Rice Technology *Bulletin*

Department of Agriculture
Philippine Rice Research Institute (PhilRice) **ISSN 0117-9799** **2001 No. 39**

Use of Indigo as Green Manure

RICE TECHNOLOGY BULLETIN SERIES

No. 1 Released Rice Varieties (1968 - 1994)
No. 2 Pagpaparami at Pagpupuro ng Binhi sa Sariling Bukid
No. 3 Paggawa ng Maligaya Rice Hull Stove
No. 4 PhilRice Micromill
No. 5 PhilRice Flourmill
No. 6 PhilRice Drumseeder
No. 7 PhilRice Rototiller
No. 8 Rice Food Products
No. 9 PhilRice-UAF Batch Dryer
No. 10 Integrated Management of the Malayan Black Bug
No. 11 SG800 Rice Stripper-Harvestser
No. 12 Dry-Seeded Rice-Based Cropping Technologies
No. 13 Maligaya Rice Hull Stove
No. 14 10 Steps in Compost Production
No. 15 Rice Tungro Virus Disease
No. 16 The Philippine Rice Seed Industry and the National Rice Seed Production Network
No. 17 10 Hakbang sa Paggawa ng Kompost
No. 18 10 nga Addang ti Panagaramid iti Kompost
No. 19 Characteristics of Popular Philippine Rice Varieties
No. 20 Rice Stem Borers in the Philippines
No. 21 Rice Food Products (revised edition)
No. 22 Leaf Color Chart (English)
No. 23 Leaf Color Chart (Ilocano)
No. 24 Leaf Color Chart (Filipino)
No. 25 Equipment for Rice Production and Processing
No. 26 Use of 40kg Certified Seeds per Hectare
No. 27 Rice Wine
No. 28 Management of Field Rats
No. 29 Controlled Irrigation: A water-saving technique for transplanted rice
No. 30 Minus-one Element Technique: Nutrient deficiency test made easy
No. 31 Management of the Rice Black Bug
No. 32 Management of Zinc-Deficient Soils
No. 33 Management Options for the Golden Apple Snail
No. 34 Use of Evaporation Suppressant
No. 35 Pagpaparami ng Purong Binhi ng Palay
No. 36 Management of Sulfur-Deficient Lowland Rice Soils
No. 37 Management of Planthoppers and Leafhoppers
No. 38 Management Options for Ricefield Weeds

FOREWORD

The potential accruing indigo as green manure has paved the way towards the farmers' in Ilocos ultimate goal for maximum production. It is a timely innovation concurring with their existing farming system. A remarkable number of benefits sparked behind the use of this crop as revealed in the recently conducted research, which serves as ground to become a good alternative for fertilizers. Unlike inorganic fertilizers, indigo can sustain soil and crop productivity in the long term. This is evident in the higher rice grain yields obtained in fields planted and incorporated with indigo than those where indigo had not been incorporated. Besides, a biomass of indigo can produce organic nitrogen, which is one element necessary for the enhancement of soil fertility. It also serves as a catch crop for residual soil nitrate, which otherwise would move at deeper soil layer and ultimately contaminate the groundwater.

Sad to note, however, despite the benefits behind the technology, the use of indigo is not yet widespread.

In line with our pursuit to accelerate the widespread dissemination of the technology, this bulletin is purposely made.

LEOCADIO S. SEBASTIAN
Executive Director

Indigo as green manure

Indigo *(Indigofera tinctoria L.)*, locally known as "tayum", is a shrubby legume that was initially introduced in the Philippines as a source of dye but was adopted by farmers as green manure (GM). It grows slowly during the first three months from planting. Thereafter, the plant grows rapidly. In 210 days, indigo intercropped with dry season (DS) crops could accumulate biomass amounting to 2,190 – 2,570 kilogram per hectare. This could contribute about 38 – 71 kg organic nitrogen (N) per hectare(Agustin *et al.*, 1998). The slow growth rate of indigo is an adaptive advantage, as it would allow indigo to be established through intercropping scheme.

Who will benefit from the technology

This technology helps farmers who are working in a highly diversified and intensified rainfed lowland cropping system to sustain crop and soil productivity.

Benefits associated with Indigo GM

1. **Enhanced soil fertility.** This is evident in the production of grain yield as shown by the 1,200 kg/ha yield increase in field incorporated with indigo. Lower grain yield was obtained in field without indigo despite the higher N applied (*Table1)*.

2. **Better growth and yield performance of rice with Indigo.** The yield parameters that include tiller number, panicle count, and 1,000-grain weight were enhanced by indigo GM (*Table1).*

Table 1. Growth and yield performance of rainfed lowland rice in farms with and without indigo green manure. WS 1999.

Parameter	With Indigo	Without Indigo	% increase
Tiller no./m^2	492	385	21.79
Panicle no./m^2	420	370	13.51
No. of filled grains/panicle	65	59	10.17
1000-grain weight	25.67	23.89	7.45
Yield, kg/ha	5444.39	4197.17	29.72

3. **Increased profits and reduced production cost per kilogram rice grains.** Farmers, who are applying indigo obtained an average net income of P21,846/ha and production cost/kg of rice grain, P5.90. Without indigo, the production cost was P7.90/kg grain whereas the farmer's net income averaged P8,538.60.

4. **Reduced use of chemical fertilizers.** The amount saved (P800) from reduced fertilizer application rates and the cost return (P21,875) from increased grain yield are more than enough to cover the added cost required by the technology, which include additional labor for the establishment and incorporation of indigo GM amounting to P6,300.00 *(Table 2).*

Table 2. Partial budget analysis of fertilizer application and Indigo as green manure in the 400 m^2 experimental area of Mr. Roger Taroma in Paoay, Ilocos Norte.

	With Indigo	Without Indigo
A. Cost of Inorganic Fertilizer		
5 bags 14-14-14	2,050.00	2,050.00
bags 46-0-0	600.00 (1.5 bags)	1,400.00 (3.5 bags)
Total	2,650.00/ha	3450.00/ha
Reduced cost of fertilizer with the use of Indigo = 800.00		
B. Cost of Indigo Incorporation		
Gathering and Chopping	4,800.00	
Indigo Incorporation	1,500.00	
Total	6,300.00	
C. Added Returns		
Grain Yield	6,792.00 kg/ha	4,219.00 kg/ha
Added Yield with the use of Indigo	2,573.00 kg/ha	
D. Cost & Return Analysis:		
Added Yield using Indigo		2,573.00 kg/ha
Price/kg of palay		P8.50
Total Value		21,875.00
Reduced cost of fertilizer using Indigo		800.00
Total Value		22,675.00
Cost of Indigo		6,300.00
Net Benefit with the use of Indigo = P16,375.00		

Fertilizer rate is reduced from 3.5 to 1.5 bags/ha in the rice farms with the integration of indigo GM.

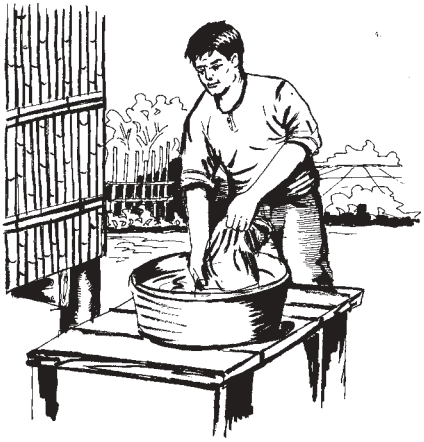
5. **Sustained yield of companion DS crop**. Research has shown that indigo users obtained corn grain yield of 333 and 300 kg/ha in farm with and without indigo, respectively. In contrast, corn in the indigo non-user farm did not produce grains. Instead, it was harvested only as fodder for animals.

Aside from reducing the commercial fertilizers used, Mr. Napoleon Sapaden, a farmer of Batac, Ilocos Norte also increased his yield from 6,320 kg/ha to 7,760 kg/ha with indigo. From then on, indigo has become a constant ingredient in his 2.5-ha rice and corn field.

5. **Catched residual soil nitrate**, which otherwise would move at deeper soil layer and ultimately contaminate the groundwater. Research has shown that the nitrogen efficiency of the different catch crop management systems was in the order of indigo (46%) > corn (43%) > indigo plus mungbean (40%) > fallow (20%).

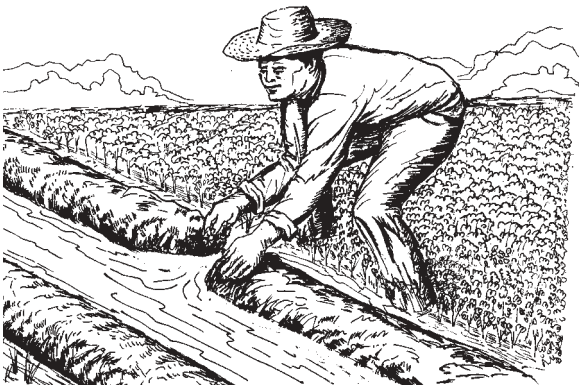
How to produce the planting materials

1. Place the seeds in a sack and soak it in tap water for at least eight hours before sowing or dip in boiling water for not more than one minute.

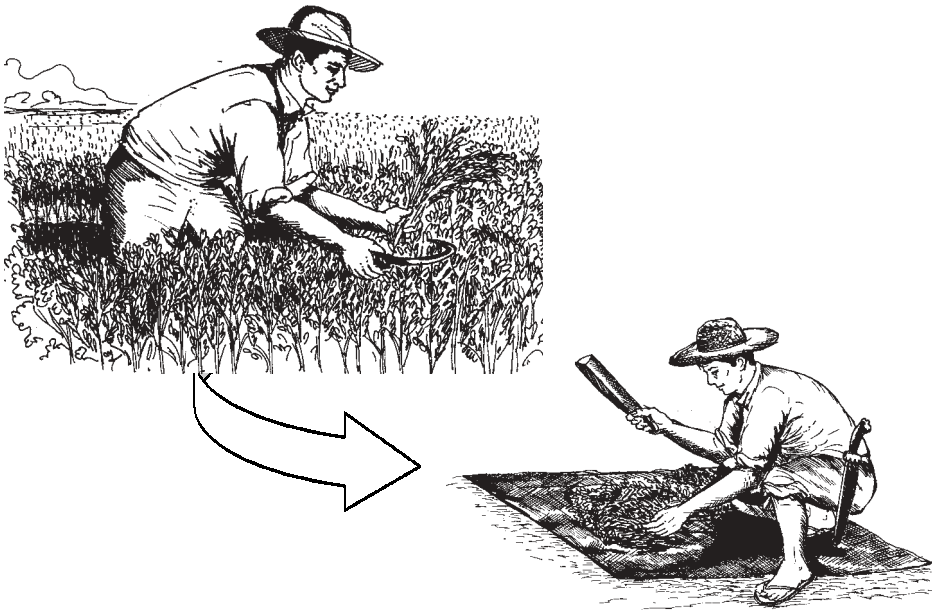


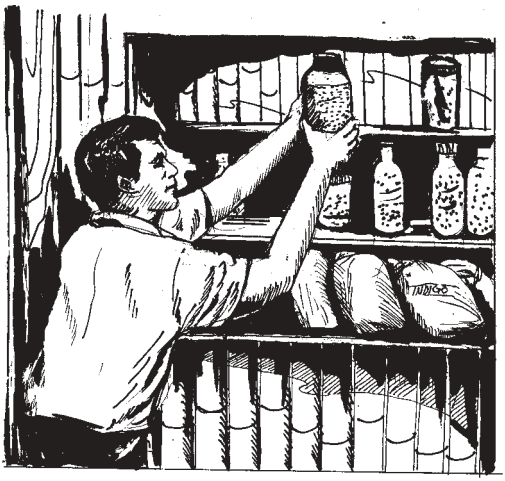
2. Broadcast seeds in moist and thoroughly prepared field. To ensure even distribution of seeds in the field, mix indigo seeds with clean sand, then broadcast.

3. Flash irrigate the indigo one-month after sowing or when the plants are about 3-4 inches tall. (No fertilizers or insecticides are applied until seeds are harvested).



4. Harvest indigo seed pods at 3.5-4 months after sowing. Most farmers cut the indigo stalks above ground, then dry the cut stalks with pods. Seeds can be separated from the biomass by manual pounding.

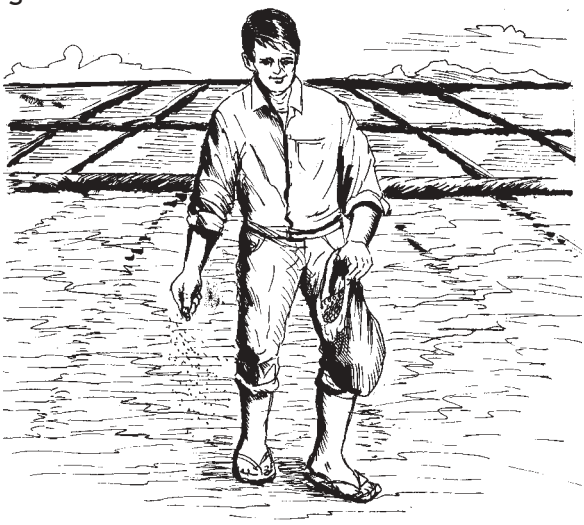




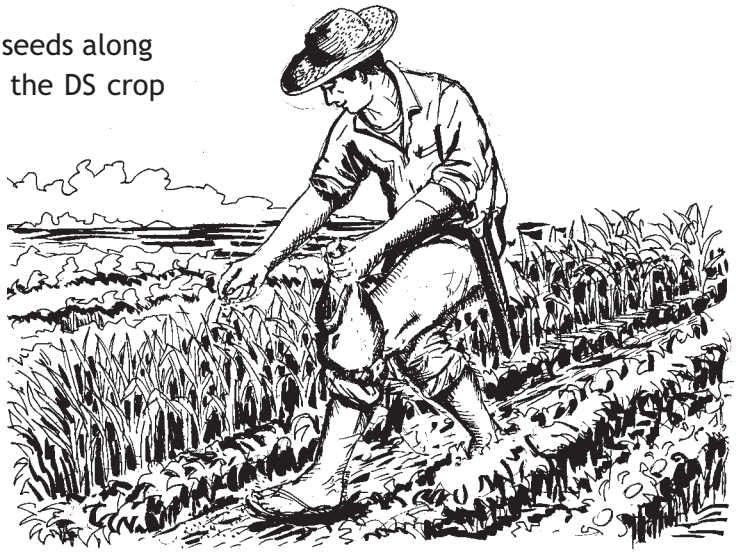
5. Store seeds properly at room temperature in sacks, bottles, or plastic container until planting time.

How to plant Indigo

1. Broadcasting



2. Drilling the seeds along the rows of the DS crop



When to plant Indigo

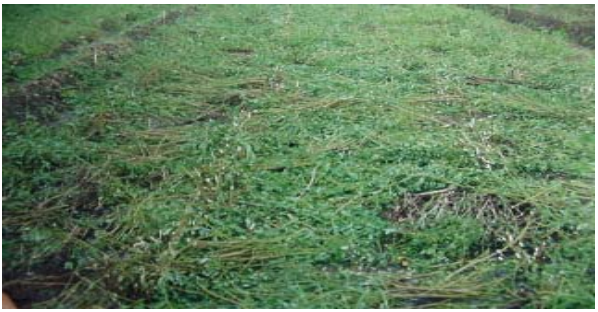
The time of planting indigo varies depending on the purpose:

- Indigo for seed production is planted as a monocrop in September - November.
- For green manuring purposes, indigo is planted in February - March, mainly as intercrop of the DS crops such as garlic, corn, and mungbean. Planting is usually scheduled to coincide with the irrigation of the DS crop.

How to incorporate Indigo as GM

1. Wait until the field has accumulated sufficient water for wetland preparation.

2. Cut the indigo at ground surface or topple the plants using spike tooth harrow.



3. Plow the field thoroughly using an animal-drawn plow or a tractor to incorporate the indigo.

4. Transplant rice immediately or 3-5 days after GM incorporation.

The indigo biomass is incorporated as GM for the succeeding WS rice in July - August depending on the availability of rainfall. It is incorporated in the soil while the land is prepared for rice transplanting.

Where to obtain the planting materials

Farmers can either produce their own or buy them during market days. The following places are identified to have been selling indigo seeds during market days:

- Badoc, Ilocos Norte
- Sinait, Ilocos sur

TAKE NOTE!

Manure and compost have been used all along the history of farming. These are already available in the farm. If not available, these can be easily produced in the farm. Chemical fertilizers can be readily bought in the market at a reasonable price because of government subsidy. But we may wake up one day and find that prices have gone up; worst, there is a shortage of supply available in the market.

Research has indicated that the present farming systems of non-indigo users may not be sustainable in the long run. Thus, farmers should adopt sustainable soil management technologies, among which is the indigo manuring technology.

REFERENCES

Agustin EO, Pablico SMA, Culannay DR, Baga MCP, and Lucas MP. 1998. Indigo Green Manuring Technology: Socio-economic and Technical Dimensions. Paper presented during the 12th ILARRDEC Regional Symposium for R & D Highlights, UCC - CONDORA, Damortis, Rosario, La Union.

Castro RC, Aguinaldo AC, Abrogena NQ, Alquiza PC, James MC, and Liboon SP. Research report on the project, titled: Technology Promotion and Impact evaluation of RBFS Technologies. PhilRice Batac.

Marcos TF, Agustin EO, Shresta RK, Ladha JK, Morales AC, Balasubramanian V, Culannay DR, Baga MCP, and Obien SR. 2001. Soil Management Options for Diversified and Intensified Cropping. Paper presented in a plenary session during the 32th national R&D Review and Planning Workshop on March 7-9.

Solis, Kathleen. 2001. A century-old tradition of green manuring. PhilRice Newsletter. Vol.14, No. 2, April-June.

Subject Matter Specialists
Epifania O. Agustin, PhD
Teresita F. Marcos, PhD
Madonna C. Casimero, PhD
Alma C. Aguinaldo

Managing Editor/Desktop Artist
Ronan G. Zagado

Cover & Design
Carlo G. Dacumos (carlo77@mozcom.com)

Illustrator
Carlito N. Bibal

Editorial Advisers
Leocadio S. Sebastian, PhD
Teresa P. De Leon

For further information, contact:

Agronomy, Soils, and Plant Physiology Division
Philippine Rice Research Institute
Maligaya, Science City of Muñoz, 3119 Nueva Ecija
Tel. No. (044) 456-0285; -0113 local 259, 212

DA-PhilRice

The Philippine Rice Research Institute (PhilRice) is a government corporation attached to the Department of Agriculture (DA). Executive Order 1061 approved on November 5, 1985 and amended by EO 60 dated Nov. 7, 1986, created PhilRice to help develop high-yielding technologies so that farmers can produce enough rice for all Filipinos. PhilRice accomplishes this mission through research, technology promotion, and policy advocacy, which are implemented through a network that includes 57 agencies and 115 seed centers strategically located nationwide.

Its interdisciplinary programs include the following: (1) direct-seeded and (2) transplanted irrigated lowland rice; (3) hybrid rice; (4) rice for adverse environments; (5) rice-based farming systems; (6) rice and rice-based products; (7) policy research and advocacy; and (8) technology promotion. With these programs, PhilRice aims to develop and promote technologies that are ecosystem-based, location- and problem-specific, and profitable to the Filipino farmers.

for more information, write, visit or call:

DA-PhilRice *Maligaya*
Science City of Muñoz, 3119 Nueva Ecija
Tel: 63 (044) 456-0113, -0258, -0277
Tel/Fax: 63 (044) 456-0112; -0651 local 511; -0652 local 515;
e-mail: philrice@mozcom.com
Website: http://www.philrice.gov.ph

DA-PhilRice *Los Baños*
UPLB Campus, College, 4031 Laguna
Tel: 63 (049) 536-3631 to 33, -3635
Tel/Fax: 63 (049) 536-3515
e-mail: philrice@laguna.net

DA-PhilRice *San Mateo*
Malasin, San Mateo, 3318 Isabela
Tel: 63 (078) 664-2280, -2954
Tel/Fax: 63 (078) 664-2953
e-mail: philrice_isabela@digitelone.com

DA-PhilRice *Batac*
17 Tabug, Batac, 2906 Ilocos Norte
Tel: 63 (077) 792-4714
Tel/Fax: 63 (077) 792-4702; -4745; -2543
e-mail: philrice@ILN.CSI.com.ph

DA-PhilRice *Midsayap*
Bual Norte, Midsayap, 9410 North Cotabato
Tel: 63 (06422) 97242
Tel/Fax: 63 (06422) 98178
e-mail: philrice@microweb.com.ph

DA-PhilRice *Agusan*
Basilisa, RTRomualdez, 8611 Agusan del Norte
Tel: 63 (085) 818-2277, -3377
Tel/Fax: 63 (085) 818-4477
e-mail: cvces001@cdo.philcom.com.ph

TECHNOLOGY TODAY FOOD TOMORROW

DA-PhilRice

Department of Agriculture
Philippine Rice Research Institute

GINTUANG MASAGANANG ANI
Go Modern Agriculture