The Pharma Innovation Journal 2022; 11(5): 2565-2569

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(5): 2565-2569

www.thepharmajournal.com
Received: 02-03-2022
Accepted: 07-04-2022

Popiha Bordoloi
Subject Matter Specialist, Krishi Vigyan Kendra Ri-Bhoi, ICAR (RC) for NEH Region, Umiam, Barapani, Meghalaya, India

Corresponding Author:
Popiha Bordoloi
Subject Matter Specialist, Krishi Vigyan Kendra Ri-Bhoi, ICAR (RC) for NEH Region, Umiam, Barapani, Meghalaya, India

Productivity enhancement of black gram (*Vigna mungo* L.) as influenced by lime in acid inceptisol and yield gaps analysis in Ri-Bhoi district of Meghalaya

Popiha Bordoloi

Abstract
In North East India the productivity of pulse crop is low as because of improper soil nutrient management coupled with soil acidity problem. To popularize the technology of pulse production through soil nutrient along with soil acidity management and for analysis of yield gaps in Black gram (*Vigna mungo* L.) in Ri-Bhoi District of Meghalaya, a front line demonstration (FLD) was conducted at the farmers' field in Ri-Bhoi District of Meghalaya. The demonstration was conducted at ten farmers' field covering 4 hectares of land during the year 2016 and 2017. The results of the study revealed that the application of Lime 400 kg/ha + vermicompost @ 2.0 t/ha + 50% RDF (10:20:10 kg/ha) + 20 kg /ha Sulphur had recorded significantly higher yield i.e., 9.86 q/ha with B.C ratio of 1.85 followed by farmer's practice (6.4 q/ha yield with B.C ratio of 1.44). Moreover, the soil nutrient status was also significantly improved at the time of harvesting as compared to farmer's practice in both the years. Technology Gap of 2.14 q/ha, extension gap of 3.46 q/ ha and technology index 17.83 had been recorded. The technology index achieved from the demonstration showed the feasibility of the evolved technology at the farmer's field. If the technology dissemination is successful in North East India with application of Lime with organic and inorganic fertilizers for yield improvement, maintaining the soil health, reducing the rate of chemical fertilizer in black gram crop (*Vigna mungo* L) the productivity could be improved attractively.

Keywords: FLD, black gram, acid soil management, yield gap analysis, North East India

Introduction
In North East India the productivity of pulse crop is low as because of improper soil nutrient management coupled with soil acidity problem. This is a cause of low productivity of some of the major crops in this area due to severe deficiencies of phosphorus, calcium, magnesium, molybdenum and toxicities of aluminum and iron in the acidic soils (Sanjay-Swami and Yadav, 2021) [18]. Approximately, 84 per cent of the soils in the North Eastern Hill (NEH) region of India are acidic in reaction (Lyngdoh and Sanjay-Swami, 2020) [12]. Moreover, improper soil nutrient management also a cause of low productivity of crops in this area (Bordoloi, 2021a; Bordoloi, 2021b; Sanjay-Swami and Singh, 2020) [2, 3, 17, 19]. Meghalaya is located at the North Eastern region of India, with a geographical area of 22429 sq. km and a population of 29.67 lakh. About 81 per cent of the total population of the state lives in rural areas and mainly depends on agricultural activities for their livelihood (Anonymous, 2011, Bordoloi, 2021c) [1, 4]. Pulse is an important leguminous crop widely grown and consumed in India and it accounts for 6-7% of the total food grain production of the country. Black gram (*Vigna mungo* L) due to its capacity of biological nitrogen fixation plays an important role in sustainable agriculture by enriching the soil nutrient status and it has the capacity of fixing 72 to 350 kg per ha. per year atmospheric nitrogen in their root nodules (Tiwari and Shivhare, 2016) [24]. Black gram is the cheapest source of protein so it is regarded as the poor men's meat. It is also rich in lysine and essential amino acids, so black gram is a good source of food (Mohmoud, 2009) [14]. It holds about 25-26 percent protein, 60 percent carbohydrates, 1.3 percent fat and also loaded with phosphoric acid (Tamang and Sanjay-Swami, 2017, 2021) [22, 23].

Pulse productivity depends mainly on appropriate nutrient management practices (Kumpawat, 2010) [11]. The integrated nutrient management is a good technique of nutrient management for increase the productivity of crop as well as for improvement of soil nutrient status (Bordoloi and Islam, 2020) [6]. Integrated use of balanced inorganic fertilizers and organic manures in combination with Lime improves the soil nutrient status which is favorable for achieving higher productivity of crop in intensive cropping system of North eastern hilly region of India

(Bordoloi, 2020, Sanjay-Swami *et al*., 2020) [6, 7, 12, 17, 19, 20]. Satya and Sanjay-Swami (2020) [20] reported significantly highest seed yield of black gram and soil nutrient status by application of 50 kg of P_2O_5 per ha. along with 1.5 kg of B per ha. in Ri-Bhoi District of Meghalaya.

Materials and Methods

A front line demonstration was conducted at ten farmers' field covering 4 ha. of land at Ri-Bhoi District of Meghalaya during the year 2016 and 2017. The village covers are Mawbri, Borkatchari and Kyrdem. The area under each demonstration was 0.4 ha. The treatment comprised of Lime 400kg/ha + vermicompost @ 2.0 t/ha + 50% RDF (10:20:10 kg/ha) + 20 kg /ha sulphur. Farmers' practice includes imbalance fertilizer application (FYM 10 q/ha). The black gram variety taken was Tripura Maskalai. The Physical and Chemical properties of lime used in the investigation are presented in Table 1. All the participating farmers were trained on all aspects of black gram cultivation and soil fertility management before implementing the FLDs at their field. To study the impact of frontline demonstration, data from FLDs and local practices were collected and analyzed. The extension gap, technology gap and technology index along with benefit cost ratio were calculated using the formula as suggested by Samui *et al* (2000) [16] as follows:

Technology Gap = Potential yield – Demonstration Yield (q/ha)
Extension Gap = Demonstration Yield – Farmers Yield (q/ha)
Technology Index = Potential Yield – Demonstration Yield/ Potential Yield x 100

The soil fertility statuses were estimated by soil analysis of composite soil sample from each plot before transplanting and after harvesting of crop. The soil of the experimental site was sandy loam and acidic in reaction. Data were analyzed using the standard statistical packages and some descriptive statistics for interpretation. The comparison between results achieved from treated plot (Demo.) and farmers practice (Check) for yield and soil characteristics was tested using student's t test with the help of SPSS software.

Results and Discussion

Seed yield

The application of Lime 400kg/ha + vermicompost @ 2.0 t/ha + 50% RDF (10:20:10 kg/ha) + 20 kg /ha sulphur had given significantly higher yield i.e. 9.86 q/ ha followed by Farmers Practice (FYM 10 q/ha) (6.4 q/ha) (Table 2, Figure 1). This may be due to improvement of soil pH and other soil nutrients requirement by the crop. This is also similarly reported by Sanjay-Swami and Singh (2020) [17, 19]. The percentage increase in average yield recorded as 154.06. Kumar *et al.* (2015) [9] also found the increased yield of black gram by 34.1 to 81.6% over farmer practice by the use of improved variety and balanced application of fertilizers. The yield advantage of 36.9 to 192.0% has also been reported in earlier studies (Kumar *et al*., 2007 and Choudhary *et al.*, 2006) [10, 8]. Satya and Sanjay-Swami (2021) [21] also reported improvement in yield of black gram with soil fertility management in acid Inceptisol of Meghalaya.

Economics

The Net Return and Benefit Cost ratio were calculated by taking the prevailed cost of commodities during both the year of demonstration. From the Table 2 it is seen that the Net Return is highest in the application of Lime 400kg/ha + vermicompost @ 2.0 t/ha + 50% RDF (10:20:10 kg/ha) + 20 kg /ha sulphur i. e. Rs. 15520 /-. This is also recorded that the application of treatment had given significantly higher B.C ratio of 1.85 followed by farmers practice (B.C ratio 1.44). This may be due to higher yields obtained under recommended practices compared to farmers' practice. Similar results of highest B: C of Maze by the application of Lime along with vermicompost also recorded by Bordoloi, 2021. Similarly, the improved benefit-cost ratio was also observed by Kumari *et al.*, (2007) [10] by the application of improved soil fertility management in black gram crop.

Gap Analysis

The extension gap in the Lime 400kg/ha + vermicompost @ 2.0 t/ha + 50% RDF (10:20:10 kg/ha) + 20 kg /ha sulphur was found 3.46 q/ha emphasized the need to trained the farmers through demonstration and training for adoption of improved technology to reverse the trend of wide extension gap (Table 2). Technology gap of 2.14 q/ha reveals the farmers' cooperation in carrying out new demonstration with good results. The technology index of 17.83% showed the feasibility of the demonstrated technology at the farmers' field and suitability of the Technology in the region.

Soil Fertility Status

Soil samples were collected before the implementation of the Technology and at the time of harvesting. The soil fertility status was significantly increased with the application of Lime 400kg/ha + vermicompost @ 2.0 t/ha + 50% RDF (10:20:10 kg/ha) + 20 kg /ha Sulphur from initial to final stage of the crop during both the years of demonstration. From Table 3 it is reveals that the soil is acidic in nature with high organic carbon content. The organic carbon, available nitrogen, available phosphorus and available potassium status of soil after harvest of the crop increased due to application of the treatment i.e. pH: 5.85, OC: 1.20, N: 418.9 kg/ha, P: 29.54 kg/ha and K: 72.8 kg/ha as compared to farmers' practice i.e. pH: 4.47, OC: 1.12, N: 378.43 kg/ha, P: 18.32 kg/ha and K: 65.43 kg/ha. It indicates that applications of Lime 400kg/ha + vermicompost @ 2.0 t/ha + 50% RDF (10:20:10 kg/ha) + 20 kg /ha Sulphur was found effective in building up soil fertility status as compared to farmers' practice. So, the application of Lime 400kg/ha + vermicompost @ 2.0 t/ha + 50% RDF (10:20:10 kg/ha) + 20 kg /ha Sulphur can successfully maintain and improve the pH level and soil fertility. Similar results of integration of lime with organic and inorganic fertilizer for yield improvement of crop were also reported by many researchers (Bordoloi, 2021d; Maier *et al*., 2002; Saha *et al*., 2010) [5, 13, 15]. It indicates that applications of organic sources with inorganic sources along with Lime were found more effective in building up soil fertility status as compared to farmers' practice.

Fig 1: Acid Soil Management in Black gram at Farmers' Field

Table 1: Physical and Chemical properties of lime used in the investigation

Properties	Value
Water absorption	0.62%
Specific gravity (G)	2.68
Lime (Cao)	38-42%
Silica (SiO)	15-18%
Alumina (Al_2O_3)	3-5%
MgO	0.5-3%
FeO + Fe O	1-1.5%
Alkalies	1-1.5%
Loss of ignition (Loi)	30-32%

Table 2: Effect of Lime on Yield and Economics of Black Gram under Rain Fed Condition

Technology Details	Avg. yield (q/ha)	% increase/ change in avg. yield over local	Gross Cost (Rs/ha)/ (Rs./ unit)	Gross Return (Rs/ha)/ (Rs./ unit)	Net Return (Rs/ha)/ (Rs./ Unit)	B:C Ratio (GR/GC)	Technology gap (q/ha)	Extension gap (q/ha)	Technology Index
Demo: Lime 400kg/ha + vermicompost @ 2.0 t/ha + 50% RDF (10:20:10 kg/ha) + 20 kg /ha sulphur	9.86	154.06	18250	33770	15520	1.85	2.14	3.46	17.83
Check: Farmers Practice (FYM 10 q/ha)	6.4	-	15200	21920	6720	1.44	-	-	-
p value	0.032								
Significant at 0.05 level (p<0.05)									

Table 3: Effect of Lime on Soil Nutrient Status under Rain Fed Condition

Treatments	pH		Organic C (kg/ha)		Available N (kg/ha)		Available P (kg/ha)		Available K (kg/ha)	
	Before	After	Before	After	Before	After	Before	After	Before	After
Demo: Lime 400kg/ha + vermicompost @ 2.0 t/ha + 50% RDF (10:20:10 kg/ha) + 20 kg /ha sulphur	4.45	5. 85	1.06	1.20	356.45	418.9	13.43	29.54	58.5	72.8
Check: Farmers Practice (FYM 10 q/ha)	4.47	4.67	0.98	1.12	359.34	378.43	14.21	18.32	59.55	65.43
p value		0.037		0.021		0.014		0.008		0.041
Significant at 0.05 level (p<0.05)										

Conclusion

Black gram is a popular crop among the farmers of Ri-Bhoi District of Meghalaya. From the study, it can be concluded that application of Lime 400kg/ha + vermicompost @ 2.0 t/ha + 50% RDF (10:20:10 kg/ha) + 20 kg /ha Sulphur was found effective for getting the highest yield of black gram as well as for maintaining the sustainability in Agriculture. The suitable BC ratio reveals the economic viability of the demonstration and convinced the farmers to adopt the Technology. The soil fertility status also improved by the use of the treatments from the above technology. So, this soil test-based technology can defiantly play an important role by popularizing the FLD for motivating the farmers for adoption of new technology for socio economic development of this region.

References

1. Anonymous. Census report, Government of Meghalaya; c2011. ribhoi.gov.in.
2. Bordoloi P. Organic Farming in North Eastern Hill Region of India: The Way Forward. International Journal of Global Science Research. 2021a;7(2). 34-38.
3. Bordoloi P. Organic Farming for Sustainable Soil Health Management: Prospects and Potential in North Eastern Region of India. Indian Journal of Agriculture and Allied Sciences. 2021b;7(2):34-38.
4. Bordoloi P. Organic Waste Management: Boon for doubling Farmers' income in Meghalaya. Journal of Plant Health Issues. 2021c;2(2):036-039.
5. Bordoloi P. Lime Application for Higher Productivity of Potato (*Solanum tuberosum* L.) and managing soil acidity in Ri-Bhoi District of Meghalaya. Indian Res. J Ext. Edu. 2021d;21(2&3):202.
6. Bordoloi P, Islam M. Effect of Integrated Nutrient Management on Productivity of Rice (*Oryza sativa* L.) and Soil Fertility Status under Rain-fed Condition of Meghalaya. Journal of Krishi Vigyan, 2020;9(1):176-179.
7. Bordoloi P. Productivity enhancement of Maize (*Zea mays*) through liming under rainfed condition of North east India. International Journal of Current Microbiology and Applied Sciences. 2020;11:2875-2881.
8. Choudhary AK, Thakur RC, Kumar N. Effect of integrated nutrient management on water use and water - use-efficiency in wheat - rice crop sequence in N-W; 2006.
9. Kumar S, Choubey AK, Singh R. Analysis of yield gaps in black gram (*Vigna mungo*) in district Bilaspur of Himachal Pradesh, Himachal Journal of Agricultural Research. 2015;41(1):49-54.
10. Kumar V, Kumar A, Kumar A, Bhateria S. Demonstration- an effective tool for increasing the productivity of rape seed–mustard in Kangra district of Himachal Pradesh. Him. J of Agri. Res. 2007;33(2):257-61.
11. Kumpawat BS. Integrated nutrient management in black gram (*Vigna mungo*) and its residual effect on succeeding mustard (*Brassica juncea*) crop. Indian J Agric. Sci. 2010;80(1):76-79.
12. Lyngdoh EAS, Sanjay-Swami. Potential screening of phytoremediating crops and performance of maize in phytoremediated coal mined acid soil with phosphorus application. Journal of Environmental Biology, 2020;41(6):1788-1797.
DOI: http://doi.org/10.22438/jeb/41/6/ SI-283.
13. Maier NA, McLaughlin MJ, Heap M, Butt M, Smart MK. Effect of current season application of calcitic lime and phosphorus fertilization on soil pH, potato growth, yield, dry matter content, and cadmium concentration. Comm. Soil Sci. & Pl. Anal. 2002;33:13-14.
14. Mohmoud S. Global partnership in eradicating hunger and malnutrition of resource poor farmers in non- tropical dry areas in: International conference on grain legumes held at IIPR Kanpur, 14-16 February Invited paper Abstract I-2:1; 2009.
15. Saha R, Mishra VK, Majumdar B, Laxminarayana K, Ghosh PK. Effect of integrated nutrient management on soil physical properties and crop productivity under a maize (*Zea mays*) - mustard (*Brassica campestris*) cropping sequence in acidic soils of Northeast India. Comm. Soil Sci. & Pl. Anal. 2010;41:8-14.
16. Samui SK, Maitra S, Roy DK, Mondal DK, Saha D Evaluation of FLD on Groundnut. J Indian Soc Coast Agric Res. 2000;18:180-183.
17. Sanjay-Swami, Singh S. Effect of nitrogen application through urea and Azolla on yield, nutrient uptake of rice and soil acidity indices in acidic soil of Meghalaya. Journal of Environmental Biology. 2020;41(1):139-146.
DOI: http://doi.org/10.22438/jeb/41/1/MRN -1133.
18. Sanjay-Swami, Yadav OS. Soil properties as influenced by biochar application under integrated nutrient management in acid Inceptisol of Meghalaya. Journal of Natural Resource Conservation and Management. 2021;1(2):104-111.
19. Sanjay-Swami, Singh S, Konyak, Chingak PW. Physico-chemical and microbiological properties of acid Inceptisol as influenced by INM practices under cabbage (*Brassica oleracea* L. var. *capitata*) production. J. Chem. Res. Adv. 2020;01(01):01-09.
20. Satya MSSC, Sanjay-Swami. Yield and yield attributes of black gram (*Vigna mungo* L. Hepper) as influenced by

phosphorus and boron in acid Inceptisol, International Journal of Agricultural and Applied Sciences, December 2020;1(2):73-78.
21. Satya MSSC, Sanjay-Swami. Performance of black gram (*Vigna mungo* L. Hepper) under phosphorus and boron fertilization in acid Inceptisol, Journal of Environmental Biology, 2021;42(2):534-543. DOI: http://doi.org/10.22438/jeb/42/2(SI/SI-281)
22. Tamang B, Sanjay-Swami. Effect of phosphorus and sulphur on nutrient uptake of black gram (*Vigna mungo* L. Hepper) in acid Inceptisol. In: Natural Resource Management for Climate Smart Sustainable Agriculture, (eds.) Sanjay Arora, Sanjay-Swami and Suraj Bhan, Soil Conservation Society of India, New Delhi; c2017. p. 298-309. ISBN: 978-81-909228-8-3.
23. Tamang B, Sanjay-Swami. Temporal availability of phosphorus and sulphur in acid Inceptisol as influenced by graded application of P and S under black gram (*Vigna mungo* L. Hepper) production. Legume Research: An International Journal. 2021;44(5):608-612. DOI: 10.18805/LR-4127.
24. Tiwari AK, Shivhare AK. Pulses in India: Retrospect and Prospects; c2016. Publication No: DPD/Pub.1/Vol. 2. http://dpd.dacnet.nic.in.