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Techniques of Azolla mass Production and Agricultural application in North East Region of India

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BACKGROUND

Azolla is a multifaceted aquatic microphylla which can be used as a resource to ensure ecosystem sustainability. It propagates vegetatively by breaking as separate plants and also by sexually by means of production of spores. The leaf cavities contains a symbiotic cyanobacterium *Anabaena azollae*. The endosymbiont *Aazollae* can fix upto1000 kg of atmospheric nitrogen per acre per year. The nitrogen fixed acts as a natural fertilizer for Azolla's growth. This makes the plant a free floating plant freeing it from its dependence on soil. Nitrogen is the element that most often limits food production. Rice crop takes up nitrogen nearly about 19–21 kg N per ton of whole grain rice. Therefore, rice yields can be raised significantly by increasing the nitrogen fertilizer application.In order for agriculture to be sustainable,nutrients must be replenished back to substrate *i.e.* soil. Poor N recovery by rice can cause substantial economic loss to farmers. The challenge, therefore, is to develop new management techniques which can curtail the high N losses and improve the poor N use efficiency by rice.The nitrogen fixing potential of azolla designates it as an important biological N source for agriculture. In North east of India, rice is one of the major crop. Thus, azolla can be a potential resource to improve rice. This technical bulletin highlight protocols for mass production of azolla in an economical way which can be adoptable by farmers easily. Secondly it exhibits the strategies of azolla application to improve crop yield. Based on the promising results, the technology has been transferred to many KVKs of Assam. Technology has been demonstrated to farmers and large number of farmers has been benefitted by the technology. State Govt of Assam also have adopted this technology and have published package of practice for different kharif and rabi crops. The technical bulletin will contribute to improve agriculture and socio-economy of farmers of NEH region using the natural resource azolla.

Azolla caroliniana an exotic species introduced first in Assam Agricultural University during 2002 showed a promising biofertilizer agent as well as feed supplements under the weather vagaries of North East India. Moreover, this species could be mass multiplied round the year and can serve as off-season starter stock. A technique has been developed for mass production of azolla economically. The effect of azolla on rice has been evaluated and found to enhance yield by about 20% over RDFs. Trainings have been extended to 1856 farmers and the technology has been transferred to 10 KVKs and state agricultural department of Assam. Package of practices of using azolla has been published by the state agriculture department for organic agriculture in north east regions of India.

Mass production of *Azolla caroliniana*.

Azolla caroliniana can be mass multiplied in two types of structure *viz*: semi-permanent and permanent

Semi-permanent structure

Permanent Structure

Low cost technology (semi-permanent structure) for azolla production :

Protocol for azolla mass production

1. Dig out a pit in the ground of size 2mx1mx 0.20m
2. Place good quality polythene to cover the pit
3. Raise the bund through mud plastering all around the pit
4. Maintain water level at 10-20 cm
5. Add 10 gm each of SSP, MOP & Zn Sulphate plus 200gm of dried powdered cowdung
6. Apply 300-400 g of fresh *A. caroliniana* in the pit
7. Multiply azolla for 15- 20 days until a thick azolla mat is formed and by this time there will be increase in fresh biomass to the tune of 8 -10 times.
8. For continuous harvest of fresh azolla,10-15 numbers of the above sized pits are required
9. The maximum cost of each pit is approximately Rs 300-400 and can be used for two years.

Elemental composition of *Azolla caroliniana*

Parameters	Values (%)
Total N(%)	4-6
Total P (%)	0.30-0.34
Total K (%)	3.32-3.35
Ca	0.70-0.75
Mg	0.30-0.32

Technology transferred to KVKs

To accelerate the utilization of azolla as a green manure for wetland rice and other multifaceted uses, an extension program on azolla has been carried out through the financial assistance of Rastriya Krishi Vikash Yojona (RKVY) in different KVK's located across the state under Assam Agricultural University. As such, 10 numbers of KVKs *viz*: Kokrajhar, Barpeta, Nalbari, Sonitpur, Dhemaji, Nogaon, Tinsukia, Dibrugarh, Golaghat and Jorhat were selected for creation of infrastructure for 'Production of Organic Inputs'.

Sl No	KVKs
1	Kokrajhar, Gossaigaon, Kokrajhar. Pin: 783360, Assam, (M) 9435084843 or 8638223072, kvkkokrajhar@gmail.com,kvk_kokrajhar@aau.ac.in
2	Barpeta,Howly, Barpeta. Pin-781316, Assam, (M)9435080235 pckvkbarpeta@gmail.com kvk_barpeta@aau.ac.in
3	Nalbari,Sariahtoli, Nalbari. Pin: 781335, Assam (M)9435123352, kvknlb@gmail.com,kvk_nalbari@aau.ac.in
4	Sonitpur,Napam,Tezpur. Pin: 784001 (M) 9435521447, kvk_sonitpur@aau.ac.in,kvk_sonitpur@aau.ac.in
5	Dhemaji,Silapathar. Pin: 787059, Assam (M)9435092550, kvkaau_dhemaji@rediffmail.com,kvk_dhemaji@aau.ac.in
6	Nagaon,RARS Campus, Shillongani,Nagaon. Pin: 782002, Assam(M) 9435066297, kvknagaon@gmail.com, kvk_nagaon@aau.ac.in
7	Tinsukia,CRS Campus, GelapukhuriRoad,Tinsukia. Pin-786125,Assam(M) 9435672010, kvktinsukia@gmail.com,kvk_tinsukia@aau.ac.in
8	Dibrugarh,Romai, Dibrugarh. Pin- 786010, Assa(M)9435564391, kvk.dbr@rediffmail.com,kvk_dibrugarh@aau.ac.in
9	Golaghat,Khumtai, Golaghat. Pin: 785619, Assam (M) 9435340387, kvkgolaghat@gmail.com,kvk_golaghat@aau.ac.in
10	Jorhat,Kaliapani, Teok, Jorhat. Pin: 785112, Assam (M) 9435038547, kvkjorhat@ymail.com,kvk_jorhat@aau.ac.in

Mass production of azolla at KVKs, Assam




Application of *Azolla caroliniana* and effect on crop productivity

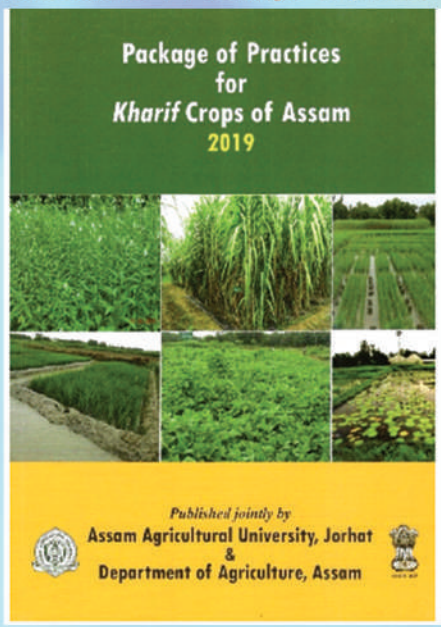
Crop	Application and crop response
Winter Rice	Fresh *azolla* caroliniana @ 500kg/ha as dual crop+50% of recommended nitrogenous fertilizers (20kg/ha) with full dozes of phosphatic and potassic fertilizers (20 and 40 kg/ha) Average yield RD of NPK(40:20:40): 4.09t/ha Average yield of azolla + NPK(20:20:20): 3.82t/ha
Rice (Organic)	*Azolla caroliniana* @ 500kg/ha as dual crop+biofertilizers (*Azospirillum*+PSB+KSB mix@4. 0kg as seedling root dip) Yield with azolla+biofertilizers:3.41t/ha Yield with microbial enriched compost+ biofertilizers :3.35 t/ha; Yield with normal compost :2.82t/ha Yield increase by azolla = 21%
Rice growing with azolla in Nagaland	

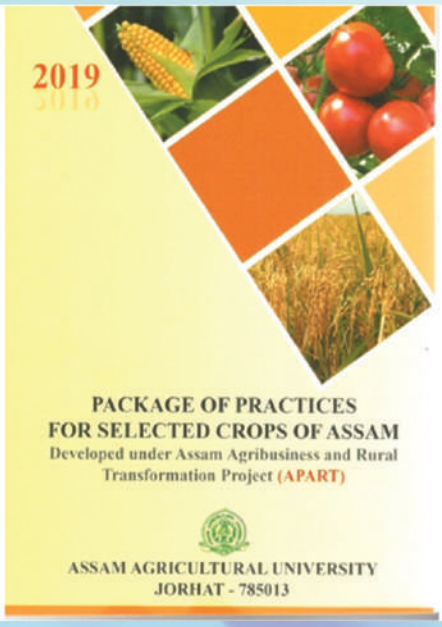


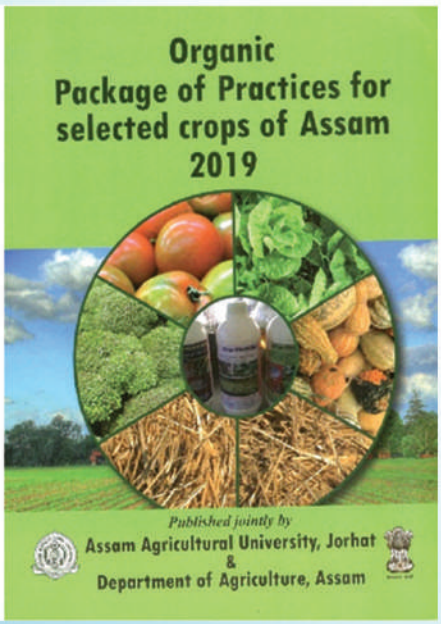
Trainings / package of practices/recommendations

Activities	Impact
Farmers trained (2017-2020)	1856 nos of beneficiaries
State agricultural officers trained	20
Technology transferred	Technology transferred to KVK and State Agriculture Department, Govt. of Assam
Package of practices	Package of practices developed and recommended to farmers of NEH regions
Publications	Published by AAU, Jorhat & State Agriculture Department, Assam as follows: • Package of practices for Kharif crops of Assam, 2019 • Organic package of practices for selected crops of Assam, 2019

Publications : Package of practices adopted by state Govt of Assam







The information given in the document is based on the experiments carried out at the AINP centre- Department of Soil Science, Assam Agricultural University (AAU). Jorhat, Assam. For training, demonstration and other enquiries please contact Principal Investigator, AINP on Soil Biodiversity-Biofertilizers, AAU, Jorhat-13, Assam.

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