Department of Agriculture Regional Field Office No.2

TAKING STRIDES TOWARDS SUCCESSFUL FARMING

A COMPENDIUM OF MATURED TECHNOLOGIES CY 2015 - 2017

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A COMPENDIUM OF MATURED TECHNOLOGIES 2015-2017

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Foreword

Research and Development (R&D) can never be separated from the agriculture sector. It is through R&D that we could find solutions to pressing agriculture problems and develop innovations for competitive farming.

Through our Research Division, Research Centers and Experiment Stations, Integrated Laboratory Division and other R&D implementing units, we have conducted a number of research undertakings all throughout the region to find technologies that are location-specific. Outputs of these researches include a wide array of farming technologies and value-adding activities for farmers' adoption.

The Department of Agriculture Regional Field Office No. 02 (DA-RFO 02) through the Research Division has compiled the matured technologies generated from the researches conducted by the department in the last two years.

This book, *"Taking Strides Towards Successful Farming: A Compendium of Matured Technologies 2015-2017"* is another initiative of the department to strengthen the promotion of technologies among farmers and other stakeholders. It details farming technologies in rice, corn, high value crops, livestock and developed products from prime commodities of the region.

This compendium is just the beginning of our fervent efforts in making our farmers agripreneurs of the future. May this publication inspire our researchers in their future R&D endeavors.

LORENZO M. CARANGUIAN, DPA
OIC-Regional Executive Director

Message

For our agricultural Research and Development (R&D) system to be effective, we need to be proactive in responding to the needs of the sector. As increasing farmers' and fisherfolk's income and reducing rural poverty remain the primary concerns of the Department of Agriculture, it is our business to come up with viable options that will be helpful to them in finding the path to prosperity.

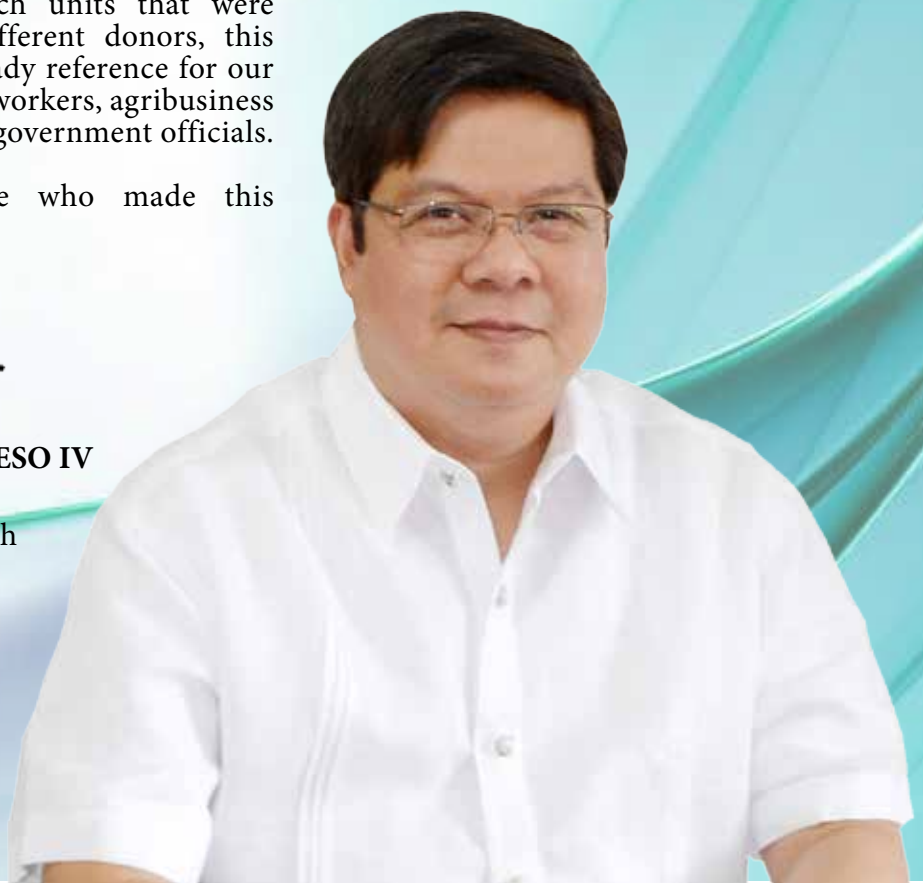
The production of this Compendium of Matured Technologies of DA Regional Office 02 is timely as this contains useful results and innovations from the region's research activities that will form the bases for technology recommendations for our agricultural producers.

Under the RDE continuum, we work to ensure that technologies generated by research are made available to the farming and fishing communities to improve their livelihoods. Along this line, the Bureau of Agricultural Research (BAR) has been providing the DA Regional Offices (RFOs) with support for their respective compilations of research results and other research-generated information that will lead to profitable options for our farmers.

I commend the DA-RFO 02 through its Research Division for taking the initiative in coming out with this publication, Compendium of Matured Technologies of DA-RFO 02. It is impressive in that, with just basic support and encouragement from BAR, you were able to continue and further develop on our earlier effort. In so doing, you have raised the platform for providing our farmers with technology and livelihood alternatives to a new level.

Packed with many relevant and useful information generated by the region's research units that were conducted with support from different donors, this book has been designed to be a ready reference for our agricultural researchers, extension workers, agribusiness investors, policy makers, and local government officials.

My congratulations to everyone who made this publication possible.



DR. NICOMEDES P. ELEAZAR, CESO IV
Director
Bureau of Agricultural Research

Message

As the government moves towards the attainment of food security in the country, the Department of Agriculture-Regional Field Office No. 02 (DA-RFO 02) takes it share in looking for ways to contribute in achieving and sustaining farmer's productivity in Region 02.

Our department, however, still believes that low adoption of technologies by farmers is still a major issue in the agriculture sector. Likewise, climate change affects the production of available and affordable food for the Filipinos.

In line with our battlecry "Cagayan Valley towards Agri-preneurship", we are recognizing the indispensable role of Research and Development (R&D) undertakings as our primary tool in making our farmers more productive.

We are taking serious steps in transforming R&D results to useful information through the packaging and distribution of Information, Education and Communication (IEC) materials to our intended users.

This year, we bring you the *"Taking Strides towards Successful Farming: A Compendium of Matured Technologies CY 2015-2017"*. It is a compilation of farming technologies and developed products. Technologies presented here are proven to be effective as it undergone rigorous on-station and on-farm validation regionwide.

I take my hats off to the men and women who worked hard in the publication of this material.

NARCISO A. EDILLO, M.A. Ed.
Regional Executive Director

Message

The Department of Agriculture-Regional Field Office No. 02 (DA-RFO 02) recognizes the efforts of our researchers whose works have resulted to new technologies and innovative products for farmers and fishers to avail and become agripreneurs.

This book, "*Taking Strides towards Successful Farming: A Compendium of Matured Technologies CY 2015-2017*", is a manifestation of a strong partnership between the researchers, users and other stakeholders in the dissemination of these technologies. Further, this compendium is the product of collective efforts of Research Division, Research Centers and Experiment Stations, Integrated Laboratory Division and other R&D implementing units.

We are happy to inform our readers that many of our researches were presented in national and international symposia and cited as to their economic importance, social and environment benefits. Moreover, we are continuously strengthening our capability in conducting research to generate more technologies to be promoted to intended users.

Likewise, the DA-RFO 02 shall also work with other government agencies and private sector to ensure a more effective technology transfer and utilization.

It is our aim that in the years to come, our farmers and fishers shall testify that their lives became better with the adoption of the technologies being presented in this reading material.

Mabuhay ang agrikultura!

ROSE MARY G. AQUINO
OIC - Regional Technical Director
Research and Regulatory

Message

To ensure the food requirement of the booming population, there is a dire need for a continuous conduct of Research and Development (R&D) undertakings. Over the years, our department has implemented a number of researches all over the region to look for solutions in agricultural problems.

Being the head of the extension arm of the Department of Agriculture-Regional Field Office No. 02 (DA-RFO 02), it is with great pleasure that we present to you the technologies generated from our researches. These proven farming technologies and value-adding activities are our inputs in pursuing extension-related activities for strengthened promotion among our farmers and other stakeholders.

We believe that our success in making every farmer agripreneurs could be measured in terms of their adoption of technologies and value-adding activities that we promote. In the end, our main goal is to put all information be of use by our farmers and other stakeholders who are our great partners in attaining food security.

I enjoin all of you to read this book "*Taking Strides towards Successful Farming: A Compendium of Matured Technologies CY 2015-2017*" and choose the best technology suited to your farming needs and value-adding interest for higher income.

ROBERT B. OLINARES
OIC - Regional Technical Director
Operations and Extension

Message

As we walk with countless innovations around us, so must agriculture. Taking long decisive steps through Research and Development (R&D) has to be taken to keep pace of this fast changing world.

This is what the book *"Taking Strides towards Successful Farming: A Compendium of Matured Technologies 2015-2017"* is all about. It showcases the knowledge products and technologies generated by the researchers of Cagayan Valley.

Each featured research output is a step closer towards Philippine Agriculture's destination --- a sustainable agriculture for our farmers and the people that surround them.

Let this book be an inspiration to our researchers and the Department to help bring each agricultural stakeholder most especially our Filipino farmers to greater heights. This is just one of our many ways to make them happy by providing them numerous options and motivate them to continue farming with renewed enthusiasm.

MR. ISIDRO B. ACOSTA, SR.
Chair, Regional Agriculture and
Fisheries Council

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PRODUCT DEVELOPMENT

RICE

NEXT-GENERATION RICE VARIETIES RELEASED FOR DIFFERENT ECOSYSTEMS

Project Title: Accelerating the Development & Adoption of the Next Generation (NextGen) Rice Varieties for the Major Ecosystems in Region 02

Rice sufficiency by all means is not just to have enough but accessible and affordable rice. Prior to its attainment is ensuring rice productivity under different climatic conditions. Hence, the Department of Agriculture (DA), Philippine Rice Research Institute (PhilRice), and International Rice Research Institute (IRRI) collaborate in producing rice varieties, that are capable to withstand the given challenges.

Climate change brings biotic and abiotic stresses that trigger the changes of ecosystem, affecting the performance of crops such as rice. In line with the making of resistant varieties, the project entitled "Accelerating the Adoption of Next Generation (Next- Gen) Rice Varieties for the major Ecosystems in the Philippines" aims to boost and mainstream the identity of the Next-Gen rice throughout farming communities. The DA, PhilRice and IRRI are identified implementers under the Food Staples Sufficiency Program (FSSP).

Here are the following new rice varieties and their agronomic characteristics:

Ecosystems	VARIETIES			
	Wet Season (2017)	Estimate harvest (ton/ha)	Dry Season (2018)	Estimate harvest (ton/ha)
Irrigated Lowland- Hybrid	NSIC Rc262H	4.22	NSIC Rc380H	6.09
	NSIC Rc314H	4.41	NSIC Rc406H	5.86
	NSIC Rc368H	4.09	NSIC Rc408H	6.15
Irrigated Lowland-Inbred	NSIC Rc394	4.25	NSIC Rc436	5.18
	NSIC Rc398	4.39	NSIC Rc438	5.45
	NSIC Rc400	4.46	NSIC Rc442	5.44
Irrigated Lowland-Special Purpose	NSIC Rc342SR	4.04	NSIC Rc342SR	5.74
	NSIC Rc15	4.48	NSIC Rc19	5.79
	NSIC Rc218SR	4.34	NSIC Rc218SR	4.16
Drought Prone	NSIC Rc418	4.36	NSIC Rc428	3.32
	NSIC Rc420	4.49		
	NSIC Rc424	3.96		
Saline Prone	NSIC Rc340	2.80	NSIC Rc468	2.95
	NSIC Rc182	3.18		
	NSIC Rc390	2.83		
Submergence	PR40146-B14-1-4-2	3.48		
	NSIC Rc194	3.86		
	GSR-8	2.37		

Agronomic Characteristics and Pests Reactions of top three (3) rice varieties per ecosystem based on the conducted PVS in the region:

Variety	Agronomic Characteristics			Disease and Insect Reactions					
	Maturity (DAS)	Height (cm)	Tillers (#)	Blast	Bacterial Blight	Tungro	BPH	GLH	Stem-borer
Irrigated lowland (Hybrid)									
NSIC Rc262H	114	113	14	I	I	S	I	MR	MS
NSIC Rc314H	118	110	14	I	I	S	I	MS	I
NSIC Rc368H	109	108	13	I	S	S	I	I	I
Irrigated lowland (Special Purpose)									
NSIC Rc218SR	120	106	14	S	I	S(S)	I	MS	-
NSIC Rc342SR	105	97	111	S	I	S	I	MR	I
NSIC Rc15	121	100	14	I	I	S	S	MS	I
Irrigated lowland (Hybrid)									
NSIC Rc394	112	94	14	S	-	S	I	I	-
NSIC Rc398	113	93	15	S	-	S	I	I	-
NSIC Rc400	120	105	15	S	-	S	I	I	-

Legend: R - Resistant, MR - Moderately Resistant, I - Intermediate, MS - Moderately Susceptible, S - Susceptible, BPH - Brown Plant Hopper, GLH - Green Leaf Hopper

Agronomic Characteristics and Pests Reactions of top three (3) rice varieties per ecosystem based on the conducted PVS in the region:

Variety	Agronomic Characteristics			Disease and Insect Reactions					
	Maturity (DAS)	Height (cm)	Tillers (#)	Blast	Bacterial Blight	Tungro	BPH	GLH	Stembo-rer
Saline Prone									
NSIC Rc182	113	86	13	S	I	S	MS	MS	MR
NSIC Rc2013 Rc340	113	93	13	S	S	S	I	MR	MS
NSIC 2014 Rc392	113	91	13	S	S	S	-	MS	I
Submergence Prone									
NSIC Rc194	112	97	20	S	I	S	S	S	I
NSIC Rc480	121	88	13	I	S	S	I	S	-

Legend: R - Resistant, MR - Moderately Resistant, I - Intermediate, MS - Moderately Susceptible, S - Susceptible, BPH - Brown Plant Hopper, GLH - Green Leaf Hopper

Farmers participate during the Participatory Varietal Selection

Funding Agency: *Department of Agriculture*
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Engr. Eddie Rodriguez of SCRC, tests the riding-type transplanter.

MECHANICAL RICE TRANSPLANTER: KEY FOR A GOOD HARVEST AND INCOME

Project Title: Comparative Analysis of Mechanized and Conventional Rice Transplanting in Region 02

Let the rice fields of the valley welcome mechanized transplanting through the rice transplanter. This machine supports timely transplanting, even spacing between hills, and ease in rice farming.

In a two-year study from 2015-2016 in Region 02 comparing the yield performance of conventional versus mechanical transplanting in a hectare of rice field, it was found that the average amount spent to produce a kilogram of palay through transplanting or lipat-tanim is Php 8.08 while with transplanter it only costs Php 6.57. Lipat-tanim can give an income of Php 46, 652.06 while with transplanter it is Php 72,939.26.

Although the cost of mechanized transplanting is a bit higher, it gets back by needing less manpower and higher yield. From the 16 persons needed to perform conventional transplanting, they are reduced to six (6) with mechanical transplanter. Five percent higher yield is associated with having more tillers from the mechanically transplanted rice which has 19 tillers while with conventional is 14. Manual transplanting yields an average of 5.65 mt but mechanical yields 7.54 mt.

DATA PER HECTARE	CONVENTIONAL TRNASPLANTING	MECHANIZED TRANSPLANTING
Manpower	16	6
Number of tillers per hill	14	19
Cost of Production per kg	Php. 8.08	Php 6.57
Net Income	Php 46, 652.06	Php 72,939.26
Yield	5.65 MT	7.54 MT
Return of Investment (ROI)	125-130%	133-146%

Conventional Vs. Transplanter

Farm Mechanization Field Day

Funding Agency: *Department of Agriculture*
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FARMING WITH INFORMATION COMMUNICATION TECHNOLOGY, WHY NOT?

Project Title: Rice Crop Manager: A Comprehensive Decision Support Tool for Increasing Yield and Income of Farmers in Region 02

Farming and Information Communication Technology (ICT) may be an odd pair but in the rice fields, ICT will be a big help like the Rice Crop Manager (RCM).

RCM is a web-based tool to give personalized recommendations to farmers about crop and nutrient management suitable for their rice fields' growing conditions and needs. It was introduced since 2014.

The technology was promoted in Region 2 through a project that aimed to make use of RCM and register at least 5,000 rice fields coming from Cagayan and Isabela in a year. The project also compared the yield of those who followed RCM's recommendation versus the yield from the usual farmers' practice in the project locations.

Results show that from the conventional rice farming practices that yields 4,756.94 mt/ha, it improved into 5,229 mt/ha. The 0.472 mt/ha increase is equivalent to Php 5,753 income. According to International Rice Research Institute (IRRI), if the recommendations of RCM will be applied in 500,000 ha of farm lands in two rice cropping seasons, there will be an increase of about 240,000 mt of milled rice in the country.

The project recorded that the conventional farming practice per hectare costs Php 35,542 while with RCM recommendation, Php 37,342. The usual farming practice may be cheaper but when it comes to return of investment, those who took RCM's guide resulted with 15% higher earnings.

Farmer monitors his rice field.

Angelito Garcia of Cabatuan, Isabela; one of RCM adoptors.

RCM oversees the exact location and measures the farm lot area for enough and efficient fertilizer input. It also tracks the history of the farm land as to what was formerly cropped in it. This is done to have an idea in the characteristics that could possibly threat and help rice cropping in an area. The data are recorded and organized and reviewed by the experts who will come up with the recommendation.

In the ever changing times, it is indeed a challenge to keep pace with technology but seeing how it makes farming easier, it is up to the farmers if they want to jump right into what is new and see its benefits first hand.

Funding Agency: *Department of Agriculture*
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DA-Cagayan Valley Research Center (DA-CVRC); da.cvrc02@yahoo.com
DA-Northern Cagayan Experiment Station (DA-NCES)
DA-Nueva Vizcaya Experiment Station (DA-NVES); cvhrfits@yahoo.com
DA-Quirino Experiment Station (DA-QES); daupros@yahoo.com

Ms. Cherrybel Cubero inspects mushroom culture media.

THERE'S MORE FOR RICE WASH

Project Title: Verification of different culture media for mushroom pure culture production

Pure culture production is mostly done in the laboratory using Potato Dextrose Agar (PDA), oatmeal and potato extract as its culture media, but recently more economical alternative is discovered. Think twice before letting the rice wash go in the drain because it has its new use.

Comparison between PDA and Rice Wash as Culture Media

	Potato Dextrose Agar (PDA)	**Rice Wash**
Days mycelium emerged and increased	14-17	12
Frequency of contamination out of 15 samples	13	15
Length of preparation	35 minutes	45 minutes
Cost of preparation	Php 133.80	Php 111.12

A liter of rice wash can make 15-20 pure media culture bottles which can be sold for Php 300.00 each. It only gets better because to produce these bottles, one only has to spend Php 1,325.00.

To use rice wash as culture media, one needs 400g of rice, two gulaman bars, 20g of white refined sugar, flat bottle, clean cloth, cotton balls, paper or aluminum foil, a liter of distilled water, pot, and pressure cooker or autoclave.

Pure Culture Media Preparation

1

Wash 400g of rice with a liter of distilled non-chlorinated water.

2

Collect the first rice wash then filter it using a clean cloth.

3

Bring the filtered rice wash to a boil and add the 2 gulaman bars and 2 tablespoons of white refined sugar.

4

Bring the filtered rice wash to a boil.

5

Then on each flat bottle, pour 40-50 ml of the mixture.

6

Close the bottle's mouth with a cotton ball and paper or aluminum foil and tighten it with a rubber band.

7

Sterilize the bottles with the mixture in a pressure cooker for 30 minutes or in a pot for 2 to 3 hours.

8

Lastly, let the bottle lay flat and wait for the mixture inside to solidify.

Funding Agency: *Department of Agriculture*
Contacts *: DA-Southern Cagayan Research Center (DA-SCRC); scrc_cvlmros_apc@yahoo.com / scrc_02@gmail.com*

Ms. Mindaflor Aquino holds sample of Trichoderma.

TRICHODERMA: MORE HITS, NO MISS

Project Title: Management of Sheath Blight of Upland Rice in Jones, Isabela

In the past, the threat of sheath blight lingers in the soils planted with rice, but now, this disease caused by a fungus can be countered by another fungus.

Trichoderma spp. is a subfamily of fungi proven as an effective biofungicide against *Rhizoctonia solani* that causes sheath blight in rice plant. Sheath blight is one of the disease that affects rice every year and affects farmers' yield at an estimate of 7% on lowland rice fields.

Trichoderma can be applied through this process.

- Prepare compost using *Trichoderma spp.*
- Apply ten (10) bags of compost (organic fertilizer) as basal during planting.
- If there is no compost available, the fungi can be incorporated with water then drench it to the plants ten (10) days after emergence.

But bear in mind that applying with compost is far more effective because of the organic matter in it.

Damages caused by sheath blight on leaves, stalk and panicle.

In a study conducted by the DA-Regional Crop Protection Center (DA-RCPC) on upland rice farms in Jones, Isabela that used Trichoderma with compost, sheath blight (*Rhizoctonia solani*) and rice blast *(Magnaporthe grisea*) are managed. Imagine not worrying about two rice diseases just by using one biocontrol! Another notable observation is from the usual 0.99 ton/ha, the yield of the farmers improved to 1.08 up to 1.09 ton/ha.

Not only does biofungicides are environmental friendly, but in the experience of the farmers with Trichoderma, they can save up to Php 3,050 per hectare.

Tried and proven, Trichoderma sheds light on sheath blight problem of rice farmers but also hits practicality and friendly to environment.

Funding Agency: *Department of Agriculture*
Contacts ***:*** *DA-Regional Crop Protection Center (DA-RCPC); da_rcpc02@yahoo.com*

Ms. Gemma Bagunu presents a ricefield treated with gypsum.

FACING SOIL THREATS OF RICE IN THE VALLEY

Project Title: Gypsum ($CaSO_4$/Calsium Sulfate) Soil Fertilization and Amelioration For Enhanced Rice Productivity under Adverse Condition and Low-Yielding Prime Lands

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Out of the 556,884 hectares of agricultural land area dedicated for rice production in Cagayan Valley, 5.10% is threatened by salinity, submergence and zinc-deficiency. To cope with this challenge and to enhance crop yield in these adverse environments, the region turns to the application of soil ameliorant such as Gypsum (calcium sulfate).

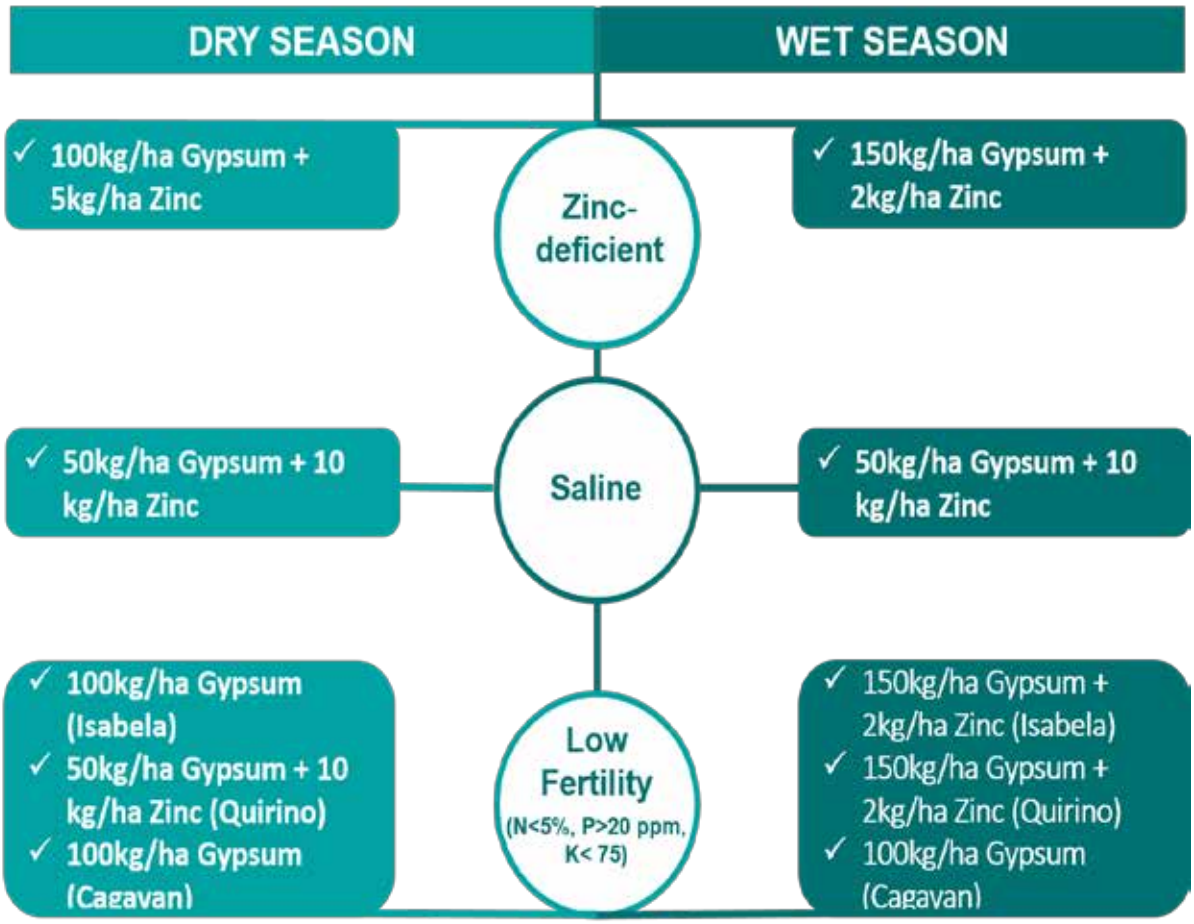
As the universal soil amendment, Gysum can do the following:

- improves soil structure
- helps reclaim sodic soils
- improves low-solute irrigation water
- increases the stability of soil organic matter
- decreases pH of sodic soils
- increases the pH of acidic soils
- improves compacted soil, corrects subsoil acidity
- enhances the values of liming
- helps plants absorb nutrients
- source of sulfur
- decreases the toxic effect of sodium chloride salinity
- multiplies the value of other inputs
- decreases loss of fertilizer Nitrogen to the air
- increases water retention in soil.

Gypum was evaluated and found responsive in the different adverse areas in Region 2 in terms of its growth and yield performance. The application of Gypsum in combination with organic and inorganic fertiizers plus zinc can substantially increase crop yield by 4.35% to 68.71%.

Recommended application rate of Gypsum based on the cropping season and status of the soil are applied as basal.

Application Rate of Gypsum combined with other Macro-Fertilizers Based on Soil Analysis:



A farmer can practically increase his yield and income through the application of the recommended rate of Gypsum in zinc-deficient areas by Php 2.70-30.33 which will be earned for every peso invested. Meanwhile, a return of about Php 2.40-4.90 in saline, and Php 1.80-4.14 in low soil fertility areas will be obtained for each peso spent in Gypsum rates.

Funding Agency: *Department of Agriculture*
Contacts *: DA-Cagayan Valley Research Center (DA-CVRC); da.cvrc02@yahoo.com*

CORN

The researcher (Mr. Roynic Y. Aquino) does pollination.

CAGAYAN VALLEY'S PROTEIN-RICH OPV CORN

Project Title: DA-CVRC Corn Crop Improvement Project: Development of High-Yielding Open Pollinated Varieties(OPV) of Yellow and White Special Corn Types for Commercialization as Staple Food and Feeds in the Philippines

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The Department of Agriculture - Cagayan Valley Research Center (DA-CVRC) is continuously undertaking breeding program for OPV corn in addressing continuous need for affordable, high yielding and climate change responsive OPV white and yellow varieties suited to farmers, consumers and processors preference/requirements.

Through conventional breeding, the center was able to develop five (5) new high-yielding and protein-rich varieties (2 OPV glutinous, 2 yellow and 1 white flint) registered to Bureau of Plant Industry- National Seed Industry Council (BPI-NSIC) in 2014 and 2015 after passing the rigid National Cooperative Test (NCT) evaluation.

Variety facts of new registered OPV corn:

CVRC Cn 13 (NSIC 2015 Cn 301)
Yield (mt/ha): 5.65
Maturity (days): 104.25 (DS) and 107.33 (WS)
Plant height (cm): 208.5 (DS) and 232.0 (WS)
Ear Length (cm): 16.29
Shelling Recovery (%): 74.07
Crude Protein Content: 8.24%

IES Cn 11 (NSIC 2014 Cn 294)
Yield (mt/ha): 6.14 (Luzon) and 6.32 (Mindanao)
Maturity (days): 107.0 (DS) and 105.0 (WS)
Plant height (cm): 208.6 (DS) and 234.9 (WS)
Ear Length (cm) : 16.0
Shelling Recovery (%): 76
Crude Protein Content: 8.41%

IES Glut No. 8 (NSIC 2014 Cn 293)
Yield (mt/ha): 4.92 (Visayas) and 4.19 (Mindanao)
Maturity (days): 104.0 DS and 101.0 WS
Plant height (cm): 210.0 DS and 238.4 WS
Ear Length (cm): 14.6
Shelling Recovery (%): 71
Crude Protein Content: 10.0%

IES Glut No. 10 (NSIC 2014 Cn 292)

Yield (mt/ha):	4.24
Maturity (days):	104.0 (DS) and 104.0 (WS)
Plant height (cm):	231.5 DS and 21.7 (WS)
Ear Length (cm):	14.3
Shelling Recovery (%):	75.8
Crude Protein Content:	10.51%

CVRC 12-06 (NSIC 2015 Cn 302)

Yield (mt/ha):	5.97
Maturity (days):	105.11 (DS) 100.33 (WS)
Plant height (cm):	219.66 (DS) and WS: 226.00
Ear Length (cm):	15.50
Shelling Recovery (%):	77.74
Crude Protein Content:	10.51%

Funding Agency: *Department of Agriculture-Bureau of Agricultural Research*
Contacts ***:*** *DA-Cagayan Valley Research Center (DA-CVRC); da.cvrc02@yahoo.com*

Dr. Roberto Busania seals the silage in plastic storage drum.

CORN: SILAGE OF YOUR CHOICE

Project Title: Corn Silage: Enhancing the Beef and Dairy Industry in Cagayan Valley

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From its stalk, leaves, silk and cobs every part of a corn plant won't be a waste. It can be used as source of food and living, guaranteed to be an A+ crop. It has also two primary harvest options: combine grain or chop silage.

"Pickled" for ruminants

When in dry season and pasture isn't good, silage save ruminants as a healthy meal. Silage is roughage material that underwent fermentation, a process called ensiling for at least 18 days. It is being produced when there is surplus. The excess feed materials are wilted up to 30% dry matter, chopped (1-3 cm) and packed air tight in a silo. This will be fermented for a minimum of 18 days. This will be readily used thereafter. The desired silage materials are 70 to 75 day-old corn, 45 day-old Napier and Guinea grasses. Other grasses can also be used.

Here are the advantages of silage:

- Stable composition for a longer period (up to 5 years);
- Reduction of nutrient loses is lesser at below 10% compare to standard hay production which amount to 30% of the dry matter;
- Requires 10 times less storage space compared to hay;
- More economical use of plants with high yield of green mass;
- Better use of the land with 2-3 crops annually; and
- Can be produced in both cold and cloudy weather;

Why corn?

Green fodder from corn has qualities that put itself above grasses as silage material. Corn offers consistent source of palatable and high energy forage for ruminants. It is one of the most high yielding forage crops that require less labor (harvested in single operation) and it is a good way to secure crops damaged by severe rain and drought. Corn silage has 30-50% higher nutritive value compare to corn grain and corn straw.

How to make it?

Preparation of corn silage is quite laborious however materials are readily available. Processes in making corn silage includes land preparation, crop establishment, fertilization, harvesting, chopping, mixing of molasses, packing of silage in a drum, storage, and feeding.

Planting of corn

- 3-4 seeds per hill with 14-14-14 basal
- Application at a rate of 2 bags of seeds per hectare
- 0-25 cm per hill and .5 m between furrows using second generation hybrid yellow corn.

Fertilization of corn

- 1 bag 46-0-0 per hectare application, 1 month after emergence.

Harvesting

- Harvesting is done 75 to 85 days after emergence or "milking stage".

Chopping of corn stalks

- Cutting of corn stalks to about 1-2 inches long. Cutting in smaller pieces makes a good quality of silage.

Mixing of Molasses (Optional)

- 1 kilo of molasses to 1 liter of water to 100 kilos of chopped corn.
- Mix the silage ingredients thoroughly

Packing of silage in a drum

- Silage must be pack tightly to avoid spoilage.

Covering of silage drum

- Sealing is needed to create anaerobic environment. It must be securely wrap with plastic, tightly tied with straw.

Storage of silage drums

- Storage served as protection against rodents, heat, and rain.

Feeding

- Feed the silage 18-21 days after ensiling.

Table shows the estimated cost of materials in making corn silage:

Materials	Cost
Corn silage (118 kg in every 1 drum)	118.00 pesos (118 kg is sold for 1.00/kg but in Bulacan, it is sold in minimum of 3.00 up to 4.50 pesos)
1 Drum	650.00 pesos
Plastic (cover)	3.00 pesos for every 1 drum
Straw (tie) (1 roll of straw could be used in tying 15-20 drums of corn silage)	6.00 cents for every 1 drum

Drums of corn silage produced in every 1 ha

$$\text{Drum/ha} = \frac{\text{(sqm/ha) (cost of corn silage)}}{\text{Kg of corn silage/drum}}$$

$$\frac{\text{(10,000 sqm) (4.00 pesos/sqm)}}{\text{118kg}}$$

$$= 339 \text{ drums}$$

Estimated profit of making corn silage for every ha

Profit= (no. of drums produced per ha) (cost of corn silage/drum)

(339 drums) (118 pesos)

= 40,002 pesos

Funding Agency: *Department of Agriculture*
Contacts ***:*** *DA-Quirino Experiment Station (DA-QES); daupros@yahoo.com*

Joel Cabanayan of Nueva Vizcaya, Double -row adoptor.

DOUBLE ROW PLANTING FOR DOUBLE CORN INCOME

Project Title: Commercialization of GAP Corn Technology Using Double Row Planting in Nueva Vizcaya

Good Agricultural Practices (GAP) is one of the standards in the production of corn which is regulated by the Philippine National Standard (PNS) and Department of Agriculture (DA). It aimed to provide safe and high quality corn to consumers and feed millers/processors. While in double row planting, it allows the farmers to almost double the yield of a given area. By giving the same space and ease of access that single row gardening does.

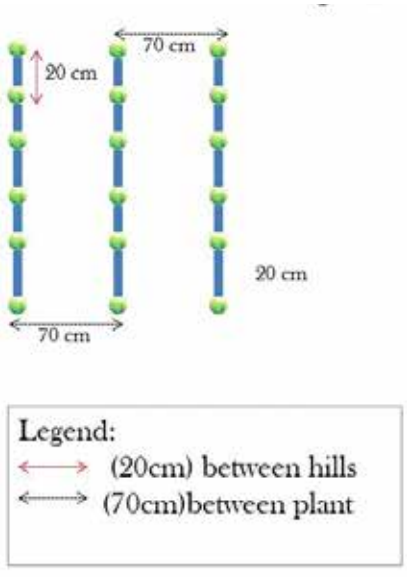
A double row arrangement increases the space between plants compared to single rows and can lead to earlier canopy closure and improved light interception.

Double-row planting of corn was assessed and compared with other row distances of planting corn. They found that double-row planting gave the highest yield and income. In a double-raw configuration, corn is planted in paired rows, usually 7 or 8 inches apart, on 30-inch centers. This system provides a more uniform spacing of plants, similar to narrow row corn, but allows a grower to use the same corn head and other equipment set for 30-inch rows.

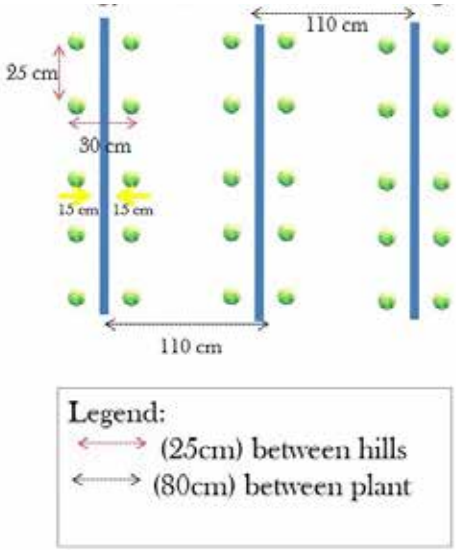
Mr. Cabanayan shows Crop Cut Samples harvested from double row corn.

Furrowing

Technology Double Row Planting



Farmers' Single Row Practice



Using such technology can give a large margin of increase in the production as high as 20% from the total production. GAP also have a contribution on corn farming for the safety of workers, the environment and the end users.

To ensure the GAP standard for corn, proper land preparation should be observed to safeguard healthy and uniform plant growth and provide advance effective and efficient weed control measures up to harvesting. Additions to consider are workers health, safety and welfare and environmental sustainability to meet the production outcome.

Using double row planting, production cost is a bit higher but it gave higher yield compared to the farmer's practice or single row planting. The income derived from venturing into double row is 30% higher compared to single row.

COST AND RETURN ANALYSIS		
PARTICULARS	*DOUBLE ROW PLANTING (30cmX80cmX25cm)*	*FARMERS PRACTICE SINGLE ROW PLANTING (70cmX20cm)*
Production (kg/ha)	12,500.00	9,500.00
Production (cavan)/ha	250	190
Total Cost Production/ha	48,380.00	43,721.00
Price/kilo (Fresh weight)	8.20	8.20
Gross Income/ha	102,499.99	77,900.00
Net Income/ha	54,120.00	34,179.00
Return of Investment (ROI)	111.86%	78.18%
Ave. Cost of Production/kg	3.87	4.60
Break even yield(kg/ha)	5,900	5,331.83

Funding Agency: *Department of Agriculture*
Contacts ***:*** *DA- Nueva Vizcaya Experiment Station (DA-NVES); cvhrfits@yahoo.com*

HVCC

(High Value Commercial Crops)



Ms. Celerina T. Miranda, the principal author of the project.

NVES REAPS NEW FRUIT VARIETIES

Project Title: Development and promotion of fruit tree industry in Region 02

Longan, rambutan and lychee are sub-tropical fruits that belong to the Sapindaceae family. In the Philippines, these fruit trees are rarely grown due to their inability to flower naturally under local growing condition. They require a period of exposure to cool temperature and dry location before the trees start to flower and bear fruits.

It is almost impossible but a team of persistent researchers headed by Celerina Miranda, station manager of Nueva Vizcaya Experiment Station (NVES), was able to unlock a breakthrough on longan, lychee and rambutan propagation that eventually made the new variety and Certified Parent Source Trees (CPST) in Region 02.

The longan variety was already registered with NSIC code NSIC2016Lg01 while the registration for lychee and rambutan is still underway. The researchers have evaluated these mother plants and mass propagated for commercialization.

Longan "LRAlviar PRIDE"

Plant/Tree Characteristic	
Canopy Spread	Semi- Spreading
Vigor	Strong
Brancing	Profused
Bearing Habit	Annual
Yield (at 10 yrs old)	100 kg.
Other tree characteristics	with many fruit cluster
Fruit Characteristics	
Fruit size	9.51 g.
Other outstanding characteristics	Fruits not prone to cracking
Peel color	Brown
Peel Thickness	0.86 mm
Flesh / aril color	Creamy white
Flesh Texture	Smooth and firm
Flesh Flavor	21.4%
Juiciness	Moderate
% Edible portion	68.24%
Seed Size	1.48g

Sweet Lychee / "Celerina Lychee"
(Certified Parent Source Tree (CPST))

Plant/Tree Characteristic	
Canopy Spread	Spreading
Vigor	Strong & hardy
Branching	Dense
Bearing habit	Regular/Annual
Yield (at 10 yrs. old)	27.8 kg/tree (for 12 yr. old)
Other tree characteristics	Early maturing w/ an average of 39 fruits/cluster
Fruit Characteristics	
Fruit size	Large (19.9g)
Fruit shape	Ovoid
Peel Color	Red to maroon
Peel Thickness	Thick (1.02 mm)
Peel Texture	Smooth to slightly rough
Flesh/aril Color	White
Flesh texture	Soft
Flesh flavor	Sweet (19.5% brix)
Juiciness	juicy
% edible portion	Intermediate (71.34%)
Seed size	Intermediate(1.5%gms
Other seed characteristics	% chicken tongue-high (55%)
Other outstanding characteristics	Skin not prone to craking and high percentage of chicken tongue seeds (towards seedless)

Rambutan / "Corales Rambutan"
(Certified Parent Source Tree (CPST))

Plant/Tree Characteristic	
Canopy Spread	Spreading
Vigor	Strong & handy
Branching	Profuse
Yield (at 10 yrs old)	High (120 kg)
Other tree characteristics	Resistant to trunk borer, fruits borne in clusters
Fruit Characteristics	
Fruit size	Medium (38.3% g)
Fruit shape	Spheroid
Other outstanding characteristics	Long shelf - life (>3 days) early maturing
Peel color	Red
Peel Thickness	Intermediate (2.95mm)
Peel Texture	Tough and Leathery
Spinstern length	Long (19.98mm)
Flesh/aril color	Creamy white
Flesh Texture	Smooth & firm
Flesh Flavor	Sweet (22.14% brix)
Juiciness	Moderate
Ease of separation from seed	Easy
Testa Adhering to flesh	Intermediate
% Edible portion	High (51.9%)
Seed size	Small (1.5g)
Other outstanding characteristics	Fruits has long spinstern which protect the flesh from damage during transport

Cagayan Valley is blessed to have a favorable type of climate for cultivating different varieties of fruit trees. Many varieties of fruit trees can be cultivated in the region particularly Nueva Vizcaya that can bear fruits like in their native source.

Funding Agency: *Bureau of Plant Industry*
Contacts ***:*** *DA-Nueva Vizcaya Experiment Station (DA-NVES); cvhrfits@yahoo.com*

RTD Rose Mary Aquino shows new and improved peanut variety.

DA-CVRC UNSHELLS NEW AND IMPROVED PEANUT VARIETIES

Project Title: Peanut (*Arachis hypogaea L.*) Varietal Improvement Project in Region 02: Yield Evaluation Trials of Promising Lines/ Selections towards Variety Registration

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Peanut (*Arachis hypogaea L.*) is one of the most versatile and economically important agricultural crops in the world. Over the years, the local production of peanuts in the Philippines has declined from 29,091 metric tons to 27, 291 mt in 2016 (Philippine Statistics Authority, 2016). Hence, there is a need to constantly develop new and improved peanut varieties to sustain production of high quality seeds in major peanut growing areas.

The Department of Agriculture- DA-Cagayan Valley Research Center (CVRC) constant varietal improvements were conducted to address the farmers' infinite demand for improved varieties suitable to their soil and climate condition and target market. The introduction of new and improved varieties increased peanut crop productivity in the country by 30% in 2013. Compared with native, small-seeded and low yielding peanut varieties, the new and improved varieties are especially adapted to address common problems such as low yield, prevalence of insect pests and diseases and lack of large-seeded varieties with sweet taste and higher oil content.

Further, the center has now six (6) NSIC – approved peanut varieties and 2 promising peanut selections on the pipeline (CVRC Pn 1 and CVRC Pn 2).

NSIC Pn 14 (Namnama-2)

High peanut yield and income during wet season are now possible through planting of "Namnama 2", the best wet season peanut variety in Cagayan Valley. Namnama-2 or NSIC Pn 14 is the second variety released by DA-CVRC through its peanut crop improvement project. It is one of the promising breeding lines released by ICRISAT, India in the Philippines in 2002. It is recommended as wet season variety in Regions 02, 03 and 04. It is therefore a variety specifically recommended for wet season production of stable high yield because it produces numerous pods with fully – developed large seeds during the cropping season. It is also adopted and ideal variety for both wet and dry season in Southern Mindanao and Ilocos Region.

Varietal Characteristics:

Yield:	2,231 – 2,370 kgs/ha	*No. of Pods/plant:*	15-18
100-seed weight:	69.5-81.7 grams	*Days to Flower:*	26-27 DAE
Shelling Recovery:	69.1 -69.5%	*Days to Mature:*	101-105 DAE
Plant Height:	45-8 - 62.1 cm	*Color:*	Rose Tan

NSIC Pn 15 (Asha)

The peanut variety of biggest seeds is now popularly grown in Region 02. Asha (ICGV 86564) or NSIC Pn 15 is an ICRISAT, India – bred variety introduced in the Philippines in CY 2005. Dubbed as "New Hope for peanut farmers", Asha means HOPE in Hindi (India). Being the only 3-in-1 variety (with Extra Large, Large and Medium seeds in a plant), Asha is an answer to every farmers' hope and clamor for the best option for a much higher yield and income as proven by its yield and special attributes. Asha is the first 3-in-1 variety introduced in the Philippines having 3 different seed classes in a plant:

Class A
- Extra large seeds
- Export market size (1seed:1g)
- 50% of the pods/plant have extra-large seeds

Class B
- Export & domestic market size (2 seeds:1.6g);
- 30% of the pods/plant have large seeds

Class C
- Small to medium seed size (2-3seeds:1g);
- 20% of the pods/plant have small-medium seed size
- Ideal for planting & local processing purposes

Varietal Characteristics:

Yield:	1,741.1 – 2,781.6 kgs/ha	*No. of Pods/plant:*	15-25
100-seed weight:	76.9 – 92.8 grams	*Days to Flower:*	28-30 DAE
Shelling Recovery:	71.9 – 74.2%	*Days to Mature:*	101-105 DAE
Plant Height:	55.9-74.15 cm	*Color:*	Tan

NSIC 2013 Pn 17 (G.D. Lasam Pride) 'ICGV 95390'

NSIC 2013 Pn 17, locally known as the G.D. Lasam Pride, is the first identified drought-resistant variety in the Philippines. This peanut variety is preferred by farmers to attain high yield and income under drought season. It is a consistent high-yielding variety with a high shelling recovery (72%). It is also medium-maturing and large-seeded (sweet and with high oil content), making it ideal for processing. This all-season variety is also moderately resistant from early Cercospora leaf spot and rust diseases.

Varietal Characteristics:

Yield:	2,182.3 – 2,481.9 kgs/ha	*No. of Pods/plant:*	13-15
100-seed weight:	79.8 – 85.25 grams	*Days to Flower:*	26-31 DAE
Shelling Recovery:	71.6-72.5%	*Days to Mature:*	104-106 DAE
Plant Height:	69.7 cm	*Color:*	Pink

NSICPn 18 (Namnama-3) 'ICGV 01273'

NSIC Pn 18 or Namnama-3 is a consistent, high-yielding variety during wet season, particularly in Mindanao and Visayas. It has a prolific podding behavior and good seed quality due to its shorter height and manageable vegetative growth. It is also medium-maturing (107 days after emergence) and resistant to Cercospora leaf spot and other rust foliar diseases. This variety is ideal for addressing the need for year-round production under erratic weather conditions.

It is also preferred by local processors because of its high oil content and sweetness (sticky sweet), which is best for peanut butter, fried nuts, and other suitable food uses.

Varietal Characteristics:

Yield:	1,664.2 – 2,968.1 kgs/ha	*No. of Pods/plant:*	16-24
100-seed weight:	50-60.4 grams	*Days to Flower:*	27-28 DAE
Shelling Recovery:	71.3-72.1%	*Days to Mature:*	106-108 DAE
Plant Height:	50.8 – 70.7 cm	*Color:*	Pink

NSIC 2015 Pn 19(Namnama-4) 'ICGV 96176'

NSIC 2015 Pn 19 or Namnama-4 is one of the few medium-duration varieties that give the highest wet season cropping bean yield attributed to its short height (69.7 cm). It also has a stable high yield in both wet (June–September) and dry (November–March) season cropping, while consistently producing good quality large seeds.

Varietal Characteristics:

Yield:	2,583 – 2,661 kgs/ha	*No. of Pods/plant:*	17-21
100-seed weight:	54.6-57.7 grams	*Days to Flower:*	27-28 DAE
Shelling Recovery:	72-73%	*Days to Mature:*	105-107 DAE
Plant Height:	48-70 cm	*Color:*	Pink

Two (2) Peanut Promising Varieties undergoing seed multiplication and yield trials through National Cooperative Test (NCT) being conducted in participating test-stations in the country

1. CVRC Pn 2011-001

- *Color: Semi-rose tan*
- *Medium seed size (2 seeds/pod)*
- *Days to Mature: 121 DAP*
- *Pod Yield: 2,536.7 kgs/ha*
- *100-seed weight: 59.2 grams*
- *No. of pods/plant: 14*
- *Shelling Percentage: 72.4%*
- *Yield adv. Over NSIC Pn 14: 16%*
- *Yield Adv. Over NSIC Pn 17: 20.2%*

2. CVRC Pn 2011-002

- *Color: Rose tan*
- *Medium seed size (2 seeds/pod)*
- *Days to Mature: 120 DAP*
- *Pod Yield: 2,389.7 kgs/ha*
- *100-seed weight: 50.5 grams*
- *No. of pods/plant: 12*
- *Shelling Percentage: 68.8%*
- *Yield adv. Over NSIC Pn 14: 9.3%*
- *Yield Adv. Over NSIC Pn 17: 13.2%*

Planting and Soil Fertility Management

1. Prepare the land thoroughly to control weeds and minimize attack of insects and diseases. This, in turn, will reduce production cost especially during drought stress.
2. Coat the seeds with rhizobium-bacteria inoculants before seed sowing to enhance the nitrogen fixing ability of the peanut plants. This will greatly help in cutting down fertilizer cost.
3. Plant in early December to ensure availability of at least 100 mm rainfall from late December to January. This is crucial as the plants need water at critical pre-flowering to pegging growth stage.
4. Sow two seeds per hill at 10 cm apart with 40 cm row distance. Closer row spacing favors early leaf canopy closure, which helps preserve soil moisture and prevent weeds from out-growing peanut plants. For large-seeded varieties, a hectare of land requires 150–170 kg unshelled seeds. For small and medium-sized varieties, 120–140 kg of unshelled seeds is required during the dry season.
5. Apply fertilizers basally and based from soils laboratory's recommended rate. Sidedress gypsum (Calcium Sulfate) at peak flowering 20–35 days after emergence (DAE).
6. Spray boron foliar fertilizer at the rate of 20–30 grams per spray load or 200–300 grams/ha (20–30 sachets/ha) at 25–30 days after planting or before peak flowering. Boron fertilization has proven to increase peanut yield by 60–70% of both small and large-seeded peanut.

Funding Agency: *Department of Agriculture - Bureau of Agricultural Research*
Contacts **:** *DA-Cagayan Valley Research Center (DA-CVRC); da.cvrc02@yahoo.com*

Spraying of Natural Farming Inputs (NFI).

HIGH YIELDING SNAP BEAN VARIETIES SUITABLE FOR ORGANIC PRODUCTION IN HIGHLANDS OF REGION 02

Project Title: Pilot Testing and Seed Multiplication of Potential Varieties of Snap Beans *(Phaseolus vulgaris)* Under Organic Production System in the Philippines

Snap beans (*Phaseolus vulgaris)*, locally known as baguio beans, are one of the most popular legumes in the Philippines. The major producer is the Cordillera Administrative Region (CAR) as snap beans are productively grown in cooler places or highlands.

Farmers, however, are still highly dependent on using the traditional varieties that are low yielding and susceptible to major pests and diseases with inferior pod quality. Organic snap beans are being produced but in limited quantities because of these factors; unavailability of appropriate variety and seed crops adapted under organic production system, the lack and limited source of certified organic seeds and inadequate research studies on organic seed production, etc. (Palizada, et al 2012).

The Department of Agriculture – Regional Field Office No. 02 (DA-RFO 02) through its Nueva Vizcaya Experiment Station (NVES) has seen this as an opportunity to improve productivity and sustainability of vegetable production under organic production system, as well as to provide sufficient and affordable high yielding quality varieties to farmers and consumers. DA-NVES has tied partnership with Benguet State University (BSU) since it is the primary breeding institution of organic snap bean varieties in the country.

Snap beans are of two types: bush and pole. Bush types are self-supporting plants that usually grow one (1) to two (2) feet high while pole types require support such as trellis. The following are the improved varieties under each type with their characteristics that were developed for organic production in the Philippines.

1. Organic Bush Snap Beans

Description	Texture	Resistance to pests	Pod Yield	Maturity
Sablan – a selection from an introduced accession from the International Center for Tropical Agriculture (CIAT) in Cali, Colombia.	Has smooth and tasty round green pod with a length of 13.3 cm and 0.90 cm width	• Moderately resistant to bean rust infection and pod borer and weevil infestation • Resistant to lodging and stem breakage	Has fresh pod yield of 10.06 t/ha and 174% return on capital employed (ROCE)	Matures in 50 days after emergence
Bokod – another variety selected from an introduced accession from the International Center for Tropical Agriculture (CIAT) in Cali, Colombia.	Has straight and tasty green pod with 13.4 cm length and 0.90 cm width	• Moderately resistant to bean rust infection, stem breakage or lodging and pod borer an weevil infestation	Has fresh pod yield of 11.88 t/ha and 224% ROCE	Matures in 50 days after emergence
Contender – a commercial variety of bush snap beans introduced by private seed company	Has good quality, tasty, long green pod with 14.7 cm length and 1.0 cm width	• Moderately resistant to bean rust infection and pod borer and weevil infestation	Has fresh yield of 11.3 t/ha and 203.55% ROCE	Matures in 53 days after emergence
Cali – a selection from an introduced accession from CIAT Cali, Colombia.	Has good quality, tasty green pod with 13.6 cm length and 0.90 cm width	• Moderately resistant to bean rust infection, and pod borer and weevil infestation • Resistant to lodging and stem breakage	Has fresh pod yield of 8.92 t/ha and 143.27% ROCE	Matures in 52 days after emergence
Landmark – another commercial variety of bush snap bean.	Has dark green pod with 13.5 cm length and 1.0 cm width and of good quality	• Moderately resistant to bean rust infection, and pod borer and weevil infestation	Has fresh pod yield of 8.38 t/ha and 128.55% ROCE	Matures in 54 days after emergence

Source: Varieties of Bush and Pole Snap Beans for Organic Production in the Philippines
BSU-IPB Highland Crops Research Station
Benguet State University

2. Organic Pole Snap Beans

Description	Texture	Resistance to pests	Pod Yield	Maturity
Alno – a traditional prolific commercial variety in Benguet introduced by the United States Department of Agriculture (USDA).	Has light green fresh pods with 14.82 cm length and 1.10 cm width	• Moderately resistant to bean rust infection, and pod borer and weevil infestation	Has fresh pod yield of 28.89 t/ ha and 323.78% ROCE	Matures in 55 days after emergence
Tublay – a highly prolific selection from introduced accession.	Has good quality pods which are highly acceptable to snap bean growers and consumers	• Moderately resistant to bean rust infection, and pod borer and weevil infestation	Has fresh pod yield of 19.22 t/ ha and 419.46% ROCE	Matures in 55 days after emergence
Kapangan - another highly prolific selection from introduced accession.	Has long, dark green and smooth texture, with 17.10cm length and 1.0 cm width which is highly acceptable to consumers	• Moderately resistant to bean rust infection, and pod borer and weevil infestation	Has fresh pod yield of 24.93 t/ ha and 573.42% ROCE	Matures in 56 days after emergence
Kibungan – is a progeny of 'Alno' and 'Blue Lake' from 1996 hybridization activities.	Has good quality fresh pods with 15 cm length and 1.10 cm width and highly acceptable to both snap bean growers and consumers	• Highly resistant to bean rust infection, and moderately resistant to pod borer and weevil infestation	Has fresh pod yield of 14.50 t/ ha and 291.89% ROCE	Matures in 52 days after emergence with long picking period
Wangal – is a selection from a cross between 'Alno' and 'Blue Lake'	Has long, dark green, flat pods with 15.50 cm length and 1.20 cm width, of good quality which are highly acceptable to the growers and consumers	• Highly resistant to bean rust infection, and moderately resistant to pod borer and weevil infestation	Has fresh pod yield of 10.18 t/ ha and 175.14% ROCE	Mature in 54 days after emergence and has long picking period

Source: Varieties of Bush and Pole Snap Beans for Organic Production in the Philippines
BSU-IPB Highland Crops Research Station
Benguet State University

Pole snap beans mature later than bush snap beans but they are mostly prolific and have long picking period.

These varieties have been proven, tested and recommended to be adapted under the organic production system in the country.

Production and Cultural Management:

1. **Clearing** – use bolo and grab hoe in clearing. Cut grasses and uproot stubbles then shred and pile them in a compost pile, spray it with Compost Fungus Activator (CFA).

2. **Land Preparation** - Plowing and harrowing should be done twice. Use grab hoe and shovel in forming plots measuring 1m x 10m. Mix compost (vermin and decayed animal manure) at the rate of 20kg/plot.

3. **Mulching** is done using plastic mulch. This activity will control the growth weeds and preserve soil moisture. In mulching, plots were saturated with water before positioning the plastic mulch then punch a hole with a distance of 25 cm.

4. **Irrigation** - Irrigation should be done after planting of seeds and water them 3-4 times a week in the absence of rainfall.

5. **Weeding** – Regularly uproot the weeds because excessive weeds can reduce the production.

6. **Trellising** - The pole snap beans was trellised using " runo ."

7. **Nutrient Management** – proper fertilization should be based on the soil analysis but organic fertilizers or Natural Farming Inputs (NFI) are recommended.

8. **Pest Management** – Regularly and manually collect insect pests at the production area. Aphids and leaf miners are controlled by spraying decoction of hot pepper with soap. Coconut oil with soap can also be used to control the pest. Earwigs are also used to control the pest. Repellant and attractant plants are established within the production area to control insect pests.

9. **Harvesting and Processing** – yellow to brown pods are matured and ready for harvest then sundry twice (90-100 Days after Planting (DAP)). Seeds can be packed with polyethylene plastic bags. Include necessary information of the produce and should be legibly printed in the label.

Cost and Return Analysis							
Type of Pod	**Yield/kg (1000 sq. m)**	**Cost of Production (Php)**	**Annual Production (kg/1000 sq. m)**	**Selling Price (Php/ kg)**	**Gross Income (Php/year)**	**Net Income (Php)**	**Return on Investment (%)**
Organic Pole Snap Beans	159	56, 675	318	500.00	159,000.00	102, 325	183.80
Organic Bush Snap Beans	88.5	55, 675	177	500.00	88,500.00	32, 825	60

*Price of snap beans seed is at P500.00 per kilogram based on BPI prescribed selling price list (AO#15 series of 2013). The seed yield is based on the production conducted at the station for all pole and bush snap bean varieties.

Funding Agency: *Department of Agriculture - Bureau of Agricultural Research*
Contacts ***:*** *Nueva Vizcaya Experiment Station (DA-NVES); cvhrfits@yahoo.com*

Dr. Rickson T. Baldugo inspects farm with A. pintoi as biological mulch.

MANI-MANI (Arachis pintoi): THE LOW-COST AND ENVIRONMENT FRIENDLY BIO-MULCH FOR EGGPLANT AND TOMATO

Project Title: *Arachis pintoi:* It's Potential as Biological and Nitrogen-Fixing Mulch for Lowland Vegetables

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Mulching plays an important role in vegetable gardening. Aside from moderating the soil temperature, it also controls weeds growth and reduces surface run-off. It is a process of covering the top soil with either plastic mulch or different plant materials such as leaves, grass, crop residues and living plants like Arachis pintoi.

The Department of Agriculture – Cagayan Valley Research Center (DA-CVRC) spearheaded the research on *Arachis pintoi* or commonly known as "mani-mani" as a potential biological alternative for plastic mulch in organic vegetable production. Likewise, this aims to intensify the productivity and profitability of tomato and eggplant in Region 02.

Why use *A. pintoi* **or Mani-Mani?**

Arachis pintoi belongs to the family of leguminosae, flowering plants that have pods technically known as legumes. It is known for its capacity to fix nitrogen from the atmosphere and converts it into nitrogen compound that is available for plant food and as cover crop to conserve soil moisture. This is also used as raw material in compost and living mulch in no-till vegetable production. The cuttings during trimming or pruning will also serve as the source of nutrients to the plants.

According to Firth (2002), the ideal ground cover should attain a high percentage of ground in low and relatively high light, be able to cover soil quickly, have persistence, low sward height and sufficient herbage mass for effective soil erosion control. This standard makes *A. pintoi* an ideal ground cover. In addition, unlike the plastic mulch which is costly and difficult to manage under large scale field conditions for low value crops (AgriInfo.in, 2005), planting of *Arachis pintoi* is practical and environment friendly, hence the perfect biological mulch.

The DA-CVRC researchers used varieties of Diamante Max F1 and Casino 901 F1 in tomato and Eggplant, respectively. Based on the results, it was revealed that the use of Arachis pintoi as biological and nitrogen fixing mulch treated with 100% fertilizer Recommended Rate (RR), addition of organic fertilizer and reduced N-rate application (25-50%) produced a comparable yield to treatment with plastic mulch. Application of biological mulch helped decrease soil moisture evaporation and suppressed weeds growth and gave the highest net of return compared to treatment with plastic mulch, an indication of the effectiveness of *A. pintoi* as low-cost biological and nitrogen fixing mulch for increase income and alternative mulch for organic vegetable production hence it is recommended.

Tomato Production
Dry Season (2016-2017)

Crop Yield and Additional Cost							
Treatments	**Yield (kg/ ha)**	**Gross Benefits (P/ha)**	**Added Benefit (P/ha)**	**Treatment Cost (P/ha)**		**Total**	**Net Benefit (P/ha)**
				Mulch	**Fertilizer**		
No Fertilizer - Mulched w/ *A. pintoi* (control)	10, 060.00	150,900.00	-	-	-	-	150,900.00
100% RR (w/ plastic mulch)	20, 140.00	302,100.00	151,200.00	36,000.00	9,850.00	45,850.00	256,250.00
100% RR (No cover crop / mulch)	15, 010.00	225,150.00	74,250.00	5,400.00	9,850.00	15,250.00	209,900.00
100% RR mulched with *A. pintoi*	20, 750.00	311,250.00	160,350.00	7,950.00	9,850.00	17,800.00	293,450.00

Eggplant Production
Dry Season (2016-2017)

Crop Yield and Additional Cost							
Treatments	**Yield (kg/ ha)**	**Gross Benefits (P/ha)**	**Added Benefit (P/ha)**	**Treatment Cost (P/ha)**		**Total**	**Net Benefit (P/ha)**
				Mulch	Fertilizer		
No Fertilizer - Mulched w/ *A. pintoi* (control)	4, 920.00	150,900.00	-	-	-	-	150,900.00
100% RR (w/ plastic mulch)	12, 240.00	302,100.00	151,200.00	36,000.00	9,850.00	45,850.00	256,250.00
100% RR (No cover crop / mulch)	7, 970.00	225,150.00	74,250.00	5,400.00	9,850.00	15,250.00	209,900.00
100% RR mulched with *A. pintoi*	9, 650.00	311,250.00	160,350.00	7,950.00	9,850.00	17,800.00	293,450.00

How to Establish and Manage Arachis pintoi (Mani-Mani) as Living Mulch for Tomato and Eggplant

1.Secure and Prepare Necessary Materials
- Tomato and Eggplant Seeds
- Seedling Trays for sowing of Eggplant and Tomato
- A. pintoi cuttings
- Brass or Grass cutter

2. Establishment of Biological or Living Mulch
- Directly plant the cuttings in the plots/field and let it grow for two weeks before the final vegetable crop establishment.
- Irrigate after planting to ensure fast recovery and survival of the plants

3. Transplanting of Eggplant and Tomato
- Dig holes within the plots planted with *Arachis pintoi* following the recommended planting distance of the main crop
- Transplant the vegetable seedlings 25-30 Days after Sowing (DAS) for eggplant and 20-25 DAS for tomato

4. Trimming/Prunning of Arachis pintoi
- Trim the overgrown A. pintoi (usually 2-3 weeks after transplanting of main crop) to avoid out-growing of planted vegetables
- Leave the pruned/trimmed A. pintoi plant parts in the field to serve as green manure for the main crop

Funding Agency: *Department of Agriculture*
Contacts ***:*** *DA-Cagayan Valley Research Center (DA-CVRC); da.cvrc02@yahoo.com*

CVRC IMPROVES CROP MANAGEMENT STRATEGIES FOR MUNGBEAN

Project Title: Pilot Testing and Technology Transfer of Improved IPM and INM Strategies of Mungbean

Mungbean (*Vigna radiata*) or munggo is one of the most popular legumes in the Philippines and a well-known source of protein, nutrients and minerals. The total area production of mungbean is 45, 283 with a volume production of 32, 960 MT and an average yield of 0.72mt/ha (BAS, 2011).

Despite the high volume of production, we still import mungbean from other countries like China, Myanmar and Australia due to insufficient supply in the local market. The country's mungbean production fell short of its annual domestic requirement with a self-sufficiency ratio of only about 52% (DOST-PCAARRD, 2018).

Cagayan Valley is the second top producer of mungbean in the country. It is mostly used as a fallow crop after harvesting rice and corn. However, poor management practices and the alarming use of chemicals and synthetic fertilizers have seriously affected the yield of the farmers. In the same way, the damages caused by insect-pests and diseases to plants are a contributing factor.

This issue has been brought to the attention of the Department of Agriculture - Cagayan Valley Research Center (DA-CVRC). They conducted a pilot testing on the technology about Integrated Pest Management (IPM) and Integrated Nutrient Management (INM) strategies that aims to address the problem on low production and eliminate insect-pests and diseases to plants. The improved Integrated Crop Management (ICM) system such as the use of improved variety, release of available Biological Control Agents (BCAs), organic extracts, vermitea, use of fertilizers and different cropping systems play significant roles in increasing the yield up to 20% through reduction of damages by 20%.

On-farm trials have been conducted in the corn-based areas of Burgos and Gamu, Isabela and rice-based areas of Cabatuan, Isabela. The variety of mungbean used in the demonstration trial was UPL Mg-7 (Pagasa 7) with a seeding rate of 20 kgs./ha. Three effective foliar fertilizer were applied; oligo-carrageenan, vermitea and boron.

Oligo - Carrageenan

- Irradiated carrageenan "bio-fertilizer" is a product of R&D of DOST-PNRI. It is

an indigestible carbohydrate (polysaccharide) extracted from edible seaweeds.

[Seaweeds are commonly used as thickener or stabilizer by the food industry and also as a binding agent for domestic products such as toothpaste and shampoo and are found in selected pharmaceutical products.]

- Carrageenan, as growth enhancer offers an array of benefits that result in improved

productivity.

Boron Fertilizer

- Boron is an essential nutrient for growth and development of healthy plants. Boron compounds are used in small concentrations as micronutrients in fertilizers. When used in large concentrations they function as herbicides, algaecides and other pesticides.

Vermi Tea

- Vermi tea is a complex solution produced from worm castings. It contains microbes such as fungi, bacteria, protozoa and other useful nematodes. Protozoa and nematodes are food for the bacteria and fungi. Vermi tea provides an easy way to provide a quick bit of nutrition to your plants. By steeping or brewing the vermicast in water, the nutrients and beneficial microbes can easily be absorbed by the soil and/or taken up into the plant.

Average Bean Yield and Economic analysis of UPL Mg 7 as affected by different foliar fertilizers, Burgos and Gamu, Isabela; (Mungbean after corn cropping system)

Treatments	Bean Yield, kg/ha	Gross Income, (Php)	Yield difference from FP, kg/ha	Gross Income from increased in yield, (Php)	Added Treatmet Cost / Total Losses, (Php)	Additional Profit or Net Income, (Php)
1. Farmers' practice	757.9	37,895	-	-	-	-
2. Carageenan	1035.4	51,770	277.5	13,875.00	1,200.00	12,675.00
3. Boron	986.72	49,336	228.82	11,441.00	2,550.00	8,891.00
4. Vermi tea	980.14	49,007	222.24	11,112.00	1,460.00	9,652.00

Average Bean Yield and Economic analysis of UPL Mg 7 as affected by different foliar fertilizers, Cabatuan, Isabela; (Mungbean after rice cropping system)

Treatments	Bean Yield, kg/ha	Gross Income, (Php)	Yield difference from FP, kg/ha	Gross Income from increased in yield, (Php)	Added Treatmet Cost / Total Losses, (Php)	Additional Profit or Net Income, (Php)
1. Farmers' practice	852	42,600	-	-	-	-
2. Carageenan	1357.3	67,865	505.3	25,265.00	1,200.00	24,065
3. Boron	1109.3	55,465	257.3	12,865.00	2,550.00	10,315
4. Vermi tea	1142.6	57,130	290.6	14,530.00	1,460.00	13,070

- Application of Carageenan economically increased yield by 277.5 kg/ha or 36.6% under corn-based areas and 500 kg/ha or 59% under rice-based areas with additional profit or net income of Php12,675 and Php 24,065.00, respectively.
- Spraying of Boron Fertilizer is contributed to increased yield by 228 kg/ha or 30% in corn-based and 257.3 kg/ha or 30% in corn-based areas giving additional net income ranging from Php 8,891 – 10,000.
- Vermi-tea is effective in increasing yield of 100-300 kg/ha with additional net income or profit of Php 4,000 – 13,000.00.

Improved POT particularly on IPM and INM strategies was promoted through pilot testing and conduct of field days to major mungbean growing regions in the country.

The following are developed formulation for the application of Oligo-carrageenan, Vermitea and Boron:

Use of Carrageenan:

1. Mix 160 ml of Carrageenan in a Knapsack with 16 liters of water. In every 10 ml of Carrageenan, mix it with 1 liter of water
2. 1 hectare can be applied with 10 knapsack tank loads every application.
3. First application is done 2 weeks (vegetative stage).
4. Second application, 2 weeks after first application or before the flowering stage
5. Third application is completed 2 weeks after second application or flowering and pod formation stages.

Use of Boron:

1. Mix 32 grams of boron in a knapsack with 16 liters of water. In every 2 grams of boron, mix it with 1 liter of water.
2. Apply 10 knapsack tank loads in 1 hectare every application.
3. First application is done 2 weeks (vegetative stage).
4. Second application, 2 weeks after first application or before the flowering stage
5. Third application is completed 2 weeks after second application or flowering and pod formation stages.

Use of Vermi-Tea:

1. Soak 5 kilos of vermicast in a 100 liter of water with 1 kilo of molasses for 72 hours. Make that the vermicast is placed in a cloth sack to strain it.
2. Mix 1 liter of vermitea in a knapsack with 16 liters of water
3. 1 hectare can be applied with 10 knapsack tank loads every application
4. First application is done 2 weeks (vegetative stage).
5. Second application, 2 weeks after first application or before the flowering stage.
6. Third application is completed 2 weeks after second application or flowering and pod formation stages.

Funding Agency: *DOST-Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development*
Contacts *: DA-Cagayan Valley Research Center (DA-CVRC); da.cvrc02@yahoo.com*

BORON FERTILIZATION ON PEANUTS

Project Title: Enhancing Value Chain for Peanut Production: Verification Trials on the Response of Peanut to Boron Fertilization under Sandy Soils Growing Condition in Region 02

In Cagayan Valley, peanut is dominantly cultivated in sandy soils along river-flood-prone areas. Productivity in these areas is generally low due to poor quality of harvested pods (empty pods & internal nuts/seed damage) caused by Boron micronutrient deficiency which usually exist in coarse-textured soils low in organic matter content triggered by the element fast leaching during heavy rainfall thereby limiting pollen germination, flowering and seed setting.

To address this problem, a study was conducted by the Department of Agriculture Cagayan Valley Research Center (DA-CVRC) and the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) in 2014 to determine the effectiveness and efficacy of boron nutrient application on peanut. The cost-effectiveness of the technology was also determined to see its economic benefits for small and large-scale peanut farmers in Region 2.

In addressing boron deficiency, farmers sought the application of boron microelement through the use of boron fertilizers. These fertilizers are proven to increase yield by 60–70% of small and large-seeded peanut varieties. Boron fertilization is a breakthrough and a practical method of enhancing peanut farming productivity and improving the income of small-scale peanut farmers in the country.

Boron-based fertilizers in the form of Solubor borax and Fertibor are applied simultaneously to peanut prior to flowering and seed setting. The ideal amount of spray application of boron foliar fertilizer is at the rate of 250-500 grams/ha and soil application of boron granular fertilizer is at the rate of 2-3 kgs/ha. This can ensure the sufficient supply of boron needed to attain yield increment for the following varieties:

- 500-700 kg/ha for small-seeded peanut variety
- 700-1,000 kg/ha for medium-seeded variety
- 1,500-1,900 kg/ha for large-seeded (Virginia-type) variety

Technology Efficiency in Sandy Soil

The study was conducted during dry season cropping in sandy soils at Benito Soliven, Isabela and Enrile, Cagayan in 2014. Foliar application of boron fertilizer at a rate of 250g/ha after planting or before peak of flowering (25–30 days after planting) will provide additional yield of 250kg/ha or an added income of P10, 000 with additional cost of only P 1,725/ha. This yield increment can be translated to increase income ranging from Php10, 000-20,000/ha depending on prevailing farm gate price of the crop at harvest.

- Solubor borax Fertilizer = Php 50.00 per sachet (10g)
- Fertibor Fertilizer = Php150.00/kg

Treatments	Yield, kgs/ha	Gross Benefit, Php	Added Benefit, Php	Added Treatment Cost, Php	Net Benefit, Php	MBCR*, %
Control (no application)	1,599.34	55,977	-	-	55,977	-
Applied with 250g/ha borax	2,196.00	76,860	20,883	1,725	75,135	12.11
Applied with 500g/ha borax	2,498.00	87,430	31,453	2,850	84,580	11.04
Applied with 750g/ha borax	2,586.00	90,510	34,533	3,975	86,535	8.69
Applied with 5 kg/ha fertibor	2,400.00	84,000	28,023	3,000	81,000	9.34
Applied with 5 kg/ha fertibor + 250g/ha borax	2,559.40	89,579	33,602	4,725	84,854	7.11
Applied with.5 kgs/ha fertibor + 500g/ha borax	2,827.40	98,959	42,982	5,350	93,609	8.03
Applied with 750g/ha borax + gypsum	2,506.80	87,738	31,761	12,575	75,163	2.53

** Marginal Benefit Cost Ratio (MBCR) is the ratio of the benefits of a technology expressed in monetary terms, relative to its costs, also expressed in monetary terms.*

Application of Boron in Sandy Soils

1. Spray boron foliar fertilizer at the rate of 20–30 grams per sprayload or 200–300 grams/ha (20–30 sachets/ha) at 25–30 days after planting or before peak flowering.

2. On the other hand, boron granular fertilizer can be supplied to peanut plants in two ways:
   - Drench the dissolved product into the soil (dissolve 20 grams-pack fertilizer in 2.5 L water or 3 kgs: 500 L water/ha).
   - Sidedress/dust the sand-mixed boron granular fertilizer (1 kg fertilizer: 1 bag or 50 kgs sand) at the rate of 2–3 kg/ha prior to off-barring cultivation.

Funding Agency: *Department of Agriculture*
Contacts ***:*** *Cagayan Valley Research Center (DA-CVRC); da.cvrc02@yahoo.com*

BORON FERTILIZATION FOR ENHANCED VEGETABLE GROWTH AND PRODUCTIVITY

Project Title: Boron Fertilization on Selected Vegetables and Onion for Fruit/Bulb Quality and Quantity in Region 02

Ampalaya or bitter gourd and tomato are important crops that are usually prone to flower abortion and poor fruit quality caused by disease and poor nutrient management. It' s production is significantly influenced by macro and micro nutrients fertilization. Boron is the second most widespread and economically important micronutrient in crops (Nonnecke, 2001). It has a role associated with cell wall formation, functioning and strength of plants, flowering and fruit formation.

Fertilization management has a significant effect in the growth and productivity of plants. Hence, evaluation of the effect of Boron fertilizer was performed in tomato, ampalaya and onion. Foliar such as Solubor and Fertibor was applied at different rates (Solubor at 250 grams, 500 grams and 750 grams/ha and drenching of Fertibor at 1kg, 2kg, and 3kg/ha respectively).

Application rate and dosage recommended in combination to recommended rate of NPK:

a. Ampalaya and Tomato

Apply 500-750g/ha solubor+ 1-2kg/ha fertibor.

- Dissolve 50-75 grams solubor in one sprayload then spray in tomato and amplaya plants at 30 days after transplanting (before or during flowering) and 60 days after transplanting.
- Dissolve 100-200 grams fertibor in 200L of water then apply by drenching into the soil at 30 and 60 days after transplanting.

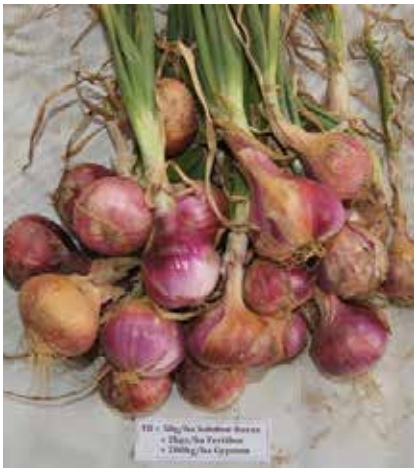
b. Onion

Apply 250g/ha solubor + 2kg/ha fertibor.

- Dissolve 25 grams solubor in one spray load then spray in onion plants at 30 and 60 days after transplanting.
- Dissolve 300 grams fertibor in 200L then apply by drenching into the soil at 30 and 60 days after transplanting.

Vegetable	Applied Solubor (grms)	Applied Fertibor (kg)	Shelf-life (days)	Yield (t/ha)	Marginal Benefit Cost Ration (MBCR) (%)
Ampalaya	500/750	2/1		10.12-19.35	6.03-6.57
Tomato	750	1	20	9.13-27.59	4.89-4.90
Onion	250	3		10.22	6.92

The application of Boron (foliar spray and drench method of application) was proven effective in increasing the yield of ampalaya, tomato and onion while it is contributory to the observed crop fruits resistance to blossom, end rot infection and cracking of fruits marketability and eventually longer shelf-life addressing increase income.



Funding Agency: *Department of Agriculture*
Contacts ***:*** *DA-Cagayan Valley Research Center (DA-CVRC); da.cvrc02@yahoo.com*

LIVESTOCK

Dr. Vincent Jim Palor gives pointers on feed formulation during the techno forum held at DA-NVES , Bagabag, Nueva Vizcaya.

INDIGENOUS FEEDS FOR NATIVE PIGS

Project Title: Feed Formulation of Silage for Native Pig

The Department of Agriculture Regional Field Office No. 02 (DA RFO 02) through its Nueva Vizcaya Experiment Station (NVES), being a third party certified by the Organic Certification Centre of the Philippines (OCCP), took the initiative to formulate feed ration using indigenous feedstuff for organic swine.

Feed ration is formulated using the identified indigenous feedstuff to enhance the nutritive value and meet the standard nutrient requirement of the native pigs.

Components of feed formulation:

- **Taro/Gabi**

One of the most important functions of taro root in the diet is its role in digestion. The high level of dietary fiber found in taro root (a single serving contains 27% of the daily requirement of dietary fiber) makes it very important for supporting gastrointestinal health.

• **Papaya**

The antioxidant zeaxanthin found in papaya filters out harmful blue light rays and is thought to play a protective role in eye health and possibly ward off damage from macular degeneration.

• **Trichantera**

Trichantera gigantea has small mineral concretions and cystoliths, appearing as minute short lines on the upper surface of the leaf blades, the upper portions of the stems, on the branches of the inflorescence and on the calyx.

• **Banana Stalk**

Banana stalks are high in moisture, high in fiber and low in protein. Therefore, animals' needs must be met through supplemented feed if they are fed fermented banana stalks (CTAHR, 2016).

• **Cassava Roots**

Cassava is one of the most important starchy root crops, serving as energy source because of its high carbohydrate content.

Feed Preparation

1. Chop all the raw materials such as papaya, taro/gabi, trichantera, banana stalk and cassava roots. (10kg.each)

2. Ensile in Plastic Container (drum) with addition of 2 kg. Molasses, 2 kg. Salt and 20 liters water as feed ingredient.

3. Seal properly to prevent the entry of air in order to hasten its fermentation and to avoid contamination.

4. Ferment it for 1 week. It must have a good smell. The fermentation process is used in preparing the formulation before feeding to animals.

Funding Agency: *Department of Agriculture*
Contacts ***:*** *DA-Nueva Vizcaya Experiment Station (DA-NVES); cvhrfits@yahoo.com*

Dr. Gerly Zulueta shows samples of biodewormer.

BIODEWORMER: SAFER METHOD THAT SURELY KEEPS PESTS AT BAY

Project Title: Identification of Nematophagus Fungi for the Control of Parasitic Gastroenteritis among Small Ruminants in Region 02

Parasitism is still the primary constraint in small ruminant industry mainly due to the development of anthelmintic resistance. Anthelmintic resistance is the ability of worms to survive drug treatments that are generally effective. It is worldwide phenomenon and found to be present in 41.2% of commercial small ruminant farms in Region 02.

In line with the program of the Department of Agriculture on Organic Agriculture and its vision of sustainable, ecological and economical means to increase productivity, alternative parasite control is needed.

What is Nematophagous Fungi?

Nematophagous fungi are biological agents that trap and attack all stages of worms (egg, larva and adult) for food. Arthrobotrys drechsleri is specie of nematophagous fungi indigenous in Region 02. Its predatory activity focuses on free living stages of worms. It captures larvae by its adhesive non – constricting ring, forms penetration tube that pierces the larvae's cuticle and produces enzymes that kills.

What is a biodewormer?

Biodewormer is the first "chemical-free" oral suspension developed by the Regional Animal Disease Diagnostic Laboratory (RADDL) of the Cagayan Valley Integrated Laboratory (CVIAL) to control roundworms of small ruminants.

In a study conducted in the region, oral drench of 2.7x106 *Arthrobotrys drenchsleri* spores reduced the egg laying capacity of the adult nematode by 29.5%.

Benefits of using biodewormer

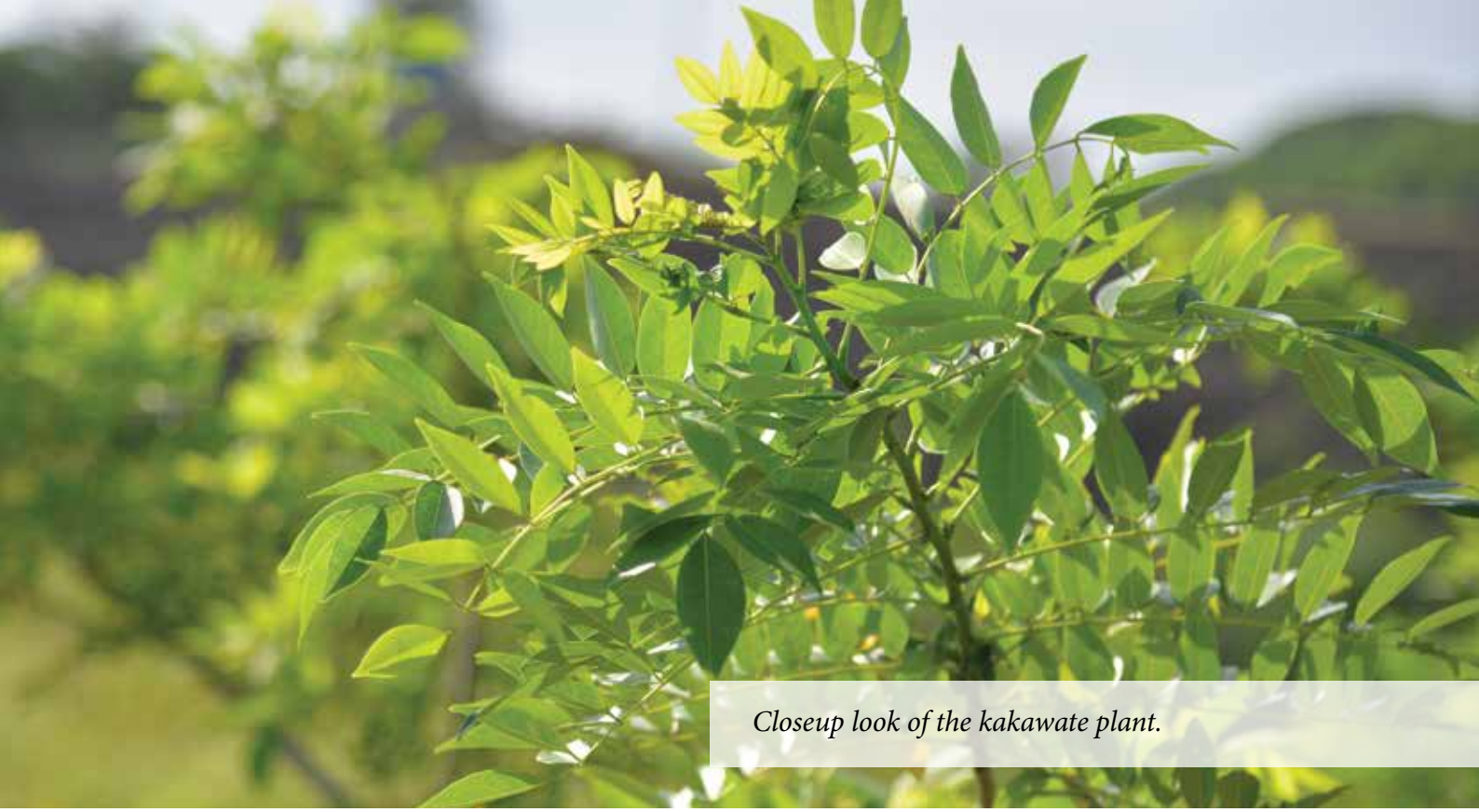
- Provides opportunities to maintain effective parasite control
- Reduces cost for anthelmintic or anti-parasitic drugs
- Does not produce harmful residues
- Increases income of small ruminant farmers

How to Administer?

1. Give 5 ml for five (5) consecutive days before they are released to graze in the pasture.
2. Give the same dosage after the one (1) to three (3) months (after the last administration) depending on the result of fecalysis.
3. It can be given to sheep and goat regardless of age.

Market Retail Price: Php 250.00/liter

Funding Agencies: *DA-Bureau of Agricultural Research*
Department of Agriculture
Contacts **:** *DA-Cagayan Valley Integrated Agriculture Laboratory- Regional Animal Disease Diagnostic Laboratory (DA-CVIAL-RADDL); ild.darfo2@gmail.com*



Closeup look of the kakawate plant.

KAKAWATE: ANTI GASTROINTESTINAL PARASITES IN GOATS

Project Title: Anthelmintic Efficacy of Kakawate Leaves (*Gliricidia sepium*) Against Gastrointestinal Parasite of Goats

Kakawate leaves (*Gliricidia sepium*), which are grown abundantly in any farm setting, are known to have anthelmintic properties that helps eradicate parasites among goats.

In the study conducted by the Department of Agriculture (DA) through the Southern Cagayan Research Center – Cagayan Breeding Station (SCRC-CBS), it was revealed that Gliricidia sepium is indeed effective in reducing Gastro Intestinal (GI) parasites of goats by feeding fresh Gliricidia leaves at 1% of the body weight of the goat. During the fecalysis, there were four (4) gastrointestinal parasites that were identified: Haemonchus spp., Strongyloides spp., Trichostrongylus spp. and Trichurius spp.

With the use of Gliricida sepium as an alternative dewormer, the following significant results were attained.

- Parasite load in bucks reduced from 5,800 to 3,400 egg per gram (EPG) with 70% reduction
- Grower goats reduced from 14,800 to 8,500 EPG with 35.81% reduction
- Lactating reduced from 17,000 to 11,200 EPG with 34.11% reduction
- Pregnant reduced from 12,500 to 8000 EPG with 36% reduction.
- In Gliricidia oral drench, the fecal egg count (FEC) was decreased in grower goats from 6,200 to 4,000 EPG with 35.48% reduction, lactating from 41,000 to 23,000 EPG (43.41%) .

Extraction of Kakawate Leaves

1. One (1) kilogram of fresh Gliricidia sepium leaves will be collected.

2. Finely cut using scissors.

3. Blend the Kakawate leaves and mix one liter of water into 1 kilogram finely blended Kakawate leaves.

Administration

Daily stall feeding of Kakawate leaves at 1% of body weight of the animals and oral drench of Kakawate leaves extract at 0.5 ml/kg body weight as oral drench once a month. Recommended in grower, buck, pregnant and lactating goats.

Funding Agency: *Department of Agriculture*
Contacts **:** *DA-Southern Cagayan Research Center-Cagayan Breeding Station (DA - SCRC -CBS); caverzosa@yahoo.com*

DA- Isabela Experiment Station - One of the stations that focuses on small ruminants.

AUSTRALIAN BREEDS OF SHEEP ADAPTED TO REGION 02 CONDITION

Sheeps are relatively easy to tame and consequently one of the first species to be domesticated and used as a source of food and fiber. Today, sheeps are widespread throughout the world. It is a ruminant (cud-chewing) mammal of the genus Ovis. They mature at about year of age. They conceive at 150-155 days (5 months) having mostly single births, although they do have twins on rare occasion. The lambs stop sucking and begin to graze at about four (4) or five (5) months of age.

The Isabela Experiment Station (IES) located at Upi, Gamu, Isabela was recognized as the nucleus farm for sheep in the region with its purpose of producing and maintaining quality breeder sheep for distribution to qualified applicants through breeder loan program of the Department of Agriculture. Through the sound program of the Department is the offshoot of sheep population build up in Region 02. Together with the breeder loan program is a research and development agenda designed to develop and promote technologies that would help boost production, increase production efficiency, product development and promotion of sheep based- products.

At present, there are three (3) tropical breeds of sheep maintained in IES imported from Australia. These are st croix, katahdin, and dorper breed. The first two mentioned breeds have adapted to Region 02 climatic conditions since they are the first breed infused in the station and underwent performance evaluation. Meanwhile, the latter breed was recently introduced in the station and currently undergo process of performance evaluation.

Here are the characteristics of said breeds:

The St Croix Breed

The breed is mostly white in color with some solid tan, brown or black spots. They look lean have long straight neck with erect ears and usually have wattles in the neck. An adult ewe weighs about 40 to 50 kg while adult ram weighs around 60-70 kg. They are known for high twinning rates and ability to produce lambs twice a year. They have high degree of tolerance to parasite infection. Rams are usually covered with hair

The Katahdin Breed

They are white or light to dark brown in color. They appear shorter and stocky and exhibit natural hair shedding. They have similar weightst as st croix. They have wide deep chest with strong, smooth and broad back. Female katahdin is best crossed with st. croix male to attain good hybridization.

The Dorper Breed

The dorper is a South African mutton breed developed through the crossing of black head Persian ewe with Dorset horn ram. This breed is one of the most fertile of sheep breeds that is hornless with good body length and short light covering of hair and wool. The breed has the characteristic black head as well as white head dorper. The dorper has a long breeding season which is not seasonally limited.

Funding Agency: *Department of Agriculture*
Contacts ***:*** *DA-Isabela Experiment Station (DA-IES); cviarc_ies@yahoo.com.ph*

Dr. Manuel Galang Jr. conducts an interview with one of the farmers in the area reported with anthrax incidence.

ANTHRAX DISEASE MAP: INCIDENCE NAVIGATION TO DELIVER PREVENTION

Anthrax is a disease caused by a bacterium called Bacillus anthracis. It is a rod-shaped, Gram-positive, aerobic and spore forming bacterium. The bacteria from infected carcasses when exposed to air, forms highly resistant spores that is known to reinfect animals for over 70 years of being buried. Anthrax is among the top zoonotic diseases in the Philippines that poses a concern in the Veterinary community. Its occurrence in the country is commonly associated with exposure to Anthrax infected farm animals or animal by-products such as in goats, sheep, cattle, and mostly carabaos'.

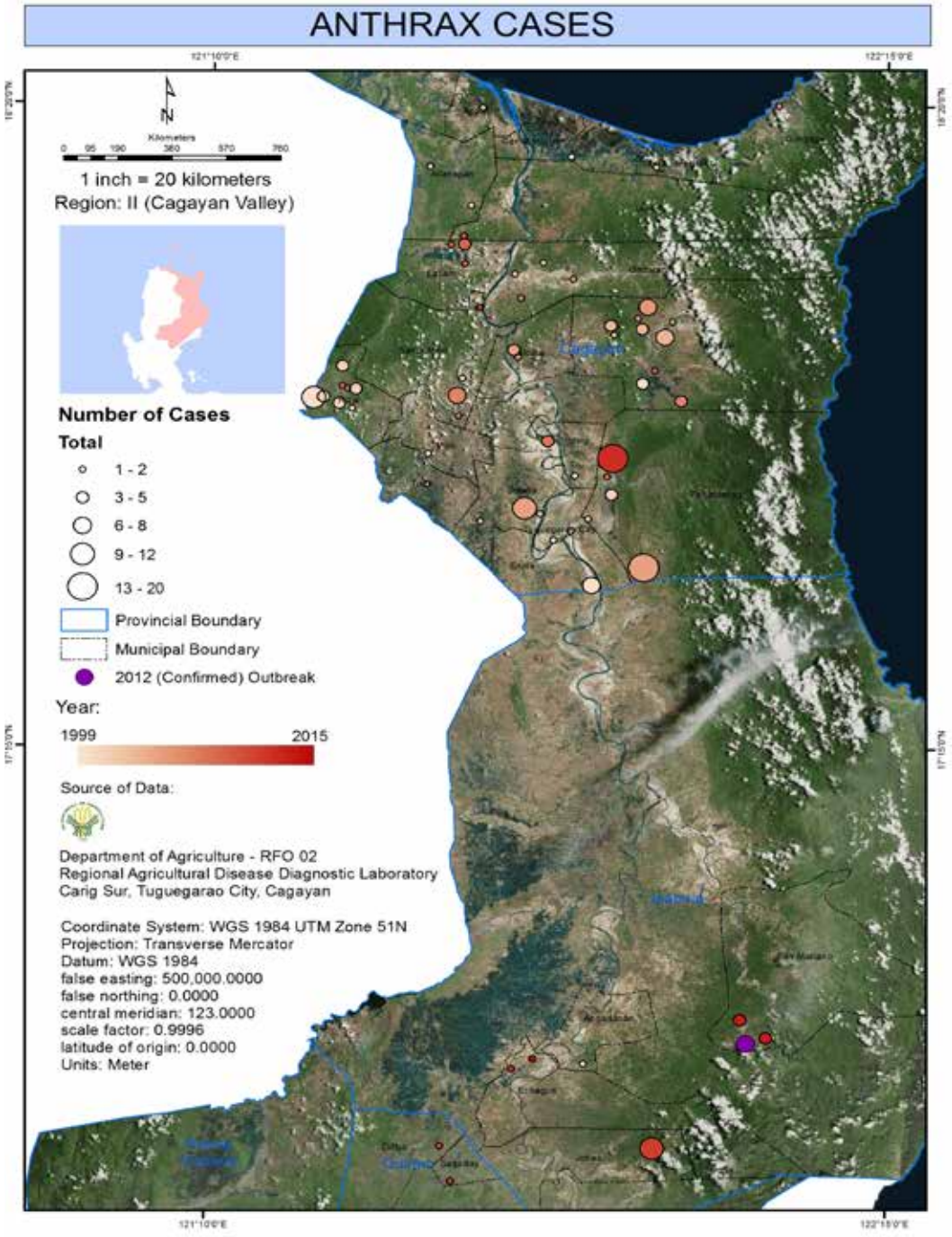
The transformation of diseases into its newest and deadly pattern was the main reason why a disease map was developed in the Region through a study conducted by the Department of Agriculture Regional Field Office No. 02- Regional Animal Disease Diagnostic Laboratory (RADDL). This is to determine the reasons on the occurence of the disease.

The study gathered the comprehensive baseline data of anthrax incidences from 1999 to 2015 of the 3 provinces and developed a disease map to enhance the Anthrax disease monitoring and surveillance in Region 02.

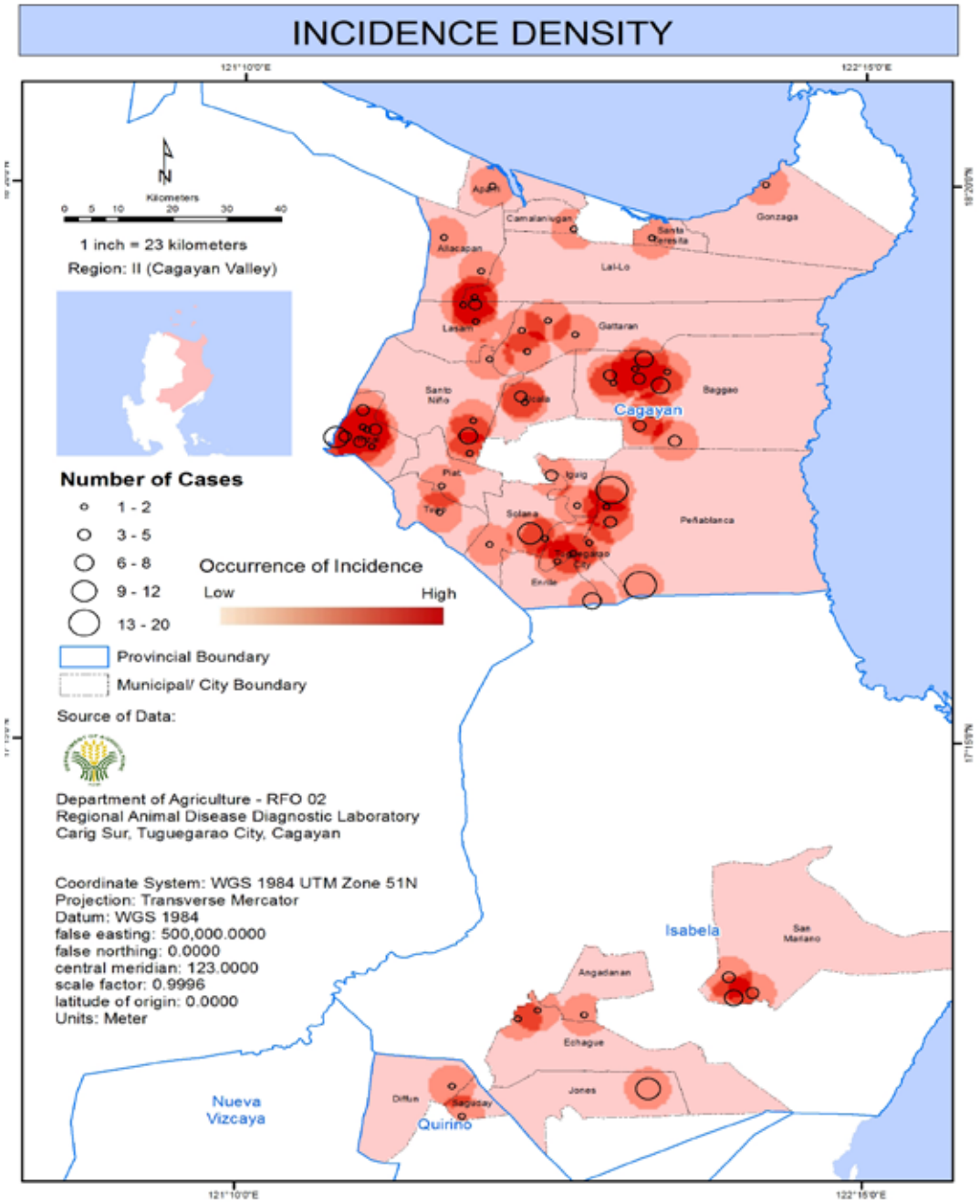
Results of the study showed that anthrax disease is endemic in Region 02, particularly in the provinces of Cagayan, Isabela, and Quirino. A total of 210 animal cases from 1999 to 2015 were identified from the three provinces included in the project. Carabaos were identified as the main livestock affected. Animal cases were identified to arise throughout the year from June to February, with peaks during the months of July and February.

For human cases, a total of 150 cases were identified from the three provinces. The highest incidence was reported in the municipality of Lasam, Cagayan in 2010 with 54 cases throughout the year. Acquisition of the disease in humans is mostly through direct contact or consumption of meat from infected animals.

With this, the study recommends intensive anthrax awareness campaigns in the municipalities, up to the barangay level. This is to educate the public about the disease. Trainings for animal and human health workers regarding proactive measures during anthrax disease incidences such as correct diagnosis, proper disposal of carcasses, close surveillance, and decontamination and disinfection procedures is also recommended.



Map shows the recorded anthrax cases in Region 02.



Incidence density map of anthrax cases. The darker the color the higher the incidence recorded.

Routine animal vaccination on 70% of susceptible population especially in highly-affected areas is recommended as the primary control measure. Based on the data collected, animal cases in Cagayan, Isabela, and Quirino occur throughout the year, from July to February. Therefore, annual vaccination should be done during the onset of the 2nd quarter of the year, from March to May.

As part of control strategies, DA-RFO 02 continously conduct vaccination program in areas identified in the disease map especially those municipalities that have recent incidence/case. For the past two (2) years, it is noteworthy to mention that there is no positive or suspected case of anthrax in the region.

Moreover, it is important for the animal and human health workers to have an inter-sectoral cooperation for the effective control of the disease. Veterinary authrities should also inform human health officials in the event of incidences as to the possibility of associated case and vice versa.

Funding Agency: *Department of Agriculture*
Contacts *: Regulatory Division; darfo2regulatory@yahoo.com*

PRODUCT DEVELOPMENT

DA-RFO-02 DEVELOPED TECHNOLOGIES AND PRODUCTS READY FOR UPSCALING / COMMERCIALIZATION

Increasing Income of Farmers through Value Adding

PINOY GOURMIX

Contact Person: Ms. Vanessa Joy Calderon
0917-315-9327
DA-CVRC, San Felipe, City of Ilagan, Isabela

It is an affordable and locally available food for every Filipino. It is a mixture of rice, white corn and adlay grits enriched with malunggay powder, TVP soybean, ground mungo and ginger turmeric. It's a nutritious and healthy food product ideally designed as relief/ disaster food, for nutrition and feeding malnourished/undernourished children/ family and less-privelege households and affordable smart food for street duelers, prisoners, on-training soldiers, etc.

Market Retail Price: Php35.00 / pack

MAIZE SILKY SIP

Contact Person: Mr. Roynic Aquino
0917-710-5445
DA-CVRC, San Felipe, City of Ilagan, Isabela

It is a refreshing and healthy drink made from boiled fresh corn silk. It has diuretic properties (good for those having problem on urinary tract infection or difficulty in urinating) and contains anti-oxidants from added honey and lemongrass juice extract.

Market Retail Price: Php 30.00/330 ml bottle
Php 50.00/500 ml bottle

MANGI MAXI PRODUCTS

Contact Person: Mr. Roynic Aquino
0917-710-5445
DA-CVRC, San Felipe, City of Ilagan, Isabela

Café Bagga

A traditional non-caffeine drink (coffee beans substitute/alternate) made from a blend of pan- roasted white and purple corn grits. It is good for those suffering from heart palpitation and avoiding coffee late in the afternoon and at night time due to fear of insomnia or hard sleep. The coffee granules can also serve as breakfast cereal to minimize satiety for more intake of rice.

Market Retail Price: Php 80/pack

Cracknic

Your extra-ordinary corn snack made from premium glutinous corn binatog that is fried to perfection as snack food for all ages and good for "pasalubong" and simple gatherings serving as pika-pika (finger food). Unlike traditional cornics, it did not undergo nixtamalization process (involving use of limewater for corn seed soaking).

Market Retail Price: Php 35/pack

Kornbi

These different blends of pure corn grits and milled rice are traditional staple for people from different regions of the Philippines. With four different combinations, you are sure to find the perfect blend for your taste and healthy diet/food trends especially of those suffering from diabetes or having problem on high blood sugar. It is also an affordable and energy staple food substitute for poor families or large households. It can also be used in the conduct of feeding programs.

Market Retail Price: Php 30/kg

MANGBEAN PRODUCTS

Contact Person: Ms. Vanessa Joy Calderon
0917-315-9327
DA-CVRC, San Felipe, City of Ilagan, Isabela

Vacuum-fried mungbean sprouts

A savory and very nutritious snack food from vacuum fried Mungbean Sprouts (togue). It is a delicious and healthy substitute to junk foods, hence ideal for school children snacks, feeding meals toppings and finger foods. Get all the important nutrients of mungbean sprouts in this new crunchy snack.

Market Retail Price: Php 50/pack

Instant Munggo soup

A savory and very nutritious snack food from vacuum fried Mungbean Sprouts (togue). It is a delicious and healthy substitute to junk foods, hence ideal for school children snacks, feeding meals toppings and finger foods. Get all the important nutrients of mungbean sprouts in this new crunchy snack.

Market Retail Price: Php 30/pack

Mungbean Milk

Satisfy your thirst for something refreshing and healthy with the new Mungbean Milk. It comes in ready-to-drink bottle and easy to prepare milk powder.

Market Retail Price: Php 30/bottle
Php 250/100 g powder

Instant mungbean cup noodles

A healthy substitute to the popular instant noodles. Instant Mungbean Cup Noodles was concocted for people who are always on-the-go but seek for healthier food options.

Market Retail Price: Php 35/cup

Neeruma Products

Contact Person: Ms. Vanessa Joy Calderon
0917-315-9327
DA-CVRC, San Felipe, City of Ilagan, Isabela

Peanut Balls

Peanut balls can be consumed as beverage, dessert and gourmet and "lugaw" toppings. Two (2) pieces of peanut balls can be dissolved in 1 cup of hot water if serve as peanut chocolate drinks.

Market Retail Price: Php 50/150 g-jar

Chewy Peanut Cookies

The cookie dough is made from standard cookie ingredients but instead of all-purpose flour alone, protein-rich peanut flour is used resulting to ultra-soft baked cookies. Great and healthy snack foods for all.

Market Retail Price: Php 65/100 pouch

Richly-Roasted

Not just your ordinary roasted peanut but blend with known healthy vege-based and turmeric flavourings/ coatings such as garlic, malunggay powder, saluyot powder, yellow ginger powder and caramels.

Market Retail Price: Php 35/100 g pack

Peanut Graham-Choco Bars

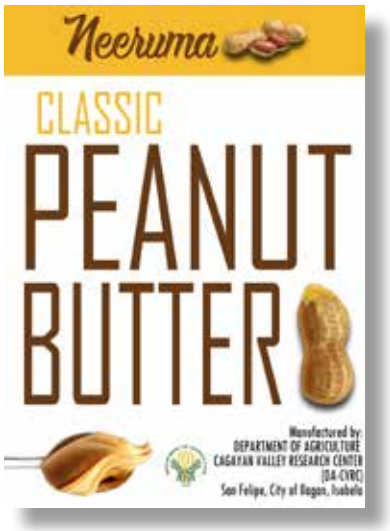
A combination of peanut-graham cracker bars. It is an individually packed chocolate bars for snacks, desserts and pasalubong.

Market Retail Price: Php 55/box (6 pcs bars)

Flavoured peanut butter in Pouch/ Sachet

An affordable peanut butter/ paste in sachets. Good for on-the-go consumers.

Market Retail Price: Php 5/10 g sachet



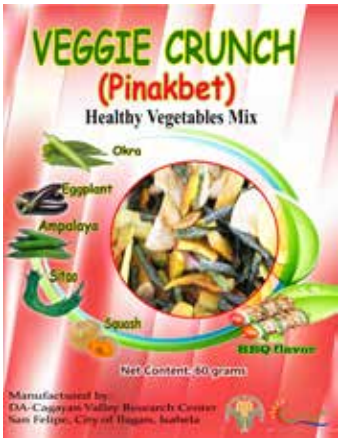
VEGETABLE PRODUCTS

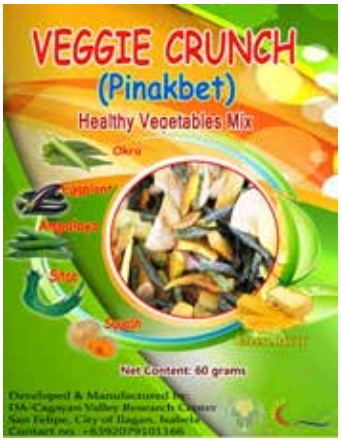
Contact Person: Ms. Mary Jane Ibarra
0906-807-2441
DA-CVRC, San Felipe, City of Ilagan, Isabela

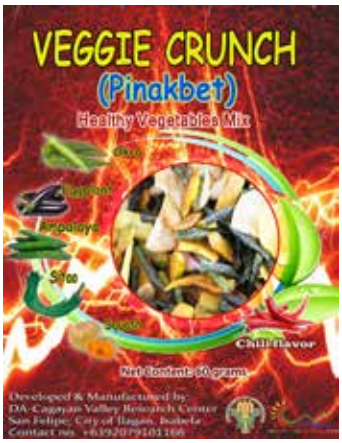
DeHIGHdrated vege-fruity crunch

Veggie-fruity Crunch is a vacuum-fried fresh vegetables and fruits. It is developed to increase consumption of vegetables and fruits. Its crunchy and tasty features camouflage the unappreciated taste of some commonly produced fresh vegetables and fruits thus ideal as school children snack and finger foods for all.

The product encourages processing of perishable and hardly-marketed fresh vegetables and fruits into high-value and marketable products thus reducing post-harvest losses.







Market Retail Price: Php 60/pack (70 grams)

MUTTSARAP PRODUCT

Contact Person: Dr. Jacqueline Gumiran
0915-667-6060
DA-IES, Upi, Gamu, Isabela

Muttsarap is made from fresh mutton (sheep meat) cooked with special spices. It is an affordable and nutritious food processed through water retort for prolonged shelf life. Perfect for on the go persons who have little time to prepare food. Just put it in a 360 degrees microwave heat or reheat it using gas stove for 1 minute, voila! It comes in tapa, adobo, kaldereta and pinapaitan.

Market Retail Price: Php 70/pack (120 ml)

MUTTONIES PRODUCTS

Contact Person: Dr. Jacqueline Gumiran
0915-667-6060
DA-IES, Upi, Gamu, Isabela

Muttonies is a product line of DA-Isabela Experiment Station (DA-IES) for wallets, bags, belts, shoes for men and women and jackets made from sheep leather. The brand was created to showcase endless possibilities of the growing sheep industry in the country.

Men's Bifold Wallet

A sleek and classic wallet that holds everything you need without the bulk. It has a photo holder to bring with you those close to your heart wherever you are. Affordable yet designed to last without getting out of style. It has two quick access card slots and two hidden card slots.

Market Retail Price: Php 450.00

Sling bag/purse

Always on the go but hate the hassle of bringing bulky bag and bulging pockets for your essentials? This sling bag is just right for you. It can fit any android phones, including keys and even your coin purse. Designed for both men and women. It is lightweight with adjustable straps and inside and outside pockets.

Market Retail Price: Php 650.00

Unisex brown Jacket

Protect yourself from harsh weather condition with this lightweight and durable sheep leather jacket.

Market Retail Price: Php 5,000.00

Women's/Men's Footwear

Shoes can make or break one's outfit and you can never go wrong with these classic leather footwear. Perfect pair for everyday office attires and for Sundays. Lightweight with soft cushions to ensure comfort.

Market Retail Price:
Ladies: Php 1,500 (*any variant)*
Mens: Php 1,650 (*any variant)*

Belt

Go with a classic timeless style belt that can grow with you and can match any outfit of the day. Made of single, solid sheep leather with metal buckle that is crafted to last. Other product features:

- adjustable
- 1 inch wide
- Comes in two colors – brown and black
- Unisex

Market Retail Price: Php 275.00

Acknowledgement

Transforming research results into usable information is our ultimate aim in bringing research outputs into the doorsteps of our farmers and other stakeholders. We believe that the success of our Research and Development (R&D) undertakings is measured on how we created impact on the lives of our farmers. Therefore, we commend the researchers of the Department of Agriculture-Regional Field Office No. 02 (DA-RFO 02) for their unceasing dedication, commitment and passion in conducting R&D all throughout the region.

Most importantly, we would also like to express our appreciation to the continuous support and guidance of our Technical Advisers and the RAFIS in editing this compendium. To the external funding agencies who supported our R&D undertakings, our heartfelt thanks to all of you.

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Mabuhay!

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