International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Research Gate Impact Factor (2018): 0.28 | SJIF (2018): 7.426

Use of Chemical Fertilizers in Rice Cultivation in Fertile Alluvial Region of North Bengal Plain: A Present Scenario of the Raiganj CD Block, Uttar Dinajpur, West Bengal, India

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Abstract: ***Use of chemical fertilizers in agriculture is now become a common trend to the farmers. Without testing the soil, farmers often applied a huge amount of fertilizers for the greed of more production. Rich fertile alluvial soil, gentle slope, humid tropical climate and abundant rainfall in the study area encourages the cultivation of rice as a major crop here. Now-a-days, rice cultivars of this area do not show any interest in the cultivation of the traditional rice varieties, rather they show interest in the cultivation of HYVs of rice by using a huge amount of chemical fertilizers. Without understanding the soil nutrient requirement, they applied more and more fertilizers to increase the yield of rice. Even they applied fertilizers to such traditional rice varieties which do not require any fertilizers. Intensive field survey in the rice fields and interview with the rice cultivars reveals the facts that use of these fertilizers, though increased the yield of rice in its initial stage, but at present the yield of rice as well as fertility of soil is lessening day by day. The aromatic quality of the famous indigenous Tulaipanji rice of this area is also decreases because of the use of chemical fertilizers. High value of pH is found when the testing is done on the water samples of the waterlogged rice fields and surrounding ponds. This study attempts to focus on the extent of the use of chemical fertilizers in rice cultivation in the rich alluvial fertile land of the study area and also highlight its ongoing impacts. Testing of the soil of the rice field in regular basis and cultivation of only selected high yielding and traditional rice varieties in organic way will be the better choice to reduce the adverse effect of the fertilizers.***

Keywords: Chemical Fertilizers, Fertile, Alluvial Region, Rice Varieties, Indigenous, HYV.

1. Introduction

Rice is the staple food grain of India and is cultivated on 0.44 million hectares of land almost throughout the year. Presently more than 90% of rice cultivation is being done using high yielding variety only [1]. In Raiganj CD Block of Uttar Dinajpur District, West Bengal, more than 85% of the total area is under the cultivation of rice. Nearly 95% of this total rice cultivation is being done using HYVs and the rest 5% by local aromatic rice variety, named Tulaipanji [2]. The rich fertile alluvial land of Raiganj CD Block of Uttar Dinajpur District was once very famous for its own indigenous rice diversity. Farmers only used organic manures to cultivate those indigenous, aromatic and non-aromatic rice varieties [3]. But now-a-days, farmers are focusing more on the cultivation of HYVs of rice in place of indigenous rice because of their higher productivity rate. Farmers use a high amount of fertilizers to cultivate these high yielding varieties [4]. Fertilizer materials are classified into three major groups on the basis of the nutrient supplied: those supplying (a) nitrogen, (b) phosphorous, or (c) potassium [5]. No doubt that chemical fertilizer boosted the crop production more than our imagination[6]. Fertilization increases efficiency and obtains bette quality of product recovery in agricultural activities [7]. Though the soil of the study area is alluvial in nature, rich enough with micronutrients and organic carbon for the cultivation of rice, yet, farmers of this area using chemical fertilizers in a improper way without testing the soil and without understanding the soil nutrient requirement. This over-dependency on fertilizers not only damaging the soil fertility and crop productivity but also affecting the soil health and surface water quality on that agricultural field directly.

It is, therefore, suggested that efforts should be made towards deeper understanding of inherent potentials as well as limitations of soil and designing the farming strategies accordingly [8]. Besides this, focusing on high yielding traditional rice variety is also an important step to reduce the dependency on fertilizers. Thus, this study attempts to highlight the present scenario of the use of chemical fertilizers in rice cultivation in this fertile alluvial dominated region and also focused its current adverse effects.

2. Study Area

Raiganj (25°31'31" N to 25°50'04" N and 88°01'20" E to 88°14'09" E) is situated in the Tal plain area of North Bengal Plain which comes under Tista Flood Plain of the lower Ganga Plain [9]**.** It comprises a total geographical area of 472.13 km^2. It has 14 gram panchayats, 222 mouzas and 221 inhabited villages. On the North, this block is bounded by Bangladesh and in the west by Bihar. Part of the west is also bounded by Karandighi block, eastern part by Hemtabad and Kaliaganj block and the whole southern part by Itahar block of Uttar Dinajpur district.

As per the 2011 Census of India, Raiganj CD Block had a total population of 4,30,221, of which 4,14,143 (96.26%) were rural and 16,078 (3.74%) were urban. The population density of this area is 910 persons per sq. km.

The region is flat in general with a very gentle slope from North to South as a result of which the rivers generally have

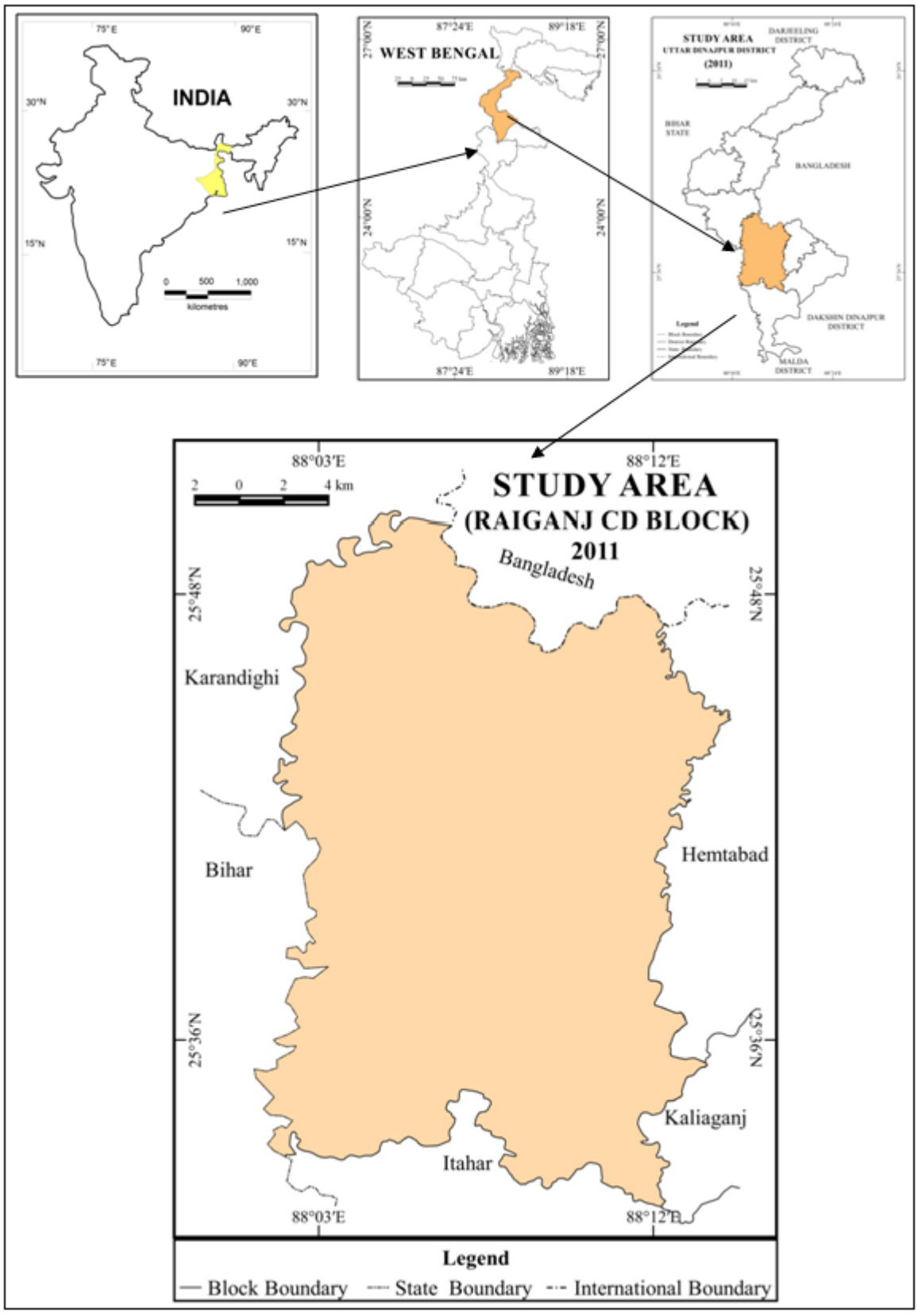

Figure 1: Map showing the Study Area
Source: NRDMS Map, P.S Map of Raiganj & Itahar and compiled by the Author

the same direction. Nagar, Kulik is the main rivers of the area. The average temperature ranges between 24°C in summer and 10°C in winter. Average annual rainfall is found 150-200cm.

The soil of the study area may be classified as old alluvium, alluvium and new alluvium. The texture of old alluvium varies from stiff clay to clay loam. The soil is deep and in reaction neutral to slightly acidic. Because of the fertile alluvial soil, agriculture is the main economic activity in this region. Rice is the main food crop here. This block is mainly

famous for two things. One is the indigenous aromatic rice Tulaipanji and another is Raiganj Wildlife Sanctuary (also popularly known as Kulik Bird Sanctuary) [10].

3. Objectives

The main objective of this paper is to focus the extent of the use of chemical fertilizers in cultivation of different variety of rice and to highlight the current impacts of these fertilizers.

4. Database and Methodology

The present study is empirical in nature. It is mainly based on primary observation means field survey, though secondary data is also collected from different sources whenever needs. Both quantitative and qualitative data are taken into consideration. Block has been taken as a unit of study. Frequent field visit is conducted during different phases of rice cultivation throughout the year. Interview of farmers is also taken during the survey. Multi-Parameter PCSTestr™ 35 device is used to measure the pH, EC, TDS and Salt of the waterlogged rice field. The water quality of the ponds and other water bodies surrounding the rice field are also measured with this instrument. The study area is mapped using the QGIS software which is based on the P.S. map of Raiganj and Itahar block collected from Directorate of Land Record and Survey Office, Alipore, Kolkata. Simple statistical calculations and diagrams are done using MS-Excel. Based on these, further reports are made for suggestion.

5. Results and Discussion

The study finds that the rice cultivars of the study area mainly cultivate the rice varieties namely Swarna, BBR 1000 & 1100, 40-94 etc. at present.

Photo 1: Author in Paddy Field with the Rice Cultivars

These are all high yielding varieties and a high amount of chemical fertilizers, mainly N-P-K composition, DAP, Urea and Potash are used for their cultivation. For quick growth of the paddy plants, use of urea is done near about 57% of the total fertilizers.

Figure 2 is showing the sharing of commonly used fertilizers in the following diagram.

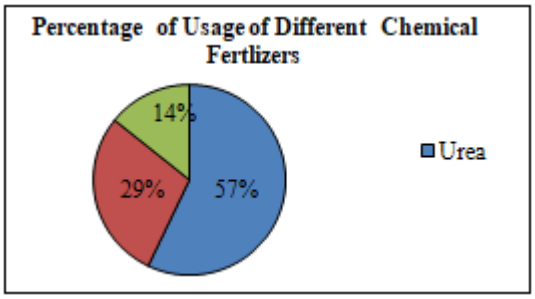

Figure 2

Besides this, famous indigenous aromatic rice named Tulaipanji is also cultivated here in various scattered parts of the study area. Though, cultivation of this rice variety requires no chemical inputs, but yet farmers are using low to medium amount of chemical fertilizers during its cultivation. Urea and NPK composition is largely used by the farmers of the study area for the quick growth of the paddy plants and for better health of the paddy plants. DAP is used to increase the soil pH after a few weeks of plant growth.

Figure 3 is showing the usage of different fertilizers for different variety of rice in the following diagram.

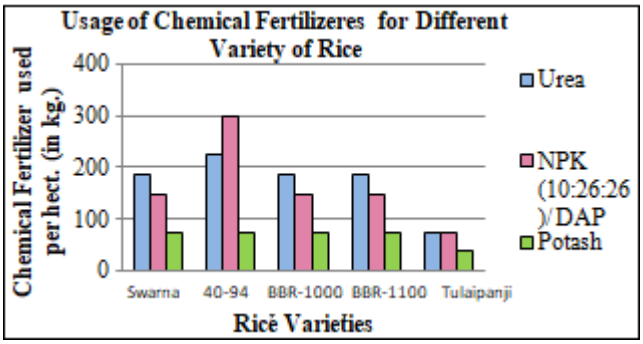

Figure 3

Farmers are applying these fertilizers in different stages of rice cultivation: at the time of preparation of rice field means before the plantation, after 3-4 weeks of plantation. Near about 60-70% of the fertilizers are used at the time of field preparation to make the soil more productive. Rest of the sharing of the fertilizers is used after 3-4 weeks of plantation to improve the health of the paddy plants **(Figure 4).**

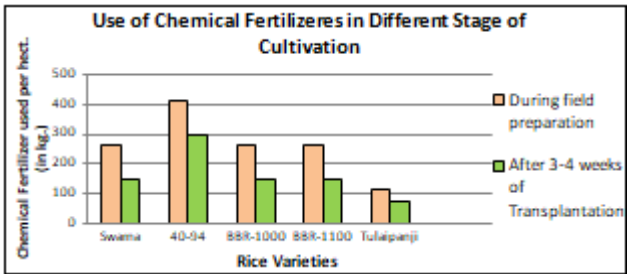

Figure 4

The highest amount of fertilizers is applied in the field of 4094 rice (598kg/hect.), followed by Swarna, BBR 1000 and BBR 1100 (411kg./hect). Low to medium amount (187kg./hect.) of fertilizers are also applied in indigenous Tulaipanji field.

Fig. 5 is showing the rice variety wise usage of different fertilizers in the following diagram.

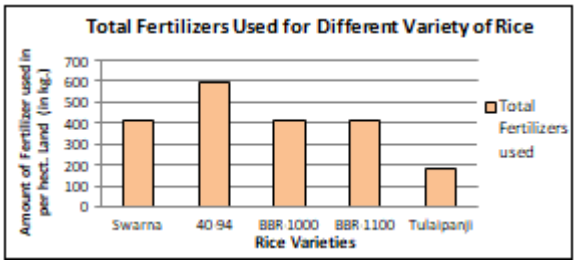

Figure 5

Water samples from different waterlogged rice fields whenever tasted after applying of chemical fertilizers, found very high pH value (>8.5) . The same high pH values are found in the surrounding ponds of the rice fields where the fertilizer-mixed solution of water mixed.

Photo 2: Testing of Waterlogged Rice Field Water

Photo 3: Multiparameter-used for Rice-Field Water Testing

The higher concentration of chemical nutrients in this water bodies increase the rate of eutrophication which adversely affects the pisciculture.

Photo 4: Eutrophication in Rice-Field Side Pond

Interview with the farmers (age group >50) reveals that the productivity of the HYVs are not as high at present as it was in its initial phase.

Photo 5: Author taking Interview of an aged Rice Cultivar

Earthworms, which were very common in the rice field, are not seen as it was seen before 3 decades. These earthworms play a very important role in maintaining the aeration process in between soil and water.

Photo 6: Aeration of Soil by Earthworms (In Rice field)

The aromatic quality of the indigenous Tulaipanji rice also become lessening due to the use of chemical fertilizers in

Tulaipanji rice field which decreases its market value and also farmers' interest of its cultivation [3].

6. Conclusion

Production, productivity and market value are three most important key factors which altogether control the mind of the farmers to cultivate any specific variety of rice. No doubt, farmers are discontinuing cultivation of traditional rice varieties because of the low yield but there have also some of traditional variety of rice that still have potentiality to give higher yield in comparison with the modern HYVs of rice [11]. The focus has to be given to such rice varieties which will give higher yield, but will require less to no chemical inputs. Tulaipanji is a type of traditional variety of rice which does not require any chemical inputs. The market value of it is 2.5 times more than that of any other HYVs of rice cultivated in this area [4]. Cultivation of this rice will be a better choice for the farmers of this area to avoid fertilizers and their adverse effects. Though, in some areas, culture of vermi-compost is being encouraged, but there should need more government efforts in case of providing manures and bio-fertilizers in least cost price. Supply of organic manure in an accessible price to the farmers by the local agricultural department will be an important step to avoid the applications of chemicals in the fundamental niche area of Tulaipanjji [12]. Training to the farmers for preparation of bio-fertilizers will be a significant step to avoid the dependency on chemical fertilizers. Organic farming, in one way can reduce the use of chemical fertilizers and in another way can improve the agricultural system more eco-friendly [13]. Seasonal soil testing of the rice fields is very necessary to understand the soil nutrient requirements. Use of inputs of right quantity and right quality in right time will ensure decline in crop losses and improvement in quality of produces [8].

7. Acknowledgement

The Author is thankful to his supervisor, Dr. Rumki Sarkar for providing him the Multi-Parameter PCSTestr™ 35 Device and guiding him in its use. The Author is also thankful to Mr. Pankaj Sarkar, Mr. Samrat Rishi, Mr. Pintu Das, Mr. Ashok Sharma, Mr. Habibur Rahman for their assistance during field survey.

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Author Profile

Sanjib Chakraborty has received his Bachelor and Master's degrees in Geography from The University of Burdwan and Pandit Ravishankar Shukla University, India in 2011 and 2013, respectively. He has also obtained Bachelor and Master's degrees in Education from The University of Burdwan and Rabindra Bharati University, India in 2014 and 2017, respectively. During 2016-2018, he played the role of a teacher in CBSE Schools and lecturer in Teachers' Training College. He was awarded Junior Research Fellowship (JRF) by University Grant Commission (UGC), India in 2017. Presently, as a Junior Research Fellow (JRF), he is continuing his Ph.D Research Work in the field of Agricultural Geography in the Department of Geography, Raiganj University, West Bengal, India. Till date, he has published 4 research articles (3 in different international journals and 1 in edited book volume). Besides this, he has also attended many workshops and national and international seminars related with his research area.