Article AR2003

DOI: HTTPS://DOI.ORG/10.23910/IJBSM/2019.10.4.2003

International Journal of Bio-resource and Stress Management

August 2019

Print ISSN 0976-3988
Online ISSN 0976-4038

IJBSM 2019, 10(4):377-381

Research Article

Natural Resource Management

Interventions of Reclamation Technologies for Sand/silt deposited Matmora area of Lakhimpur District, Assam

Arundhati Bordoloi*, Buddha Bora, Sameeron Bhattacharya, Niranjan Deka and Jogesh Goswami

Assam Agricultural University, Jorhat, Assam (785 013), India

Open Access

Corresponding Author

Arundhati Bordoloi

e-mail: arundhatibordoloi@gmail.com

Citation: Bordoloi et al., 2019. Interventions of Reclamation Technologies for Sand and /silt deposited Matmora area of Lakhimpur district, Assam. International Journal of Bio-resource and Stress Management 2019, 10(4):377-381. HTTPS://DOI.ORG/10.23910/IJBSM/2019.10.4.2003

Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

Funding: The fund for the research work was provided by the ICAR, at KVK Lakhimpur

Conflict of interests: The authors have declared that no conflict of interest exists.

Abstract

An On-farm Trial was carried out in the Matmora area of Lakhimpur District, Assam, India where sand/silt deposition is causing threats to the farming community by covering the cultivable areas with huge deposition of river sand. The mighty Brahmaputra carried sand/silt along with its fresh flood and covered the green fertile land of Matmora. Participatory Rural appraisal (PRA) was done to evaluate farmers' knowledge on the severity of problem as well as farmers response to the scientific land reclamation technologies. Only 5% of the surveyed farmers knew about the soil reclamation technologies and only 1% farmers adopted such technologies to reclaim the sand/silt deposited fields of Matmora. In order to improve the soil fertility status of the sand/silt deposited area, scientific interventions were done as On-farm Trial (OFT) with the introduction of leguminous crops like blackgram, frenchbean and a highly remunerative crop like garlic with application of huge amount of organic matter. After adopting the interventions technology for sand/silt deposited area, significantly higher average productivity of 10.75 q ha^{-1} of Blackgram was obtained with fertilizer application @ 50% NPK+2 t of FYM ha^{-1}. 150.04 qha^{-1} French bean was obtained with fertilizer application @ 50% NPK+40t FYM ha^{-1} and 18.48 q ha^{-1} garlic was recorded with fertilizer application @50%NPK+40 t FYM ha^{-1} as compared to the farmers practice. Treatments comprising leguminous crop with double dose of FYM resulted higher organic C content of soil, increased available N, P and K and reduction of soil pH in sand/silt deposited area of Matmora of Assam.

Keywords: sand/silt deposition, reclamation, OFT, organic manure, yield

1. Introduction

The north eastern part of India mainly comprises of Assam and its neighbouring seven states receive sufficient rainfall during monsoon which results surplus water in rivers of the region. This surplus water causes devastating flood in summer causing a huge amount of loss. Assam is one of the worst sufferers due to flood and post flood devastation. Matmora is an area in the district of Lakhimpur of Assam comprising 200 numbers of villages with 30.04% population being poor. Matmora is situated at remote corner of Lakhimpur district located about 100 km away from the district headquarter with poor means of communication. It is between the mighty river Brahmaputra and its tributary called Subansiri. Silt deposition from these two rivers makes the area fertile and suitable for cultivation of crops. During monsoon, many places of this area get inundated by the rivers and become inaccessible. But the situation has changed when the

Article History

RECEIVED in 10th June 2019 RECEIVED in revised form 20th August 2019 ACCEPTED in final form 30th August 2019

fertile land has started converting to a desert like unfertile land. The mighty Brahmaputra carried Sand/silt along with its fresh flood and covered the green fertile land of Matmora. The problem of sand/silt deposition has started in the year 1998 and maximum deposition occurred in the year 2008 which changed the topography of entire Matmora area. All total 98 no of villages covering ca 370 ha area of Matmora, Kherkota and Pub Matmora Gram Panchayat turned into desert like situation by this kind of deposition. Matmora under Dhakuakhana sub-division is now considered as the most affected location of Assam where thousands of farm families have witnessed massive destruction caused by huge sand/silt deposition. This area is inharited by 58% Schedule Tribe (Mishing community) population. The density of population in this area is 182 persons per sq kilometer and about 93% of its 21186 household's area being affected due to sand and silt deposition. The female and children (0-14 yrs) population affected due to flood and sand/silt deposition was estimated to be 21333 and 18764 (approx) respectively (Bora, 2010). After this destruction, youths have either migrated to Sand/silt nearby areas (60%) and outside the state (20%), leaving their farming practice or struggling in their own land with limited resource for their livelihood. It has so far incurred a loss worth around US$22.46 million (around ` 90 crore) due to flood and Sand/silt deposition and due to this irrepairable loss Matmora is now an underdeveloped backward area of Assam.

An On Farm Trial was carried out in the Matmora area of Lakhimpur District where Sand/silt deposition is causing threats to the farming community. Participatory Rural appraisal (PRA) was done to evaluate farmers' knowledge on the problem as well as farmers response to the land reclamation technologies. Only 5% of the surveyed farmers knew about the reclamation technologies and only 1% farmers adopted such technologies to reclaim the deposited fields. In order to improve the soil fertility status of the area, scientific interventions were done as OFT with the introduction of leguminous crops like blackgram, french bean and a highly remunerative crop like garlic with application of huge organic matter.

2. Materials and Methods

An On-farm Trial was conducted in Matmora area of Lakhimpur district, Assam of India during the year 2011-12, 2012-13 and 2013-14 in five different villages to assess the effect of reclamation technologies for sand silt deposited areas. The experiment site was located between 27.60°-27.35° north latitude and 94.24°-94.42° east longitude. The experiment site lies in humid and subtropical zone with average rainfall is 2830 mm.

During the initial stage of the experiment, a PRA was conducted on seventy three farmers of three different villages to study their response to reclamation process of Sand/silt deposited in agricultural fields. The PRA was also done to identify the constraints in adopting reclamation technique in such degraded area. The fertility status of the soil was accessed by taking soil sample from a depth of 0-15 cm from different location of the experiment site before initiation of the experiment. The soils selected for the experiment were deficient in organic carbon (1.12 g kg^{-1}), available Nitrogen (112.46 kg ha^{-1}), P (10.15 kg ha^{-1}) and K (220.35 kg ha^{-1}). The selected soil of the farmer's field was sandy in texture and soil pH was 6.7. Four representative farmers were selected to carry out the On-farm Participatory Trial. The selected interventions for reclamation of deposited area were as follows: T_1: Farmers practice (control), T_2: 100% NPK, T_3: 50% NPK+100% of FYM, T_4: 100% NPK+100% FYM, T_5: 50% RDF+double dose of FYM, T_6: 100% FYM, T_7: Double dose of FYM. These five interventions were applied in five locations in randomized completely block design (RCBD). FYM were applied one month before sowing of the crop, so that well decomposition would take place. The experimental crops were blackgram, followed by garlic which is a very important spice of local population and followed by frenchbean. The experimental plots were divided into five sub-plots. The recommended package of practices were followed during all the years as given in Table 1.

Soil pH was determined by using pH meter (1:2 soil water ratio) and organic carbon was determined by Walkey and Black method as outlined by Jackson (1967). For available N, the procedure involves distillation of soil with alkaline potassium permanganate solution and determining the ammonia liberated Available (Subbiah and Asija, 1956). Available P was determined by Olsen P method (Olsen et al., 1954). Available potassium (K) was extracted from 5 g of soil by shaking with 25 ml of neutral ammonium acetate (pH 7) solution for half an hour and the extract was filtered immediately through a dry filter paper (Whatman no.1) and then potassium concentration in the extract was determined

Table 1: Details of experimental operation

Operation	Blackgram	Garlic	French bean
Variety	Local	Local	Vaishnavi
Soil type	Sandy loam	Sandy loam	Sandy loam
Sowing time	Mid Oct-mid Sept	Sept-Oct	Oct-March
Seed rate	20-25 kg ha^{-1}	350-500 cloves ha^{-1}	50 kg ha^{-1}
Spacing	30x10 cm^2	15x5-7 cm^2	45x30 cm^2
Manure (RD)	1 t ha^{-1}	20t ha^{-1}	20 t ha^{-1}
Manure (Double of RD)	2 t ha^{-1}	40t ha^{-1}	40 t ha^{-1}
Fertilizer NPK (1/2 of RDF) @	7.5-17.5-0 kg ha^{-1}	50-40-30 kg ha^{-1}	15-20-10 kg ha^{-1}

by Flame photometer (Hanway and Heidal, 1952).

3. Results and Discussion

It was observed that different sources of nutrients had significant influence on yield parameters of crops cultivated in sand/silt deposited area. For reclamation of the area, application of recommended dose of fertilizer along with FYM @ 2 t ha^{-1}, 40 t ha^{-1} and 40 t ha^{-1} were very effective and significantly improve the crop yields of blackgram, garlic and french bean respectively (Table 2). Pooled yield data indicated that the treatment 50% NPK+FYM @ 2 t2 t ha^{-1} for blackgram was the best treatment for sand/silt deposited area with the highest mean yield 10.75 t ha^{-1}. Lowest mean yield of 5.29 q ha^{-1} was recorded with farmers practice (T_1). It was also observed from the pooled data that grain yield production of blackgram was highest (11.14 q ha^{-1}) during the year 2012-13 at T_5. This may be due to the residual effect of applied organic manure on blackgram. This result is in accordance with Sangeetha et al. (2013) that residual effect of organic manure enhanced the crop yield as compared to NPK. This result also supports the best effect of combined effect of organic matter for groundnut production demonstrated by Patra et al. (2012). Higher seed yield might be due higher growth attributes, enhanced rate of net photosynthesis and higher yield attributes. The results are in close agreement with the observation of Verma et al. (2013), Davari et al. (2012), Kumar et al. (2018); Parewa et al. (2019).

In this present experiment, maximum yield of garlic was recorded 18.29 q ha^{-1} in T_5 treatment (50% NPK+Double FYM)

Table 2: Response of levels of FYM on crop yield of blackgram, garlic and frenchbean

Treatment	Blackgram (q ha^{-1})			Avg. Yield	Garlic (q ha^{-1})			Avg. Yield	French bean (q ha^{-1})			Avg. Yield
	2011-12	2012-13	2013-14		2011-12	2012-13	2013-14		2011-12	2012-13	2013-14	
T_1	5.37	5.16	5.33	5.29	10.87	11.98	11.31	11.39	77.38	77.06	81.87	78.77
T_2	5.40	5.10	5.86	5.46	11.60	12.23	12.07	11.96	78.69	80.74	86.86	82.09
T_3	6.65	6.42	6.65	6.58	11.99	11.79	12.60	12.13	111.86	116.47	117.55	115.29
T_4	6.35	6.73	6.08	6.39	12.35	12.29	13.46	12.70	120.91	123.39	138.22	127.51
T_5	10.39	10.73	11.14	10.75	17.87	18.51	18.48	18.29	133.45	147.75	168.93	150.04
T_6	5.88	6.40	6.26	6.18	13.09	13.42	13.94	13.48	109.67	118.64	121.49	116.60
T_7	6.63	8.87	10.02	8.50	13.78	16.93	17.06	15.93	124.13	136.07	140.45	133.55
CD (p=0.05)	4.15	4.59	4.16		5.36	6.10	6.24		13.60	9.89	9.92	

T_1: Farmers practice (control); T_2: 100% NPK; T_3: 50% NPK+100% of FYM; T_4: 100% NPK+100% FYM; T_5: 50% RDF+double dose of FYM, T_6: 100% FYM, T_7: Double dose of FYM

and lowest yield was obtained from farmers practice (11.39 q ha^{-1}). Recommended dose of NPK+FYM (T_4) could produce only 12.7 q ha^{-1} in the sand/silt deposited degraded soil, which is significantly lower than T_5 and T_7 treatment. Similar result was obtained by Abood et al. (2013), who reported that plant height, mean weight of bulb and number of cloves in each bulb of garlic were increased under favorable treatment of organic manure. In our On Farm Trial, highest yield of garlic (18.48 q ha^{-1}) was obtained in the third year of T_5 (50% NPK+Double FYM). However, Mohd et al. (2011) obtained maximum benefit in 50% NPK+50% FYM treatment. As our soil is highly deficient in organic matter and soil nutrients, therefore double dose of FYM is beneficial for higher crop production.

Similarly, highest mean yield of french bean (150.04 q ha^{-1}) were observed under the application of 50% NPK+FYM @ 40 t ha^{-1} which was significantly higher than the farmers practice 78.77 q ha^{-1} respectively. Application of double dose of FYM i.e. 40 t ha^{-1} (T_7) also produced significantly higher mean crop yield 135.55 t ha^{-1} as compared to NPK, NPK+FYM, ½ NPK+FYM, FYM and farmers practice. Maximum yield of french bean (168.93 q ha^{-1}) was recorded at the third year of experiment in T_5 (double dose of FYM). This result may be due to higher nodulation in presence of sufficient organic matter as well as residual effect of organic matter in such a degraded soil. These results are in conformity with findings of Singh and Chauhan (2009) who recorded that no of frenchbean pod plant^{-1} and nodulation by FYM treatment was higher than NPK treatment, which also support the findings of Rameshwar (2006). This result is also in accordance with the findings of Kumaran (2001).

The results pertaining on application of organic manure had a significant influence on organic carbon, soil pH and soil NPK (Table 3). After the completion of the experiment, soil organic carbon was found highest in treatment T_7 (14.35 g kg^{-1}) which is significantly higher than rest of the treatments. Application of organic manure alone or combination with NPK reduced the soil pH significantly. Maximum reduction in soil pH was noticed on application of 50% NPK+double dose of FYM (5.54) along with maximum release of available N (207.23 kg ha^{-1}), P

Table 3: Effect of organic manure on soil organic carbon, pH, available NPK content

Treatment	Organic C (g kg^{-1})	Soil pH	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})
T_1	1.18	6.54	117.54	10.58	222.91
T_2	1.20	6.36	118.406	10.75	224.55
T_3	2.32	5.92	140.59	13.67	232.94
T_4	1.92	5.88	142.33	14.33	231.62
T_5	11.47	5.54	207.228	20.51	282.06
T_6	1.82	5.88	179.664	14.52	255.07
T_7	14.35	5.7	195.482	18.05	269.88
CD (p=0.05)	3.06	0.28	16.98	4.72	12.75

(20.51 kg ha^{-1}) and K (282.06 kg ha^{-1}) as compared to farmers practice (pH 6.54). The improved nutrient status of soil over initial values might be attributed to the mineralization of applied FYM (Pankaj et al., 2006) and contribution of applied NPK to the soil (Thorie et al., 2013). Integrated use of chemical fertilizer and huge amount of organic manure could enhance the chemical properties of soils of sand/silt deposited area. These findings are supported by the findings of Rakeib et al. (2011) and Singh et al. (2018). The results of the experiment also supported the concept climate resilient agriculture to cope with the adverse situation in agriculture which is found similar with the findings of Dahal et al. (2019).

4. Conclusion

Application of 50% NPK+double dose of FYM recorded the maximum crop yield in all the three crops viz., blackgram, garlic and frenchbean as compared to other treatments. Therefore 50% NPK+double dose of FYM proved the best nutrient management practice for reclamation of sand/silt deposited area not only to produce higher crop yield, but also in improving available nutrients under sand/silt deposition condition of Assam.

5. References

Abood, M.A., Jasim, A.A., Fahmi, A.H.,Khalifbadawai, T., 2013. Quality effect of organic fertilizers on some soil properties, growth and yield of Garlic (*Allium sativum* L). International Journal of Agricultural Science and Research 3(5), 25–32.

Bora, M.C., 2010. The Flood Situation of Assam-A Case Study, BALWOIS 2010-Ohrid, Republic of Macedonia- 25, 29 May

Dahal, D., Ghosh, J., Chetri, B., 2019. Impact of Bio-accelerated Farming against Conventional Farming System on Green Gram (*Vigna radiata* L.) under Rainfed Condition: Adaptive Management Enhances the Resilience to Climate Change. International Journal of Agriculture, Environment and Biotechnology 10(1), 096–106.

Davari, M.R., Sharma, S.N., Mirzakhani, M., 2012. The effect of combinations of organic materials and biofertilisers on productivity, grain quality, nutrient uptake and economics in organic farming of wheat. Journal of Organic Systems 7(2), 26–35.

Hanway, J.H.S., Heidal, 1952. Soil testing laboratory procedures. Jowa Agriculture 57, 1–31.

Jackson, M.L., 1967. Soil chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi, India.

Kumaran, S., 2001. Response of groundnut to organic manure, fertilizer levels, split application of phosphorus and gypsum application under irrigated condition. Research on Crops 2(2), 156–158.

Kumar, S., Satyavan, Bishnoi, D.P., Kumar, N., Dhillion, A., 2018. Effect of integrated nutrient management on yield and yield attributes and economics of wheat (*Triticum aestivum* L.) under saline and non-saline irrigation water. International Journal of Current Microbiology and Applied Sciences 7(5), 618–628.

Mohd., T.A., Desai, J.D., Parmar, S.B., Parmar, B.R., 2011. Effect of organic and inorganic fertilizers on growth, yield and quality of garlic cv GG.-1. The Asian journal of Horticulture 6(1), 52–55.

Olsen, S.R., Cole, C.V., Watanabe, F.S., Dean, L.A., 1954. Estimation of available phosphorus in soils by extraction with sodium bicarbonate.Circular of U.S. Department of Agriculture, 939.

Pankaj, S., Singh, S., Chaubey, A.K., 2006. Effect of integrated nutrient management on soil fertility, nutrient uptake and yield in rice- European Dill (*Anethium graveolens* L.) cropping system. International Journal of agricultural Sciences 2(2), 612–617.

Patra, P. S., Sinha, B., Paramanik, B., Mula, G., 2012. Agronomic Efficiency, Partial Factor Productivity and Seed Yield of Groundnut (*Arachis hypogeae* L.) as Influenced by Different Sources of Organic Manures. International Journal of Bio-resource and Stress Management 3(2), 173–176.

Parewa, H.P., Ram, M., Jain, L.K., Choudhary, A., Ratnoo, S.D., 2019. Impact of Organic Nutrient Management Practices on Yield Attributes, Yield and Economics Of wheat (*Triticum aestivum* L.). International Journal of Bio-resource and Stress Management 10(3), 257–260.

Rameshwar, Dogra, V., Sharma, G.D., Rana, S., 2006. Effect of FYM and sand application on Barley (*Hordeumvulgare*) under Barley–fallow cropping system in the cold desert region of Himachal Pradesh. Himachal Journal of Agricultural Research 32(2), 22–24.

Rakib, M., Banerjee, M., Malik, G.C., 2011. Effect of integrated nutrient management on biometric parameters, yield parameters and economics of baby corn (*Zea mays* L.). International Journal of Agriculture, Environment and Biotechnology 4(1), 21–26.

Sangeetha, S.P., Balakrishnan, A., Devasenapothy, P., 2013.

Influence of organic manures on yield and quality of rice (*Oryza sativa* L) and blackgram (*Vignamungo* L.) in Rice- Blackgram cropping sequence. American Journal of Plant Science 4, 1151–1157.

Singh, N.I., Chauhan, J.S., 2009. Response of French Bean (*Phaseolus Vulgaris* L.) To Organic Manures and Inorganic Fertilizer On Growth & Yield Parameters Under Irrigated Condition. Nature and Science 7(5), 52–54.

Singh, G., Singh, N., Singh, K., 2018. Effect of Integrated Nutrient Management on Growth and Yield of Baby Corn (*Zea mays* L.). International Journal of Agriculture, Environment and Biotechnology 9(6), 762–768.

Subbiah, B.V., Asija, G.L., 1956. A rapid procedure for the estimation of available N in soil. Current Science 25, 259–260.

Thorie, M., Sarkar, N.C., Kharutso, A., 2013. Effect of Biofertilizer on the Productivity of Terraced Upland Rice (*Oryza Sativa* L.). International Journal of Bio-resource and Stress Management 4(3), 400–403.

Verma, S., Singh, H.V., Saxena, R., 2013. Relative performance of sesame (*Sesamum indicum*) under organic, inorganic and integrated nutrient management. Indian Journal of Agricultural Sciences 83(3), 143–149.