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RESEARCH ARTICLE

CONVERSION OF FUNDAMENTAL NICHE TO REALIZED NICHE: AN ANALYSIS OF INDIGENOUS TULAIPANJI RICE IN RAIGANJ CD BLOCK, UTTAR DINAJPUR DISTRICT, WEST BENGAL, INDIA

***Sanjib Chakraborty**

Ph.D Research Scholar, Department of Geography, Raiganj University, Uttar Dinajpur, West Bengal, India

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Corresponding author:
Sanjib Chakraborty

ABSTRACT

Tulaipanji is one of the oldest indigenous aromatic rice varieties in the physiographic division of the North Bengal plain of West Bengal, India. Raiganj CD Block of Uttar Dinajpur District, located in this physiographic division is very famous for the cultivation of this rice variety. Cultivation of this rice has been done in this natural habitat for more than 100 years back. Thus, this rice variety adapted itself in its microhabitat or niche. The fundamental niche of this rice was spread in major parts of the Raiganj CD Block. But the introduction of the cultivation of HYVs of rice mainly Swarna started to decrease the fundamental niche of Tulaipanji. Cultivation of Swarna requires very high chemical inputs which change the soil properties in such a way that badly affects the growth and aromatic quality of the Tulaipanji rice. As a result of which, the vast fundamental niche of this rice, converted into small restricted realized niche out of which cultivation of this rice become totally ignored. This study incorporates the using GIS and GPS techniques besides the intensive field study to delineate the niche zones. The main aim of this paper is to highlight the causes behind the conversion of the fundamental niche of the Tulaipanji rice to the realized niche in the study area as well as its further impacts.

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INTRODUCTION

The habitat of a species comprises the totality of the abiotic factors with which it interacts. The subdivision of a habitat is called a microhabitat. The specific environmental variable in the microhabitat is called microclimate or microenvironment (Dash, 1993). Joseph Grinnel (1917) coined the word 'niche' to denote the microhabitats where the organisms live. Charles Elton (1927) regarded the niche as the fundamental unit of an organism or a species population in the community. Kendeigh (1974) considered the niche as a combination of the habitat and biotic interactions of a species for its survival and continuance in a community. Hutchinson (1957) suggested that the niche could be visualized as a multidimensional space or hypervolume within which the environment permits an individual or species to survive indefinitely. Hutchinson (1965) also distinguished between the fundamental niche and the realized niche. Fundamental niches represent all the environmental conditions where a species is able to live, and the realized niche is where the species actually lives. In a fundamental niche, an organism can take advantage of all the biotic and abiotic factors in an ecosystem without competition from other species or pressure from predators. This niche narrows when other organisms arrive and there is competition for food and breeding partners or when predators start hunting in the area. The organism will survive if it adapts to the new conditions of its realized niche (https://biology dictionary.net/fundamental-vs-realized-niche/). Uttar Dinajpur district in West Bengal is the homeland of the aromatic rice landace Tulaipanji which is best suitably grown in the rainfed shallow lowland ecosystem under the agro-climatic zone-Gangetic alluvial zone of West Bengal (Adhikari *et al.,* 2011). Most of Tulaipanji cultivated land of the district comes under the Raiganj CD block. The history of cultivation of this rice is more than a century ago. Tulaipanji generally requires no chemical inputs and its cultivation practices do not harms the soil of the agricultural field whether HYV Swarna requires a huge amount of chemical inputs which badly affects the soil health of the agricultural field. The cultivation of Tulaipanji do not harms the traditional rice diversity and the cropping pattern whether Swarna damages the both. The selling price of Tulaipanji paddy is 2.5 times more than that of Swarna. Before the introduction of HYVs of rice in this area, the fundamental niche of this rice was spread in a vast area of this block. But now-a-days it is seen that the fundamental niche of this rice become restricted into a few pockets and Swarna occupying its

niche zone. As a result of which, the vast fundamental niche of Tulaipanji is converted into small restricted realized niche out of which cultivation of this rice become totally ignored. Both from ecological and economic perspective, existence of Tulaipanji is more significant instead of HYV swarna. This paper attempts to find out the causes behind the conversion of fundamental niche of Tulaipanji to realized niche in the study area and evaluate the impacts of this niche conversion.

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 (Singh, 1993)**.** 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 430,221, of which 4,14,143 (96.26%) were rural and 16,078 (3.74%) were urban.

There were 221,738 (52%) males and 208,483 (48%) females. Scheduled Castes numbered 163,662 (38.04%) and Scheduled Tribes numbered 27,785 (6.46%). 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 the same direction. Nagar, Kulik is the main rivers of the area. The average temperature ranges between 24□ in summer and 10□ 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) (District Census Handbook, Uttar Dinajpur, 2011).

Objective: The main objectives of this paper is to find out the causes behind the conversion of fundamental niche of Tulaipanji to realized niche in the study area and to evaluate the impacts of this niche conversion.

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. After completing the literature review of the concerned topic, the study area is mapped using the QGIS software based on the P.S. map of Raiganj and Itahar block. Intensive field visits are done in the presently Tulaipanji cultivated areas and their administrative locations as well as geographic locations and areas are also captured using GPS. Delineation of the fundamental and realized niche is also done based on the field survey and interviews conducted with the Tulaipanji cultivators. Simple statistical calculations and diagrams are done using MS-Excel and further mapping works are done using QGIS software. Based on these, further reports are made for suggestion.

Fundamental Niche of Tulaipanji: Fundamental niches of Tulaipanji represent all the environmental conditions where it is able to live, Intensive field survey and door to door survey with the Tulaipanji farmers (mainly 50 and above aged farmers) help to delineate the natural habitat as well as fundamental niche of this rice variety throughout the entire block. In this fundamental niche, Tulaipanji was grown without any competition with other indigenous rice varieties. Seasonally and spatially, the cropping system was so stable that Tulaipanji has never faced any competition with the other crops also.

Realized Niche of Tulaipanji: The fundamental niche of Tulaipanji started to become narrow when farmers started to introduce the cultivation of HYVs of rice (mainly Swarna) which is suitable in the rainfed shallow lowland ecosystem in the study area. Yet Tulaipanji is surviving in this new condition, but its vast fundamental niche area now changed into restricted realized niche out of which its cultivated area is very negligible. Figure 2 shows the fundamental and realized niche of Tulaipanji.

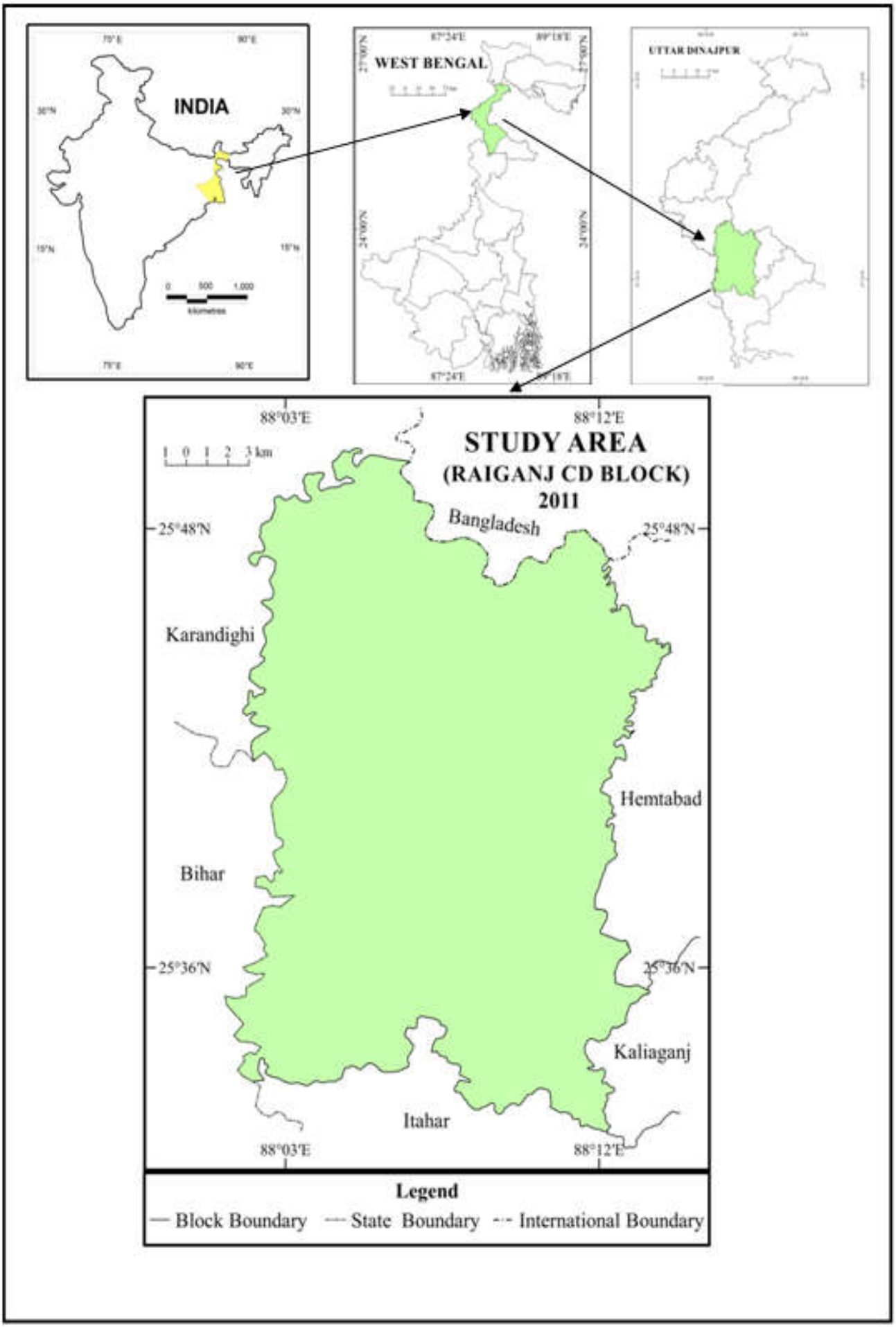
Causes behind the conversion of Fundamental Niche to Realized Niche

Spatio-temporal factor with yield comparison: Before the introduction of HYVs of rice, Tulaipanji was cultivated in a vast area of the study area. But due to the increasing demand of food because of population explosion, farmers started to show interest on HYVs of rice. Swarna is such type of HYVs of rice, which has already adapted itself in the rainfed shallow lowland ecosystem in the study area. It is cultivated in the same time and in the same field of Tulaipanji. As Swarna gives more than twice yield than Tulaipanji, so that farmers ignore the cultivation of Tulaipanji. Thus the fundamental niche of Tulaipanji is occupied by the HYV Swarna. (Photo 2).

Loss of adaptation power due to chemicals: It requires a huge amount of chemical inputs during its cultivation, which badly affect the natural health of soil. Tulaipanji cannot tolerate chemical inputs. Its growth (grain size) and aromatic quality is badly affected by chemical inputs. If Tulaipanji is cultivated again in the field of Swarna, that time the aromatic quality as well as productivity of Tulaipanji becomes less than its previous cultivation. Because of this, farmers ignore to cultivate Tulaipanji in the field of Swarna.

Gain factor and realized niche: Though Swarna's yield is more than twice of Tulaipanji but because of the stable aroma, the market price of Tulaipanji is more than 2.5 times than Swarna. So that, the aged farmers are yet traditionally cultivating Tulaipanji. But this cultivated area is very restricted.

Effects of the conversion: Human interference effecting very much the competition of HYV Swarna and Indigenous Tulaipanji. Tulaipanji fields are now replaced by the Swarna and its fundamental niche area is compressing every year and now it is restricted in limited areas in the form of realized niche. This competition creates a threat to the existence of Tulaipanji from this zone. No doubt it is a loss both from ecological and economic viewpoint. The cropping sequence of this area is followed by Jute, Tulaipanji and mustard which are all commercially helpful for the farmers associated with this cultivation.



Source: NRDMS, P.S. Map of Raiganj and Itahar and compiled by the Author

Fig. 1. Map showing the study area

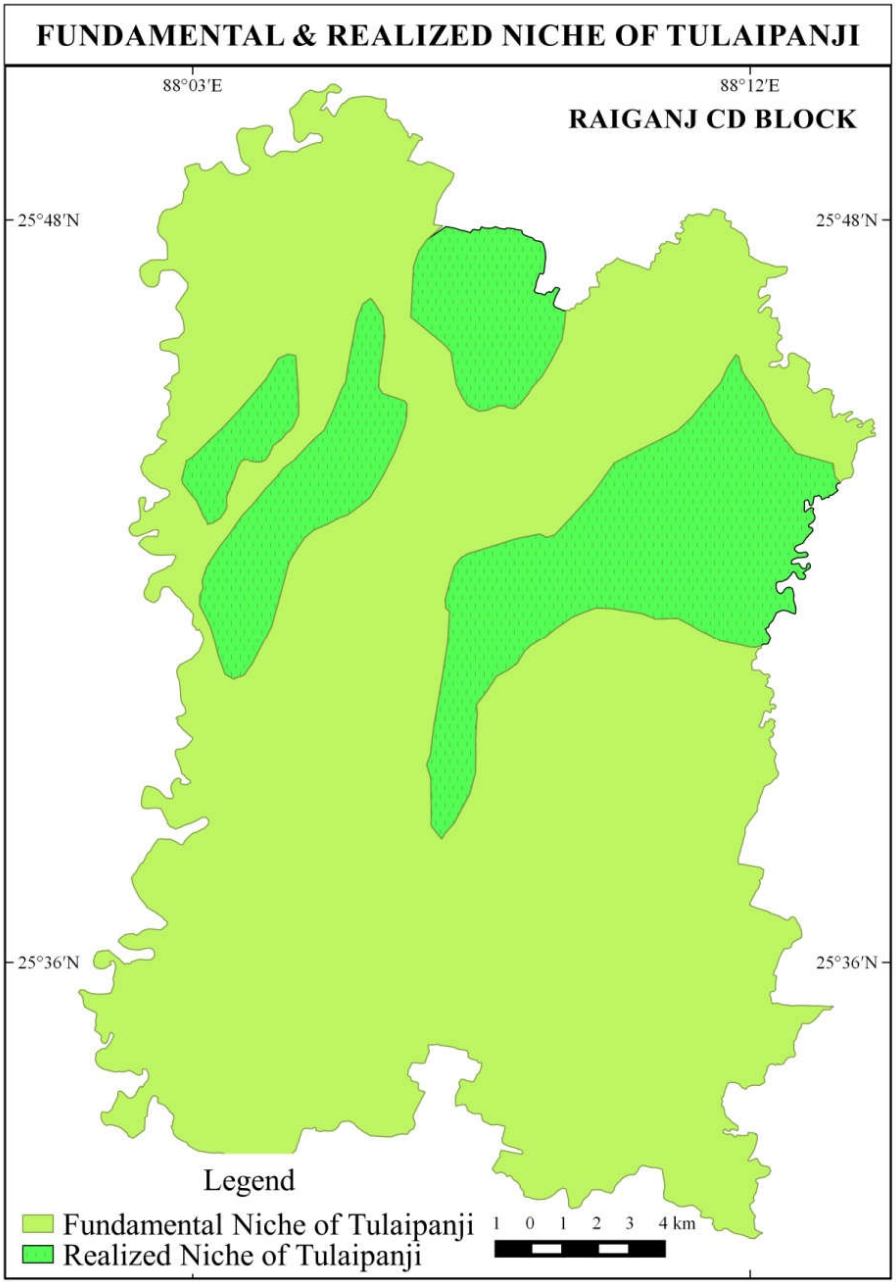


Fig. 2. Map showing the fundamental and realized niche of Tulapanji rice variety

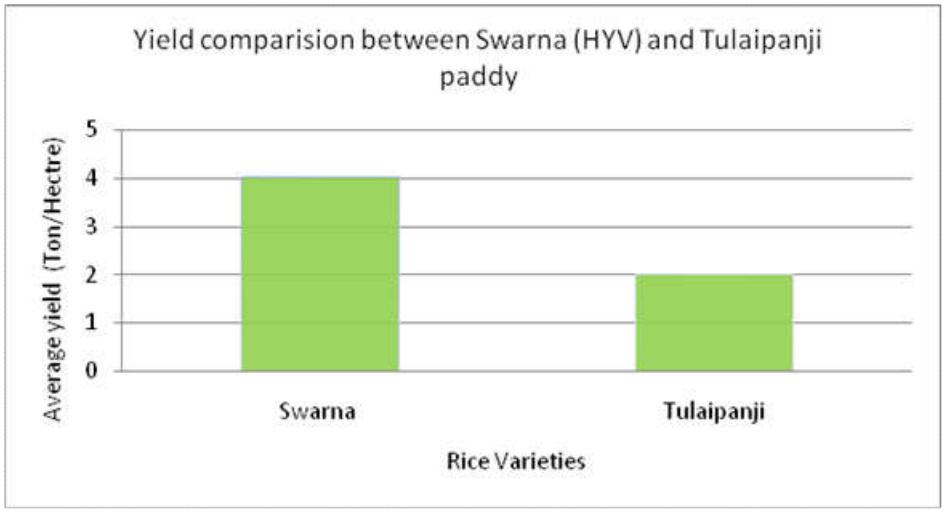


Fig. 3.

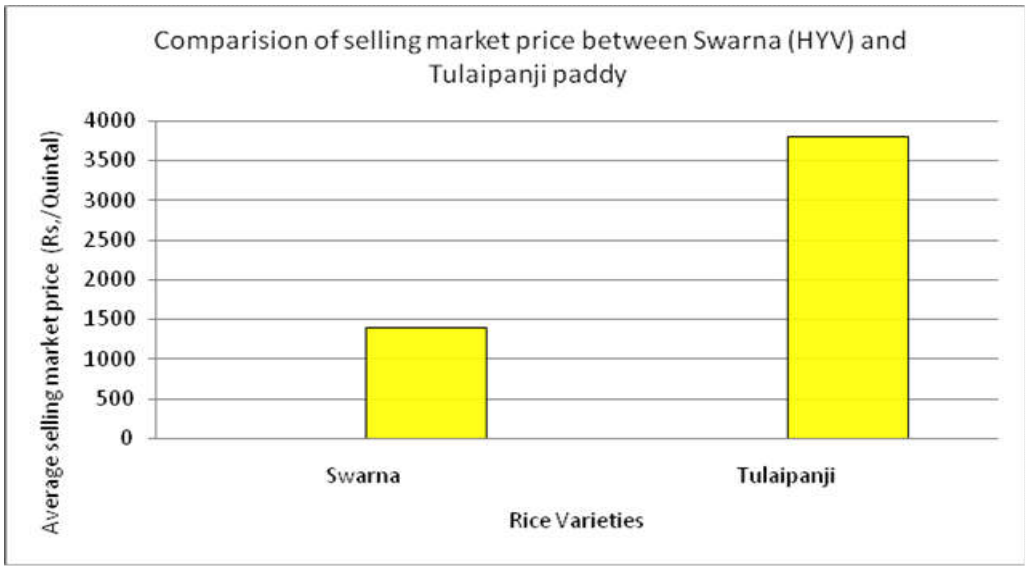


Fig.4

But out of the realized zone of Tulaipanji, this cropping cropping sequence is being damaged which badly affecting on the crop diversity of this zone.

Photo 1. Author in Tulaipanji Paddy Field (During Field Survey)

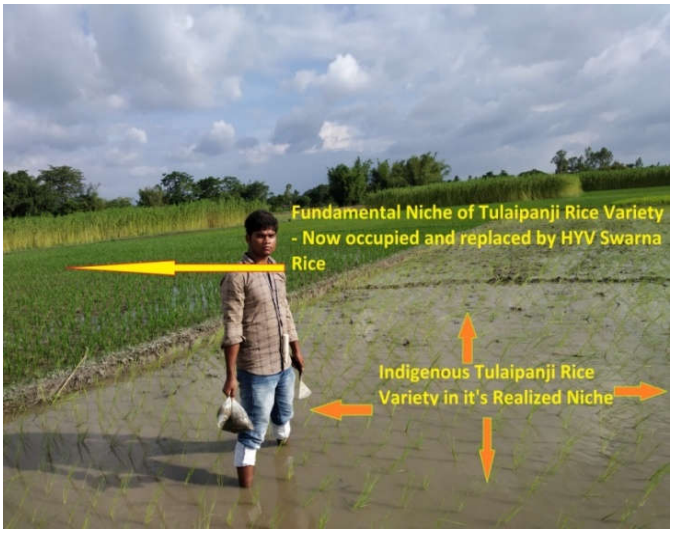


Photo 2. Niche Conversion of Tulaipanji (From Fundamental to Realized)

The use of chemical inputs out of the realized zone of Tulaipanji deteriorating the soil properties in such a way that it is unsuitable now for the natural growth of Tulaipanji.

Conclusion

Before the introduction of HYVs of rice, this area was well known because of its own indigenous rice diversity. That rich rice diversity is almost disappeared due to this HYVs of rice mainly Swarna. The only indigenous rice variety Tulaipanji has been yet struggling with this Swarna. 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. Adapting of traditional cultivation method of Tulaipanji with organic manure will be another important step to restore the soil health and regain the lost fundamental niche of Tulaipanji. In-situ conservation of Tulaipanji with natural way is very necessary otherwise we may lose this naturally growing variety like other traditional varieties. These indigenous varieties are valuable as they possess the treasure of genetic material which may prove valuable in the future crop development and improvement programs (Sinha & Mishra, 2013).

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