



तेजपुर विश्वविद्यालय

(केन्द्रीय विश्वविद्यालय)

नपाम, तेजपुर - 784 028, असम, भारत

TEZPUR UNIVERSITY

(A Central University)

Napam, Tezpur - 784 028 Assam, India

DEPARTMENT OF ENVIRONMENTAL SCIENCE
A REPORT ON

Harnessing Endophytes and Arbuscular Mycorrhizal Fungi from Citrus microbiome for plant and soil health Management in North East India

1. Name of the Collaborative Activity: Harnessing Endophytes and Arbuscular Mycorrhizal Fungi from Citrus microbiome for plant and soil health Management in North East India

2. Nature of Activity: Major Research work

3. Name of the Collaborative Agency/ Individual with affiliation and contact details: Assam Agricultural University, Sikkim University, Balurghat Mahila Mahavidyalaya, Balurghat

4. Summary of collaboration:

- Finalizing research method
- Co-authorship
- Data analysis and reporting techniques

5. List of year-wise activities under the collaboration:

2019 - DBT Twinning project

2021 - Subham C Mondal, N Gogoi, N, Nath, DJ and A Gayan (2021) Soil amendments for improving grain quality of grass pea (*Lathyrus sativus* L.) under drought, JSFA Report <https://doi.org/10.1002/jsf2.26>

Signature of Faculty

(Nirmali Gogoi)

Assistant Professor
Dept. of Environmental Science
Tezpur University

Signature and seal of HoD

(R.R. Hoque)

HoD

Deptt. of Environmental Science
Tezpur University
Assam : Tezpur

Recurring

No. BT/PR40047/NER/95/1662/2020
GOVERNMENT OF INDIA
MINISTRY OF SCIENCE & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY
(NERBPMC)

Block 2, (6-8th Floors)
CGO Complex, Lodhi Road,
New Delhi- 110 003
Date: 10 / 02 /2021

RELEASE ORDER

In continuation of this Department's sanction order of even number dated 10 / 02 /2021 sanction of the President is hereby accorded, under Rule 18 of the Delegation of Financial Powers Rule, 1978, for the release of Rs. **2957040.00** (Rupees Twenty-Nine Lakhs Fifty Seven Thousand and Forty Only) being the first year release for the project entitled "**Harnessing Endophytes and Arbuscular Mycorrhizal Fungi from Citrus Microbiome for Plant and Soil Health Management in North East India**", being implemented by

1. Dr. Anjuma Gayan, College of Sericulture, Soil Science department, Assam Agricultural University, Jorhat-13, Jorhat - 785013, Assam,
2. Dr. Arun Kumar Rai, Department of Botany, Sikkim University (Central University), 6th mile, Samdur, P.O.Tadong, Gangtok - 737102, Sikkim,
3. Dr. Kiran Sunar, Balurghat Mahila Mahavidyalaya, Balurghat, P.O.Balurghat, District: Dakshin Dinjapur, West Bengal, 733101
4. Dr. Nirmali Gogoi, Department of Environmental Science, Tezpur University, Tezpur - 784028, Assam,

The detailed break-up is as given below:

S.No	Institute Name	Recurring						Total Release Amount (Rs)
		Manpower	Consumable	Travel	Contingency	Others	Overhead	
1	Assam Agricultural University	401760.00	250000.00	50000.00	50000.00	25000.00	50000.00	826760.00
2	Balurghat Mahila Mahavidyalaya	401760.00	150000.00	50000.00	50000.00	25000.00	50000.00	726760.00
3	Sikkim University	401760.00	150000.00	50000.00	50000.00	25000.00	50000.00	726760.00
4	Tezpur University	401760.00	100000.00	50000.00	50000.00	25000.00	50000.00	676760.00

2. The amount of Rs. **2957040.00** /-(Rupees **Twenty Nine Lakhs Fifty Seven Thousand and Forty Only**) will be directly credited by the Pay & Accounts Officer, DBT in the account as detailed below:

Vandana
डॉ. वैशाली पंत, सहायक निदेशक, PANJABI
वैज्ञानिक, डी.डी.ए.ए.ए.
बायोटेक्नोलॉजी विभाग, डी.डी.ए.ए.ए.
विज्ञान और प्रौद्योगिकी, मंत्रालय, विज्ञान और प्रौद्योगिकी, भारत सरकार, नई दिल्ली / Govt. of India, N. Delhi

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Assistant Professor
Dept. of Environmental Science
Tezpur University,

Page No. [1 / 3]
Head

Deptt. of Environmental Science
Tezpur University
Napaam : Tezpur

1. Rs.826760.00/- (Rupees Eight Lakhs Twenty Six Thousand Seven Hundred and Sixty Only) to The Comptroller, Assam Agricultural University, Assam Agricultural University, Jorhat, Assam

Bank Name : State Bank of India
Branch Name : AAU Jorhat
A/c No. : 10253820769
IFSC Code : SBIN0002003
MICR Code : 785002006

2. Rs.726760.00/- (Rupees Seven Lakhs Twenty Six Thousand Seven Hundred and Sixty Only) to The Finance Officer, Sikkim University, 6TH MILE, SAMDUR, P. O. : TADONG, GANGTOK, SIKKIM

Bank Name : State Bank of India
Branch Name : Ranipool, Manolella Bhawan, Samdur Block
A/c No. : 38705964930
IFSC Code : SBIN0012421
MICR Code : 737002008

3. Rs.726760.00/- (Rupees Seven Lakhs Twenty Six Thousand Seven Hundred and Sixty Only) to The Principal, Balurghat Mahila Mahavidyalaya, Balurghat, Dakshin Dinajpur, West Bengal, Malda - 733101,

Bank Name : Punjab National Bank
Branch Name : North Chakbhabani, Balurghat
A/c No. : 6071006900000632
IFSC Code : PUNB0807100
MICR Code : 733024501

4. Rs.676760.00/- (Rupees Six Lakhs Seventy Six Thousand Seven Hundred and Sixty Only) to The Registrar, Tezpur University, Tezpur University, Assam


Bank Name : State Bank of India
Branch Name : Tezpur University
A/c No. : 30448821505
IFSC Code : SBIN0014259
MICR Code : 784002005

3. The expenditure involved is debitable to:

Demand No. 88	Department of Biotechnology
3425	Other Scientific Research 2020-2021
3425.60	Others (Sub Major Head)
3425.60.200	Assistance to other Scientific Bodies (Minor Head)
3425.60.200.29	Biotechnology Research and Development
3425.60.200.29.17	Assistance for Research and Development
3425.60.200.29.17.31	Grants -in-Aid General

4. The Registrar, Tezpur University, Tezpur, Assam and The Director, Assam Agricultural University, Jorhat, Assam and The Registrar, Sikkim University, Gangtok, Sikkim and The Dr Birman Chakraborty, Balurghat Mahila Mahavidyalaya, Malda, West Bengal will submit audited utilization certificates and statements of expenditure in respect of the above-mentioned amount.
5. As per Rule 236 (1) of GFR 2017, the accounts of all Grantee Institutions or Organisations shall be open to inspection by the sanctioning authority and audit, both by the Comptroller and Auditor General of India under the provision of CAG(DPC) Act 1971 and internal audit by the Principal Accounts Office of the Ministry or Department, whenever the Institution or Organisation is called upon to do so.
6. No International Travel will be undertaken from the sanctioned project grant unless specified otherwise.
7. The Institute/Agency will keep the whole of the grant in a Bank Account earning interest, and the interest so earned should be reported to DBT in the Utilisation Certificate and Statement of


Assistant Professor
Dept. of Environmental Science
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श्री. वैशाली पणुबी / Dr. VAISHALI PANUBI
आचार्य / Associate
संशोधन विभाग / Department of Biotechnology
पाठ्य क्र. / Page No. 102301 / University

Head
Dept. of Environmental Science
Tezpur University

Expenditure. If the Institute fails to give the interest earned, Overhead grant may be withheld in subsequent releases.

8. The other terms and conditions governing the financial sanction will remain unaltered.
9. This issues under the powers delegated to this Department and with the concurrence of IFD, DBT, vide their SAN No. **102/IFD/SAN/2351/2020-2021** dated **February, 09 2021**.
10. This sanction order has been noted at serial no.../... in the Register of Grants.

Vaishali

(Dr. Vaishali Panjabi)

वैशाली पंजाबी / Dr. Vaishali Panjabi
वैज्ञानिक 'E' / Scientist 'E'
बायोटेक्नोलॉजी विभाग / Dept. of Biotechnology
विज्ञान और प्रौद्योगिकी विभाग / M/o Science & Tech.
भारत सरकार, नई दिल्ली / Govt of India, N. Delhi

To,
The Pay & Accounts Officer,
Department of Biotechnology,
New Delhi - 110 003.

Copy to: New Delhi- 110

- 1 The Principal Director of Audit (Scientific Departments), DACR Building, New Delhi- 110 002.
- 2 Dr. Anjuma Gayan(Project Co-ordinator), College of Sericulture, Assam Agricultural University, Jorhat: 785013, Assam
- 3 The Director, Asaam Agricultural University, Assam Agricultural University, Jorhat-785013, Assam
- 4 The Dr. Biman Chakraborty, Balurghat Mahila Mahavidyalaya, Balurghat, Dakshin Dinajpur, West Bengal, Malda - 733101, West Bengal
- 5 The Registrar, Sikkim University, 6TH MILE, SAMDUR, P. O. : TADONG GANGTOK, SIKKIM, Gangtok - 737102, Sikkim
- 6 The Registrar, Tezpur University, Tezpur University Napaam, Tezpur, Assam
- 7 Dr. Anjuma Gayan, Assistant Professor, Soil Science, Asaam Agricultural University, Jorhat - 785013, Assam
- 8 Dr. Arun Kumar Rai, Assistant Professor, Botany, Sikkim University, Department of Botany, Sikkim University, Sikkim
- 9 Dr. Dhruva Jyoti Nath, Principal Scientist, Soil Science, Assam Agricultural University, Jorhat, Jorhat - 785013, Assam
- 10 Dr. Kiran Sunar, Assistant Professor, Botany, Balurghat Mahila Mahavidyalaya, Balurghat Mahila Mahavidyalaya West Bengal - 733101, West Bengal
- 11 Dr. Nirmali Gogoi, Assistant Professor, Environmental Science, Tezpur University, Tezpur - 784028, Assam
- 12 Mr. Himadri Shekhar Datta, Assistant Professor, Horticulture, Asaam Agricultural University, Jorhat - 785013, Assam
- 13 Cash Section, DBT (2 copies).
- 14 Sanction Folder.
- 15 File Copy.
- 16 **US (IFD) DBT with request to re-appropriate an amount of Rs. 2957040.00**
US (IFD) DBT with request to re-appropriate an amount of Rs. 2957040.00

Vaishali

(Dr. Vaishali Panjabi)
Scientist 'E'

वैशाली पंजाबी / Dr. VAISHALI PANJABI
वैज्ञानिक 'E' / Scientist 'E'
बायोटेक्नोलॉजी विभाग / Dept. of Biotechnology
विज्ञान और प्रौद्योगिकी विभाग / M/o Science & Tech.
भारत सरकार, नई दिल्ली / Govt of India, N. Delhi

Head

Dept. of Environmental Science
Tezpur University
Napaam : Tezpur

Assistant Professor
Dept. of Environmental Science
Tezpur University,

RESEARCH ARTICLE

Soil amendments for improving grain quality of grass pea (*Lathyrus sativus* L.) under drought

Subham C. Mondal¹ | Nirmali Gogoi¹ | Dhruvajyoti Nath² | Anjuma Gayan²

¹Department of Environmental Science, Tezpur University, Tezpur, Assam, India

²Department of Soil Science, Assam Agricultural University, Jorhat, Assam, India

Correspondence
Nirmali Gogoi, Department of Environmental Science, Tezpur University, Napaam 781028, Tezpur, Assam, India.
Email: nirmalivs@gmail.com

Abstract

Background: Use of soil amendments in agriculture is an old practice and with increase in demand of organic agriculture, it is gaining more attention. Work on the quality of the produce more particularly if crop faces any adverse situation like drought are scarce. This paper provides a comparative assessment of organic (farm yard manure) and inorganic (biochar) soil amendments on grain quality of grass pea (*Lathyrus sativus* L.) when crop faces drought. Different grain quality parameters were studied along with crop health and grain yield under the application of soil amendments during drought.

Results: Biochar and farm yard manure (FYM) lowered drought-induced leaf water potential (upto 22%) and root nitrate reductase activity (by 62% and 67% respectively). Both inorganic and organic soil amendments improved in vitro protein digestibility (up to 16% and 37% respectively). Whereas higher grain phytic acid content (increased up to 40% was noted from application of organic amendment (FYM) compared to inorganic (16% increase in biochar treated plots). Protein yield is enhanced (8%) under the application of Biochar-enhanced protein yield by 8% when crops experienced drought at vegetative stage, whereas FYM reduced it by 9% under the same situation.

Conclusion: Tested soil amendments can improve grain quality of grass pea. However, they were not equally efficient when the crop experienced drought at either stage of growth. Thus, screening of soil amendment is important when added under stressful situation like drought to ascertain better grain quality for consumers.

KEYWORDS

biochar, drought stress, farmyard manure, grain quality, grass pea, phytic acid

INTRODUCTION

The widespread consumption of grass pea with 1.2 million tons of annual production makes it an important grain legume in South Asia and East Africa.¹ Presence of proteins like globulins (66%), glutelins (15%), albumins (1%), and prolamins (5%)² in grain legume seeds enhances nutritional quality to the consumers. Protein content of grass pea (34%) is significantly higher than field pea (*Pisum sativum* subsp. *arvense* (L.) Asch) 23%, faba bean (*Vicia faba* L.) 24%, or lupine (*Lupinus albus* L.) 32%.³ However, presence of antinutritional factors such as protease and amylase inhibitors, lectins, tannins, saponins, alkaloids, nonstarch polysaccharides, vicine and convicine, lathyrigenin, and phytates^{4,5} make excessive

consumption of legumes harmful to humans. Consumption of grass pea resulted in nutrient deficiency among the consumers of South Asian countries owing to higher phytic acid (*myo*-inositol-1,2,3,4,5,6-hexakisphosphate or *ins*-6) content.^{6,7} Persistent water limitations in the semi-arid areas of South Asia significantly affect legume productivity and grain quality.⁸ Ghanbari et al.⁹ documented a significant reduction in mineral contents (Zn, P, and N) of common bean along with an increase in protein content due to drought. Thus, by differential impact on nitrate assimilation pathway, drought imposes contrasting results upon the protein yield of the crop.¹⁰

Among various strategies, application of soil amendments found effective in minimizing the drought-induced impact on crop growth