Int.J.Curr.Microbiol.App.Sci (2020) *9*(2): 1960-1964

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 9 Number 2 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.902.223

Biological Properties of Soil after Cultivation of Indigenous Quality Rice under Different Methods of Establishment

Panchami Bordoloi[1*], Jogesh Goswami[2], Kalyan Pathak[2] and Bipul Deka[3]

[1]Assam Agribusiness and Rural Transformation Project, KVK Sivasagar, India
[2]Department of Agronomy, Assam Agricultural University, Jorhat, Assam, India
[3]Department of Soil Science, Assam Agricultural University, Jorhat, Assam, India

**Corresponding author*

Keywords

kunkuni joha, *amona bao*, black rice and *jhengoni bora*, Dehydrogenase

Article Info

Accepted:
xx January 2019
Available Online:
xx February 2020

A B S T R A C T

A field experiment was carried out at Assam Agricultural University, Jorhat, Assam during *kharif* season of 2017 with a view to evaluate the biological properties of soil after cultivation of indigenous quality rice varieties under different methods of establishment. The rice varieties were *kunkuni joha*, *amona bao*, black rice and *jhengoni bora* and the methods of establishments were direct seeding, transplanting and System of Rice Intensification(SRI). Highest microbial biomass carbon (MBC) was recorded in SRI method (873.04µg g^{-1} dry soil) and lowest in transplanted rice (863.97µg g^{-1} dry soil). Among the varieties highest microbial biomass carbon was found in *jhengoni bora* (871.11 µg g^{-1} dry soil) and lowest in *kunkuni joha* and black rice (866.44µg g^{-1} dry soil). Dehydrogenase activity was found to be highest in SRI method (59.25 µg TPF g^{-1} day^{-1}) and lowest in transplanting method (58.75µg TPF g^{-1} day^{-1}). Among the varieties dehydrogenase activity was found highest in *amona bao* (60.44 µg TPF g^{-1} day^{-1}) and lowest in *kunkuni joha* (56.11µg TPF g^{-1} day^{-1}). Phosphomonoesterase activity followed the same trend with the highest value to be recorded in SRI method (57.09µg PNP g^{-1} hr^{-1}) and lowest in transplanting method (55.12 µg PNP g^{-1} hr^{-1}). Among the varieties phosphomonoesterase activity was found to be highest in *amona bao* (57.77µg PNP$g^{-1}hr^{-1}$) and lowest in *kunkuni joha* (55.58µg PNP $g^{-1}hr^{-1}$).

Introduction

Rice is the foremost staple food for more than 50% of the world's population in Asia, where 90 per cent of the world's rice is grown and consumed. It is a major staple food crop for many developing countries and not only a main source of calories but also an important source of income and employment for many farmers, particularly poor household. India is blessed with a wide range of indigenous quality rice, which is supporting a large

number of farmers to earn their livelihood. Biodiversity conservation is a new approach to addressing sustainability in a rapidly changing world. Biodiversity is intrinsically essential for our existence and is fundamentally valuable in its own right.

North-east India, including Assam, is endowed with exceptionally rich biodiversity. Assam is traditionally a rice growing area. Rice plays a pivotal role in the socio-cultural life of the people of the state. Assam is also bestowed with rich diversity of rice cultivars. Among them are *joha* (aromatic), *bora* (waxy), Semi waxy (*Chokuwa*) and red *bao* (Deep and floating) rice are unique 'gift of nature'. With the changing weather pattern, intensity and amount of rainfall is also changing.

Different methods of establishment are to be adopted to utilise the limited water resources. Soil biological environment plays pivotal role for enhancing biological activities, nutrient availability and long term system sustainability which are the ultimate goals of organic farming. Regulation of bio activities govern the functioning of organic system towards more utilization of natural resources.

As such, study on biological properties may give valid platform for analysis of organic advantage. Present research work was done to observe the biological properties of soil after cultivation of indigenous quality rice under different methods of establishment.

Materials and Methods

The experiment was carried out at the Instructional-cum-Research Farm, Assam Agricultural University, Jorhat during the *kharif* , 2017-18. The experimental farm is situated at 26°47' N latitude and 94°12' E longitude and at the elevation of 86.6 meters above mean sea level (MSL). The land having homogenous fertility and uniform textural makeup at certified organic block of ICR farm, AAU, Jorhat was selected for conducting the experiment. The climatic condition of Jorhat is humid and sub-tropical.

Monsoon normally sets in the month of June and continues up to the month of September with pre-monsoon shower from mid-March. The intensity of rainfall decreases from October, reaching the minimum during December. The mean maximum and minimum temperature during the whole crop growing period ranged from 25.2 to 35.1 °C and 11 to 26.1 °C, respectively. The weekly average relative humidity during the morning hour ranged from 90 to 100 % and in evening ranged from 60 to 90 %.

The experiment was laid out in Randomized Block Design (RBD) (2 factorial) with three replications. Soil samples were collected from the experimental plot. The biological properties of the soil were examined before the experiment was carried out. Five soil samples were collected from all replications and average result of all the five samples were taken for all the three parameters. To calculate microbial biomass carbon, Chloroform fumigation extraction technique given by Vance *et al*., (1987) was followed. For dehydrogenase activity, Reduction of TTC to TPF given by Casida *et al*., (1964) was followed. For phosphomonoesterase activity, *p- nitrophenyl* phosphate given by Tabatabi and Bremmer in 1969 was followed. The results of all the three parameters before cultivation of the crop are given in table 1.

Results and Discussion

Microbial biomass carbon

Different methods of establishment resulted in variation in MBC in soil. No significant variation was found in methods of

establishment on MBC of soil. Among the methods of establishment highest microbial biomass carbon was recorded in SRI method (873.04µg g^{-1} dry soil) and lowest in transplanted rice (863.97µg g^{-1} dry soil). Effect of varieties on MBC on soil was non-significant.

Among the varieties highest microbial biomass carbon was found in *jhengoni bora* (871.11 µg g^{-1} dry soil) and lowest in *kunkuni joha* and black rice (866.44µg g^{-1} dry soil). Interaction effect on MBC was found non-significant. The data is presented in table 2.

Dehydrogenase activity

Significantly higher dehydrogenase activity was recorded with SRI method (59.25µg TPF g^{-1} day^{-1}). The lowest dehydrogenase activity (58.75µg TPF g^{-1} day^{-1}) was recorded in transplanting. No significant difference was found in case of variety in dehydrogenase activity of soil. However, highest was recorded in *amona bao* (60.44µg TPF g^{-1} day^{-1}) and lowest was recorded in *kunkuni joha* (56.11µg TPF g^{-1} day^{-1}). The data are are present in table 2.

Phosphomonoesterase activity

Methods of establishment showed non-significant effect on phosphomonoesterase activity. Highest data was recorded in SRI method (57.09µg PNP $g^{-1}hr^{-1}$) and lowest in transplanting (55.12 µg $PNPg^{-1}hr^{-1}$). Among the varieties highest data was recorded in *amona bao* (57.77µg $PNPg^{-1}hr^{-1}$) and lowest in *kunkuni joha* (55.58µg $PNPg^{-1}hr^{-1}$).

The biological properties were higher in the soils under SRI methods compared to conventional practices. The SRI method creates ambient situation for soil microbial growth. The SRI method provides soil conditions that are favourable for the mycorhizal fungi and many soil microbes, which enhance the nutrient uptake by rice (Rupela *et al*., 2006). The enzyme dehydrogenase is regarded as an indicator of total life in the soil and a strong indicator of biological activity.

The enhancement of soil chemical, biological, and microbiological properties in SRI-organic was also observed by Subramaniam *et.al*. 2013. The presence of more microbial and biological activity in the rhizosphere leads to beneficial functions for crops such as plant growth promotion, nitrogen fixation, phosphate solubilization, induced systemic resistance and protection against pathogens.

Table.1 Biological properties of soil before conducting the experiment

Sl. No.	Properties	Value	Method followed
1.	Microbial biomass carbon (µg g^{-1} dry soil)	878.64	Chloroform fumigation extraction technique (Vance *et al*., 1987)
2.	Dehydrogenage activity(µg TPF g^{-1} day^{-1})	46.78	Reduction of TTC to TPF (Casida *et al*., 1964)
3.	Phosphomonoesterase activity (µg PNP g^{-1} hr^{-1})	33.86	*p- nitrophenyl* phosphate (Tabatabi and Bremmer, 1969)

Table.2 Biological properties of soil after cultivation of indigenous quality rice under different methods of establishment

Treatment	Dehydrogenase activity(µg TPF g^{-1} day^{-1})	Microbial biomass count (µg g^{-1} dry soil)	Phosphomonoesterase activity (µg PNP g^{-1} hr^{-1})
Variety			
V_1 : *Kunkuni joha*	56.11	866.44	55.58
V_2 : Black rice	59.67	866.44	55.71
V_3 : *Jhengoni bora*	59.89	871.11	56.35
V4: *Amona bao*	60.44	865.53	57.77
SEm (±)	1.22	3.64	1.25
CD (P=0.05)	NS	NS	NS
Methods of establishment			
M_1 : Direct seeding	59.08	865.14	56.85
M_2 : Transplanting	58.75	863.97	55.12
M_3 : SRI method	59.25	873.04	57.09
SEm (±)	1.05	3.15	1.08
CD (P=0.05)	NS	NS	NS
(V×M)	NS	NS	NS

Enhanced microbial activity in organically managed soil increases rates of carbon and nitrogen mineralization and also soluble carbon content (Sharma and Singh 2004). Thus, the soil under the present experimentation was found to be biologically active which may be a good indicator for better soil health.

SRI method resulted in the highest MBC, dehydrogenase activity, phosphomonoesterase activity and microbial population in soil suggesting improvement of biological status of soil which was significantly higher over all other methods of establishment. Soil biological parameters viz., dehydrogenase activity, MBC and phosphomonoesterase activity were not much affected by varieties in rice growing. Thus it can be found that growing crops organically improved the biological properties of soil which are in agreement with the work of Surekha and Rao (2009).

References

Casida, L.E; Klein, D. A. and Santoro, T. (1964). Soil dehydrogenase activity.

Soil Sci. 98;371-376

Rupela OP, Wani SP, Kranthi M, Humayun P, Satyanarayana A, Goud V, Gujja B, Punnarao P, Shashibhushan V, Raju DJ, Reddy PL (2006). Comparing soil properties of farmers' fields growing rice by SRI and conventional methods. Paper prepared for the 1st national SRI symposium, ANGRAU, Hyderabad, 17–18 Nov. Worldwide Fund for Nature - ICRISAT. http://sri.ciifad.cornell. edu/countries/india/Ap/InAP_ Rupela_soil_bio_Hyderabad06.pdf

Sharma PD, Singh Mohan (2004) Problems and prospects of organic farming. Bullet Ind Soc Soil Sci 22:14–41

Subramaniam , G.; Kumar, R. M.; Humayun, P.; Srinivas, V.; Kumari, B.R.; Vijayabharathi, R.; Singh, A.; Surekha, K.; Padmavathi, Ch.; Somashekhar, N.; Rao., P.R.; Latha, P. C.; Rao, L.V.S.; Babu, V. R.; Viraktamath, B. C.; Goud, V.V.; Loganadhan, N.; Gujja, B.; Rupela, O.(2013). Assessment of different methods of rice (Oryza sativa.L) cultivation affecting growth parameters, soil chemical, biological,and microbiological properties, water saving, and grain yield in rice–rice system. Paddy water environment. DOI : 10.1007/s 10333-013-0362-6

Surekha, K. and Rao, K.V. (2009). Direct and residual effects of organic sources on rice productivity and soil quality of vertisols. *J. Indian Soc. Soil Sci*. 57(1): 53-57.

Tabatabi, M.A. and Bremmer, J.M.(1969). Use of P- nitrophenyl phosphate for assay of soil phosphatise activity. *Soil Biol*. Biochem. 1;301-307

Vance, E.D.; Brookes, P.C. and Jenkison, D.S(1987). Chloroform fumigation direct extraction procedure. *Soil Biol. Biochem*. 19(6); 703-707.

How to cite this article:

Panchami Bordoloi, Jogesh Goswami, Kalyan Pathak and Bipul Deka. 2020. Biological Properties of Soil after Cultivation of Indigenous Quality Rice under Different Methods of Establishment. *Int.J.Curr.Microbiol.App.Sci*. 9(02): 1960-1964.
doi: https://doi.org/10.20546/ijcmas.2020.902.223