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ASSESSMENT OF SOIL FERTILITY AND YIELD PRODUCTION OF PADDY CROP THROUGH BIO FERTILIZER

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Abstract- The experiment has been done to assess soil fertility and increase the yield of rice production through Bio fertilizer. The plant height of rice variety Sarjoo-52 was significantly influenced by Azolla and N fertilizer. Bio-fertilizers like Azolla 0.2 kg/m^2 + 50% N and P_2O_5, K_2O recommended dose of paddy crop in T_4 treatment plot is better response the other treatments plot. In this plot highest plant height 98.35 cm, number of tiller/hill 18 and grain yield 12.37% increase over all the treatment. Azolla increases the rice productivity but also improves the long term soil fertility and contributes 40-60 kg N/ha per rice crop. The value for soil N, soil OM, bulk density and porosity of the soil were found to be increased simultaneously for Azolla treatments. Application of Azolla enhances the soil nutrients availability by their biological activity in particular and helps build up the micro flora.

Key words- Bio fertilizer, Azolla, Rice, Yield and Soil fertility.

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Introduction

Rice (*Oryza sativa*) is the world's second most important cereal and is the staple food for over one third of the world's people [6]. Rice is the staple food for 2.5 billion people and growing rice is the largest single use of land for producing food, covering 9% of the earth's arable land.

Azolla is a small aquatic fern of demonstrated agronomic significance in both developed and developing countries [1,4,10,23]. Azolla a floating fern, found in temperate climate suitable for paddy cultivation. The fern appears as a green mat over water. The Blue Green Algae cyanobacteria (Anabaena, azollae) present as a symbiotic with this fern in the lower cavities actually fixes atmospheric nitrogen. Bio fertilizers keep the soil environment rich in all kinds of micro- and macro-nutrients via nitrogen fixation, phosphate and potassium solubilisation or mineralization, release of plant growth regulating substances, production of antibiotics and biodegradation of organic matter in the soil [20].

Azolla is a fern of agronomic importance due to its ability to fix atmospheric nitrogen [11,17]. Azolla in its leaf cavities helps in nitrogen fixation and in turn increases soil organic content in terms of total nitrogen after death of the Azolla plant. [24], Reports are available to support its role as an animal feed, [21] in hydrogen production, [13] and as a bio fertilizer [16,17,19].

The important factor in using Azolla as a biofertilizer for rice crop is its quick decomposition in soil and efficient availability of its nitrogen to rice plant. Incubation of Azolla as green manure in water logged soil resulted in rapid mineralization with a release of 60-80% of the nitrogen within two weeks [12]. Azolla is used to increase soil fertility. [14] found that Azolla application improves soil fertility by increasing total nitrogen, organic carbon and available phosphorus in soil these findings were supported by [6,15]. [3] Found that Azolla improves soil structure.

It is in view of this that the current study aimed increase of soil fertility and yield production of paddy crop through biofertilizer.

Material and Method

The azolla chosen were for the experiments because biofertilizers are supposed to be safe alternative chemical fertilizers to minimize the ecological disturbance. Biofertilizers are cost effective, eco-friendly and when they are required in bulk, can be generated at the farm itself. Azolla fix nitrogen up to 40-60%. They improve soil texture, pH, and other properties of soil [1].

Preparation of Azolla

The area selected for Azolla nursery should be partially shaded. The convenient size for Azolla is 10 feet length, 2 feet breadth and 1 feet depth. The nursery plot is spread with a polythene sheet at the bottom to prevent water loss. Soil is applied to a depth of 2 cm and 1 gram of super phosphate is applied along with 2 kg of cow dung in the nursery for quick growth.

Inoculation of Azolla in Paddy Crop

The experiment was conducted in the Department of Botany, University of Allahabad, UP, India during the 22 June-15 October 2014. The trial was laid out RBD using three replication have until plot size 4.0×2.5 m^2, 20 cm row to row space and 15 cm plant to plant distance.

The treatments were;

T_1 = control.
T_2 = 0.1 kg/m^2 + 75 % N.
T_3 = 0.1 kg/m^2 + 50 % N.
T_4 = 0.2 kg/m^2 + 50 % N.
T_5 = 0.3 kg/m^2 + 50 % N.

All the treatment P_2O_5 50 kg/ha and 50 kg/ha K_2O, thirty day old seedling of Sarjoo-52 variety were transplanted in the experiment plot was filled with water up to 4-6 cm depth and Azolla was inoculated at 7 DAT. Plant height grain yield and straw yield were recorded plot wise.

Soil fertility evaluation techniques

There are three type of soil fertility evaluation technique used in this experiment:

Nutrient deficiency symptoms

The appearance of a plant, nutrient deficiency symptoms can be a very powerful diagnostic tool for evaluating the nutrient status of plants. The principal advantages of visual diagnostic symptoms are that they are readily obtained; can provide an immediate indication of nutrient status and where the symptoms do not require confirmation, no apparatus of any kind is necessary, the basic theoretical knowledge of nutrients deficiencies as described in [Table-1].

Table-1 *Nutrient Deficiency Symptoms in Plants*

Nutrient	Color change in lower leaves
N	Plant light green, older leaves yellow
P	Plants dark green with purple cast, leaves and plants small
K	Yellowing and scorching along the margin of older leaves
Mg	Older leaves have yellow discolouration between veins finally reddish purple from edge inward
Zn	Pronounced interveinal chlorosis and bronzing of leaves

On the basis of paddy yield per plot in experiment:

The Soil fertility was evaluation the response of paddy crop yield per plot. The response is measured in terms of 'percent yield or percent yield increase. Both represent the ratio of the yield obtained in unfertilized soil (nutrient limiting deficient soil) to the yield in fertilizer nutrient applied soil (non-limiting or nutrient sufficient soil).

On the basis of review of literature:

I have study of research paper related to azolla, enhance the soil fertility and which information i.e. improve soil structure, increase the water holding capacity, value of soil N and organic matter improve by application of azolla etc description in result and discussion on the basis of review research paper. Also applied the mean ± sd on the plant height of different treatment plots depicted in [Table-2].

Table-2 *Effect of Azolla with NPK different concentration on paddy growth and yield production*

Treatment No.	Plant height at randomly (cm)			Mean± SD	No. Tiller/ Hill	Wt of 1000 grain (g)
	P1	P2	P3			
T_1	93.50	93	95.50	94±1.32	13	20.2
T_2	94.60	95.50	93.90	94.66±0.80	15	21.9
T_3	96.94	95.98	96.40	96.44±0.48	17	22
T_4	98.90	97.75	98.40	98.35±0.58	18	23.3
T_5	97.15	97	96.85	97±0.15	16	21.5

Result

The results were obtained to soil fertility and increase the yield of rice production through Bio fertilizer. The plant height of rice variety Sarjoo-52 was significantly influenced by Azolla and NPK fertilizer [Table-2], which range from 94 to 97 cm. The highest plant height were obtain 98.3 cm, number of tiller/hill 18 and grain yield 23.3g wt of 1000 grain in T_4 treatment used azolla 0.2 kg/m^2+50% N fertilizer.

The result was obtained from azolla, increase the soil fertility, soil productivity and increase paddy yield 12.37% is better response over all treatment plot in [Table-3].

Discussion

The result indicate that the highest plant height of 98.35 cm, amount of grain yield (wt of 1000 grain) 23.3 gm and number of tiller/hill 18 was recorded in T_4 plot with the treatment of Azolla 0.2 kg/m^2+50% N.

Whereas plant height 94 cm, number of tiller/hill 13 and wt of 1000 grain 20.2 gm in control T_1 treatment with the recommended dose of NPK of paddy crop. In T_2 treatment plant height 94.66 cm, number of tiller/hill 15 and grain yield (1000 grain wt) 21.9 gm with the treatment of azolla 0.1 kg/m^2+75% N. In T_3 plant height 96.44 cm, amount of grain yield 22 gm, number of tiller/hill 17 with the treatment of 0.1 kg/m^2 azolla+50% N. T_5 plot plant height 97 cm, number of tiller/hill 16 and amount of 1000 grain wt 21.5 gm with the treatment of 0.3 kg/m^2 azolla+50% N. The performance of 0.2 kg/m^2 azolla with 50 % N T_4 treatment was found significantly better response over the recommended dose of fertilizer. The nitrogen fixing capacity of Azolla has been estimated to be 1.1 kg N/ha/day and this fixed nitrogen is sufficient to meet the entire nitrogen requirement of rice crop within a few weeks [10].

Table-3 *Effect of Azolla with NPK different treatment on paddy grain yield increase percentage over the control*

Treatment No.	Wt of 1000grain (g)	Yield Percentage	Increase (%) Over the Control
T_1	20.2	100	00.00
T_2	21.9	108.41	8.4
T_3	22	108.91	8.91
T_4	22.7	112.37	12.37
T_5	21.7	107.42	7.42

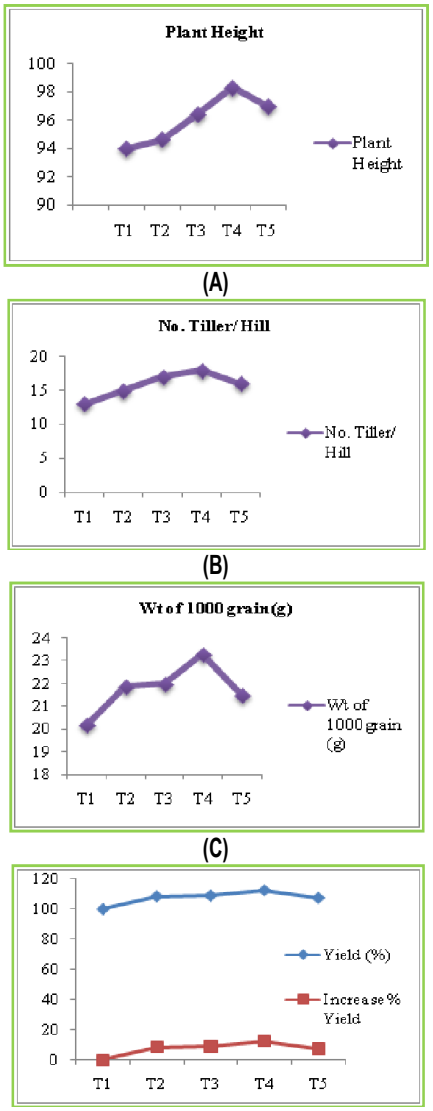

Fig- [A]: Plant Height [B]: No. of Tiller/Hill [C]: Wt of 1000 Grain gm [D]: Yield % and Increase Yield % over the Control of Paddy Yield Production.

Azolla is of great agronomic value for rice crop where it is used as dual crop with rice and contributes 40-60 kg N/ha per rice crop. Azolla forms an economical and eco friendly bio fertilizer, which provides unseen benefits in terms of carbon and nitrogen enrichment of soil and overall improvement in soil/crop management practices and fertility status [8]. Improve soil fertility through Azolla. [3] Found that Azolla improves soil structure. [9] Stated that after its decomposition, humus is formed which increases the water holding capacity of the soil and promotes aeration and drainage. The value for soil N, soil OM, bulk density and porosity of the soil were found to be increased simultaneously for Azolla treatments. Azolla has low C:N ratio, therefore it is mineralized more faster than other species [22] and supply nitrogen to the crop plant. It also contributes to the supply of Phosphorus, Potassium, Sulfur, Zinc, Iron and Molybdenum in sufficient amounts in addition to other micronutrients besides addition of Nitrogen. Similarly, the soil biological health due to application of Azolla has resulted in improving mineralization and consequent increase in the soil microbial status [25].

Soil fertility is influenced by the humic substances formed during the decomposition of Azolla [2]. Application of Azolla enhances the soil nutrients availability by their biological activity in particular and helps build up the micro flora.

Conclusion

Bio fertilizer application in rice field is better response of rice yield production and soil property, soil fertility status is maintain by azolla 0.2 kg/m^2+50%N. Application of Azolla has been found to improve the significant for soil Nitrogen and Organic matter which directly help for improving the soil fertility. Azolla is of great agronomic value for rice crop where it is used as dual crop with rice and contributes 40-60 kg N/ha per rice crop.

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