples were taken in polythene bags then tagged and labeled for easy identification. The soil samples were collected from the different zone of campus and air dried in sunlight for one day. The samples were oven dried at 105^0 C until constant weight was recorded. Then these soil samples were packed in a clean labelled bag and preserved for further analysis Saeed and Refiqu, 1980[5].

Collection of *Azolla pinnata* R.Br.: *Azolla pinnata* R.Br. were collected from Azolla tank of CUTM garden. The collected *Azolla pinnata* R.Br. were washed and dried and grinded into its powdered form.

Analysis of different elemental content present in soil samples:

The soil samples were dried and grounded into its simplest form. 0.5g to 2g of soil samples were taken and elemental analysis was done by using X-Ray Fluorescence.

Statistical analysis and presentation of data:

For this experiment triplicate data were taken and datas were analysed in the given figure by taking means of three independent experiment. The data were analyzed statistically and standard errors of mean (SEM) were given wherever required.

III. RESULT AND DISCUSSION

The elementary analysis of *Azolla pinnata* R.Br , garden soil and garden soil treated with Azolla were done by using X-Ray Fluorescence and both the results were compared.

Elemental analysis of *Azolla pinnata* R.Br.

In this study, the major elements like SiO_2, P_2O_5, SO_3, Cl, K_2O, CaO, TiO_2, MnO, Fe_2O_3,ZnO, Eu_2O_3 in percentage and minor elements like V_2O_5, NiO, CuO, As_2O_3, Br, SrO, PbO in ppm and are found to be present in *Azolla pinnata* R.Br. The element like Cl, K_2O, CaO, V_2O_5 and CuO were found to be present in higher amount than the other compound.

Elemental analysis of initial (garden soil) and final (garden soil treated with *Azolla*) soil sample:

Elemental analysis was done by XRF method the following compounds were found to be present in garden soil and treated soil.

The major element like Al_2O_3, SiO_2, P_2O_5, K_2O, CaO, TiO_2, MnO, Fe_2O_3, ZrO_2, SO_3,Cl, ZnO, Eu_2O_3 was found in initial garden soil and the concentration of the compound like P_2O_5, K_2O, CaO, TiO_2, MnO was found to be increased in 15 days of final soil sample which was treated with *Azolla pinnata* R.Br.. Silicon dioxide also known as silica is a natural compound is the earth's most abundant materials. Before treatment of soil by for plant growth the initial soil was 67.203% and in final after 15 days of treatment it was found to be the value was decreased that was 53.21%.(Table-2).In industry, CaO is to treat acidic soil and to make porcelain and glass, bleaching power, caustic soda, mortar and cement. In this present study Ca found in initial soil was 4.236%. After 15 days study, Ca found in treated soil sample was found to be increased to 6.758%. (Table-2) In case of minor element V_2O_5, Cr_2O_3, NiO, CuO, ZnO, Ga_2O_3, As_2O_3, Rb_2O, SrO, Y_2O_3, Nb_2O_5, SnO_2, Eu_2O_3, IrO_2, PbO, ThO_2, CO_2, Re these are present in soil sample. The deficiency in Cu lead to affects growth and metabolism in plant specially respiration and photosynthesis. In this present study, CuO found in initial soil was 336.8ppm. and in final after 15 days of treatment with *Azolla pinnata*, the value was found to be increased to 407.4ppm (Table-3). Like CuO, SrO was also found to be increased from 32.9 to 158.5ppm in final soil sample after treated with *Azolla pinnata*.

Some metals like iron, copper, zinc are essential for plants animals. The Availability of some metals such as copper, zinc iron manganese molybdenum, nickel and copper varies and such metals are important micro nutrients Arzoo and Satapathy, 2017[6]. From a report, it was found that nickel had a significant stimulating effect on growth of horse gram, when grown in upto 20mg/kg of nickel treated soil Arzoo *et al.*, 2014[7]. From the evident it was found that growing azolla is not only use full as a biofertilizer for both N and K is its utility as human feed also used as mosquito repellent Sing, 1977[8]. It was also observed that Azolla as a thick rug on rice field can suppress the weeds of crop field. Singh, 2000[9].

IV. CONCLUSSION

In this present study, it was observed that when a very small quantity of *Azolla pinnata* R.Br. was added to the soil, the status of soil in relation to its nutritional content was found to be enhanced. *Azolla* has been known to influence the soil health as well as helps in maintaining the soil microflora including nitrogen fixing bacteria which inhabits symbiotically for sustainable agriculture production. It has tremendous potential to enrich the soil organic matter. From the result of this investigation, it is concluded that *Azolla pinnata* R.Br. can be a potent organic fertilizer for nutritive crop production.

ACKNOWLEDGEMENT

We are thankful to Centurion University of Technology and Management for providing lab facility during the investigation.

REFERENCE

1. Voegelan, A., Barmetter, K. and Kratzscmar, R. (2003). Heavy Metals Release From Contaminated Soils, Comparism Of Column Leaching And Batch Extraction Results. Jour. Env. Qual., 32, 865 – 875.
2. Kannaiyan, S. (1997). Summary Report Presented in the 2nd Meeting of EEC Project at Kings College, London. "On the use of immobilized cyanobacteria for continuous ammonia fertilization in rice production".
3. Kannaiyan, S. and Kalidurai, M. (1995). Nitrogen Fixing Potential of Stem Nodulating Sesbania Rostrata And Its Effect On Rice Yield. Ric. Manag. Biotech., 173–195.
4. Galal, Y.G.M. (1997). Estimation Of Nitrogen Fixation In An Azolla-Rice Association Using The Nitrogen-15 Isotope Dilution Technique. Biol. and Fert.of Soils., 24, 76-80.
5. Saeed, G. and Rafiq, M.(1980). Government of pakisthan, Ministry of food and agriculture, soil survey Pakisthan, Lahore.Technical guide for the chemical analysis of soil and water, Bulletin no.14.
6. Arzoo, A. and Satapathy K.B. (2017). A Review On Sources Of Heavy Metal Pollution And Its Impacts On Environment. Inter. Jour. Curr. Advc. Reas., 6 (12), 2319-6505.
7. Arzoo, A., Nayak S.K., Mohapatra A. and Satapathy K.B. (2014). Impact of Nickel On Germination Seedling Growth And Biochemical Changes Of Macrotyloma Uniflorum (Lam.) Verdc. Inter. Jour. Bio., 5 (9), 321-331.
8. Sing (1977). Multiplication And Utilization Of Fern *Azolla* Containing Nitrogen Fixing Algal Symbiont As Green Manure In Rice Cultivation. Rizo., 46, 642-644.
9. Singh, Y.V. and Mandal, B.K. (2000). Rate Of Mineralization Of Azolla Other Organic Materials And Urea In Water Logged Soils Tropical Agriculture (Trinidad)., 77(1), 119-122.

Table-1 Different Elements/compounds present in *Azolla pinnata* R.Br.

Elements/Compounds	Unit	Concentration
SiO_2	%	8.141±0.0073
P_2O_5	%	4.919±0.0057
SO_3	%	3.720±0.0058
Cl	%	20.49±0.0065
K_2O	%	17.410±0.0057
CaO	%	37.624±0.0063
TiO_2	%	0.622±0.0043
MnO	%	1.461±0.0052
Fe_2O_3	%	5.159±0.0067
ZnO	%	0.3302±0.2199
Eu_2O_3	%	0.143±0.06
ZrO_2	%	0.006±0.001
Elements/Compounds	Unit	Concentration
V_2O_5	ppm	571.1±2.82
NiO	ppm	202.5±1.82
CuO	ppm	479.3±2.08
As_2O_3	ppm	21.2±0.08
Br	ppm	386.2±1.22
SrO	ppm	323.8±1.46
PbO	Ppm	23.8±0.06
CO_2	Ppm	0.0±0.00

Published By:
Lattice Science Publication

Table-2 Major Elemens/compounds present in garden soil and garden soil treated with *azolla pinnata*:-

Elements/compounds	Unit	Initial concentration	Final concentration
Al_2O_3	%	16.850±0.005	15.645±0.0291
SiO_2	%	67.203±0.003	53.21±0.065
P_2O_5	%	1.026±0.004	2.830±0.005
K_2O	%	2.261±0.004	3.071±0.004
CaO	%	4.236±0.003	6.758±0.004
TiO_2	%	0.535±0.003	0.72±0.055
MnO	%	0.134±0.003	1.194±0.002
Fe_2O_3	%	5.204±0.003	5.081±0.007
ZrO_2	%	0.124±0.003	0.108±0.002
SO_3	%	0.00	0.149±0.003
Cl	%	0.00	0.114±0.003
ZnO	%	0.00	0.008±0.001
Eu_2O_3	%	0.00	0.004±0.001

Table-3 Minor Elements/compounds present in final soil by application of Azolla pinnata R.Br and garden soil(initial):-

Compound/elements	unit	Initial concentration	Final concentration
V_2O_5	ppm	662.3±2.426	581.0±1.125
Cr_2O_3	ppm	2.271±0.089	2.081±0.024
NiO	ppm	553.0±1.324	371.6±0.28
CuO	ppm	336.8±1.286	407.4±1.65
ZnO	ppm	193.9±0.82	150.3±0.63
Ga_2O_3	ppm	74.6±0.68	51.5±0.08
As_2O_3	ppm	102.2±1.28	61.2±0.05
Rb_2O	ppm	147.8±1.42	140.4±1.23
SrO	ppm	32.9±0.86	158.5±1.59
Y_2O_3	ppm	13.4±0.08	11.3±0.61
Nb_2O_5	ppm	136.8±1.24	73.5±0.53
SnO_2	ppm	132.6±0.98	103.7±1.29
Eu_2O_3	ppm	37.6±0.82	35.6±1.49
IrO_2	ppm	95.4±1.38	48.6±0.02
PbO	ppm	673.4±1.42	330.1±1.70
ThO_2	ppm	48.9±0.64	43.5±0.58
CO_2	ppm	7.1±0.08	3.318±0.025
Re	ppm	35.4±0.62	17.6±0.63

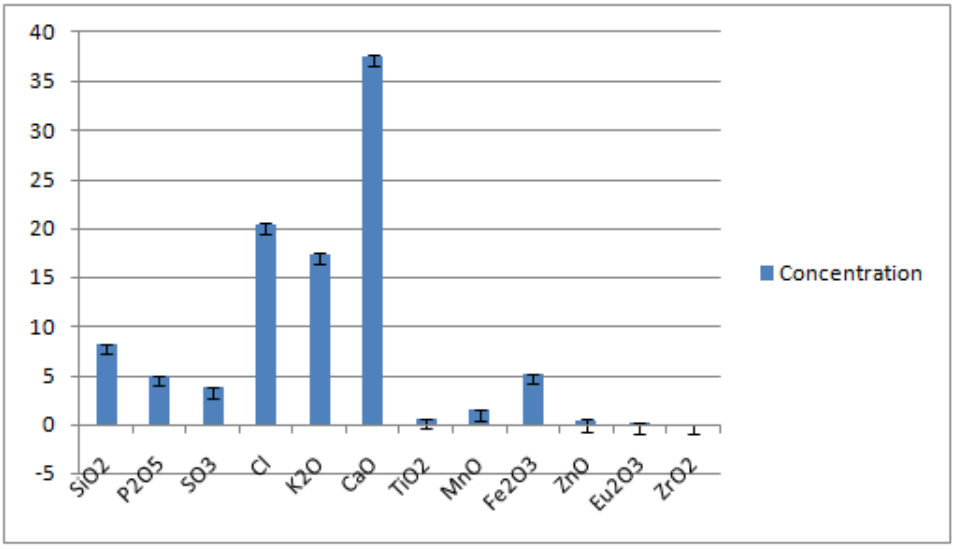

Fig 1: Diffrenet major elements present in *Azolla pinnata* R.Br.

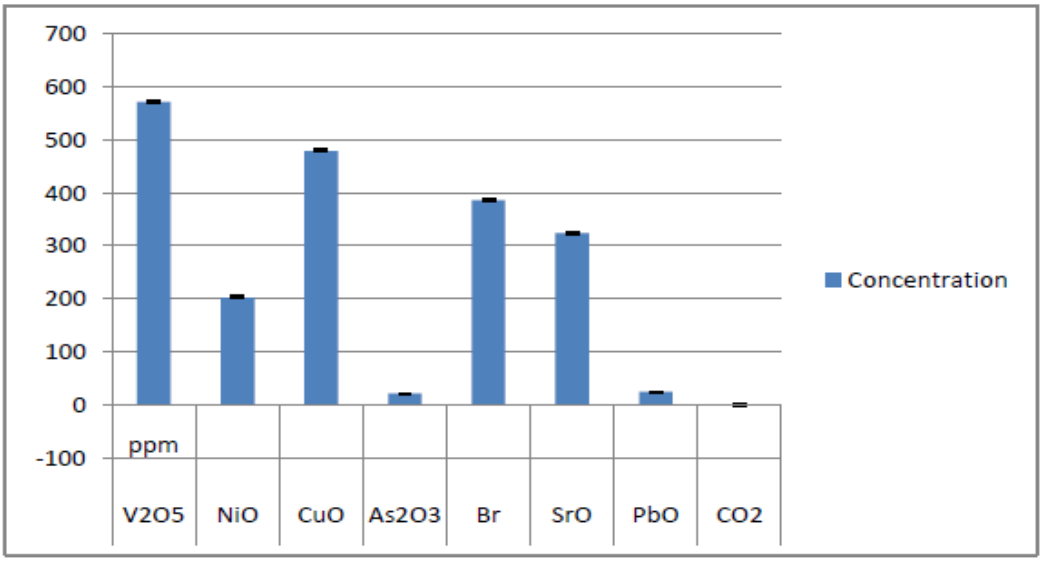

Fig 2: Diffrenet minor elements present in *Azolla pinnata* R.Br.

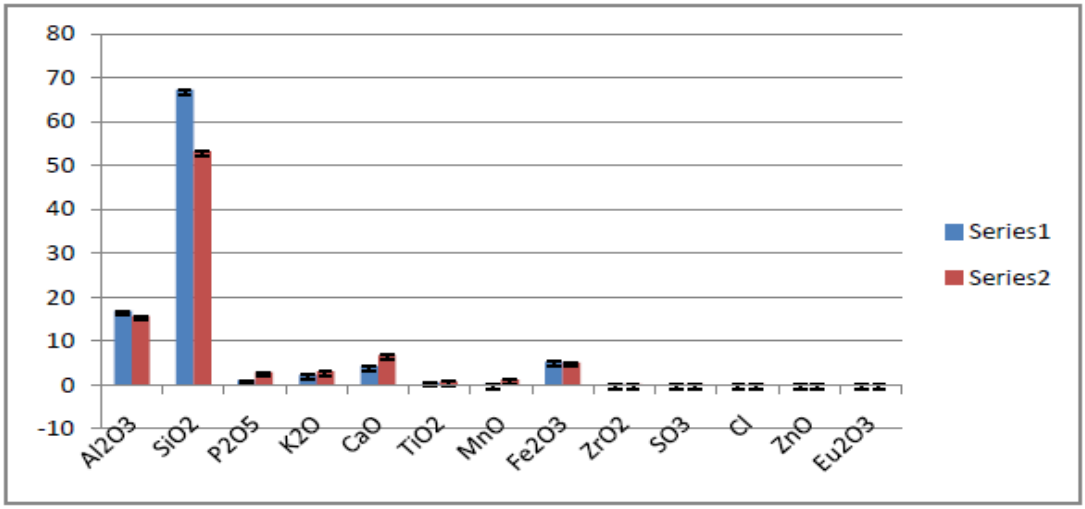

Fig 3: Major Elements present in garden soil and garden soil treated with azolla pinnata:-

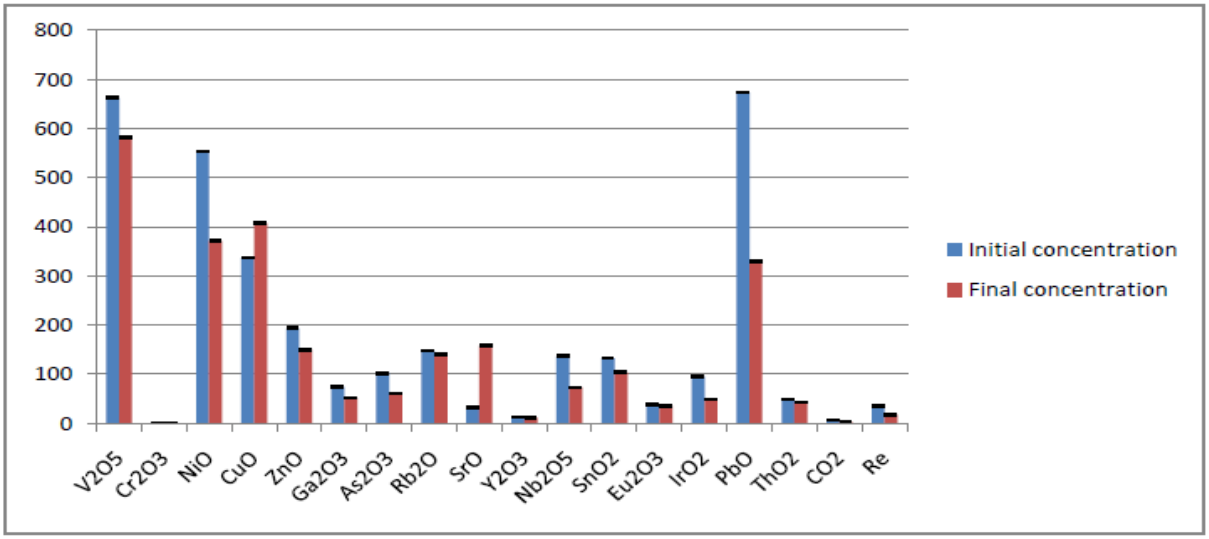

Fig 4: Minor Elements/compounds present in final soil by application of Azolla pinnata R.Br and garden soil (initial):-