PHOTO BY RDELACRUZ

BAR envisions a stable and progressive future for the Filipinos through excellence in research and development (R&D) in agriculture and fisheries, specifically to transform the agriculture and fishery sector from a resource-based to a technology-based industry. In doing so, BAR through the Department of Agriculture-National Research and Development System for Agriculture and Fisheries (DA-NaRDSAF) must develop knowledge, methods, and technologies that can make the industry competitive and efficient.

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Bureau of Agricultural Research
RDMIC Bldg., Visayas Ave., cor. Elliptical Rd.,
Diliman, Quezon City 1104

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Transformers of modern day agriculture

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Mechanizing agriculture and fisheries for sustainable development

MARLOWE U. AQUINO, PhD

When the idea came to me to look closer at agriculture and fisheries mechanization, the first thing that came up into my mind was farm implements and machineries. In a snap, I asked myself, is this right? I consulted some experts and they told me that, yes these two are included but then again, I must expand its perspective to show that it cuts across disciplinary boundaries and specific sectoral concerns.

Going through the notion of mechanization, I noted that it's not limited to farm implements and machineries only. Rather it must include product development, processing including interactions and relationships of people on how these things address the development of and improve the quality of their lives.

The idea of featuring agriculture and fisheries mechanization is long overdue in the realm of research and development (R&D). The Bureau of Agricultural Research (BAR) however, included this in its R&D priority including extension agenda and programs. It was limited to specialized areas because of the minimal technical expertise it represents.

Today, there is an increasing demand to address this because agriculture and fisheries are now being focused on competitiveness. Global marketing must see to it that products meet standards and quality. Increasing demands for product standards and quality led in the use of expanded and appropriate programs and activities on mechanization, much more in making these sustainable for continued social and economic development without aggravating the environment.

The second quarter issue of the *BAR R&D Digest* highlights areas in agriculture and fisheries mechanization with emphasis on commercialization, R&D, education and institutional partnerships including linkage and networking. Given the diverse topics and ideas presented, BAR, through its programs and activities will surely make things work to make agriculture and fisheries more sustainable with prominence on mechanization by achieving quality and competitive agriculture and fisheries products.

Although, the need is huge, we believe that we can gradually make a difference by setting the directions and by discussing trends in agriculture and fisheries (A/F) engineering and applied technologies for our products.

Proper promotion and dissemination including educating individuals to revisit agriculture and fisheries engineering will help drum beat what was initially started in 1998 on A/F mechanization to include areas for improvement and development.

We, at BAR, enjoin and encourage policymakers, researchers, and extension workers as well as development practitioners and academicians to exert efforts on how to make the program relevant and realistic in ensuring quality and competitive products. It is only through these concerns and initiatives that the goals of

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This quarterly publication contains articles that are based on studies conducted by NaRDSAF-member institutions.

RITA T. DELA CRUZ
Managing editor/Layout

MARLOWE U. AQUINO, PhD
RITA T. DELA CRUZ
MA. ELOISA E. HERNANDEZ
ELLAINE GRACE L. NAGPALA
Staff writers

MANUEL F. BONIFACIO PhD
Editorial adviser

ANTHONY C. CONSTANTINO
Print manager

JULIA A. LAPITAN
VICTORIA G. RAMOS
Circulation

MARLOWE U. AQUINO, PhD
Head, MISD

Cover photo: RICARDO G. BERNARDO

For subscription and inquiries, please contact:
APPLIED COMMUNICATION SECTION
Management Information and Systems Division
Bureau of Agricultural Research
3/F RDMIC Bldg., Visayas Ave., cor. Elliptical Rd., Diliman
Quezon City, PHILIPPINES 1104
Trunklines: 928-8505 or 927-0226 Local Nos. 2043, 2042, 2044
Fax: 920-0227 or 927-5691
E-mail: *misd-acs@bar.gov.ph* Website: *http://www.bar.gov.ph*

split-batch type (digester and gas holder are separated) and was referred to as PortaGas Model-1 or Pm-1. It has a floating gas holder attached to a Bunsen burner for cooking.

The previous model was further developed with the coming of Pm-2 in 2002 using a surplus burner from a non-functional auto-ignition LPG stove.

Then, a more refined model, Pm-3 was developed in 2003 with a pre-fabricated cast-iron manual gas stove and simplified gas holder fittings.

Finally, the most simplified model, Pm-4, which is the upshot of the *portagas*.

Recycled drums fixed with necessary fittings were used as the digesters and gas holders for the *portagas*.

A unit of the *portagas* consists of 10-drum digesters and two sets of gas holders. Each gas holder is made up of two drums, one for the water and another for the gas.

According to Dr. Nilo, this floating type gas holder, which serves as the pressure regulator, is the "heart" of this generator.

Deriving biogas from agri waste

While the floating gas holder serves as the "heart" of the generator from which the gas is being accumulated, the agricultural wastes serve as the "nub" or the meat of the generator wherein the biogas will come from.

For the *portagas*, BSWM utilized farms wastes (fresh rice straw and animal manure) and urban wastes (vegetables and fruits refused, grasses and ornamental plant trimmings) to convert into biogas.

These agri-wastes are collected and loaded into the drums. This makes up two thirds of the loaded drum after which, the animal manure and water were mixed into the container. The drum was then compressed with a concrete hollow block, which served as weights on top of the mixture. The drum was sealed and left for several days to digest and ferment.

Gas was discharged from the collectors after 14 days. On the 15th day, a burner maybe attached for the initial flame test.

It is advised not to conduct flame test directly from the gas collectors' nozzle to avoid accident. A secondary hose must be inserted from the gas collector's nozzle onto the burner before conducting flame test.

The agricultural wastes inside the drums are to be unloaded after three months.

After the trial, the study showed that the agri wastes charged into the *portagas* were able to produce 25 cubic meter of biogas fuel which is equivalent to one cylinder of LPG (11 kg).

A cylinder of LPG is the approximate fuel consumption of a typical Filipino family for two and a half months.

Results also showed that biogas emission consistently increases within the first three weeks and fluctuates within the next five weeks. Emission of biogas dwindles after the fifth week due to the declining amount of carbon in the substrate.

The "zero waste" factor

Developing the *portagas* is said to be a "zero waste" endeavor because the digested agricultural waste which was unloaded from the drums now becomes the by-products which will then serve as compost for soil fertility enhancement.

In the study trial conducted, among the by-products collected were: 98.5 kg of compost and 750 liters of organic liquid fertilizer.

Results showed that the nitrogen (N) content of the compost increased from 0.6% in fresh rice straw to 1.5%.

According to Dr. Nilo, this is equivalent to two bags of organic fertilizer. Also, the digested compost from biogas generation contributed greatly in crop production and in mitigating the methane gas greenhouse effect.

Benefit-cost analysis of the *portagas* showed that return of investment (ROI) starts after the 12th cycle.

This article was based on the study, "Design, Fabrication and Calibration of a Portable Biogas Generator (Portagas)" by Dr. Rogelio Concepcion, Dr. Gina Nilo, Mr. Alan Anida, Mr. Carlos Serrano, Ms. Leonora de leon, and Mr. Victorcito Babiera of the Bureau of Soils and Water Management (BSWM), Elliptical Road, cor. Visayas Avenue, Diliman, Quezon City, Philippines.

For more information please contact the project leader, Dr. Gina Nilo, chief of the Soil and Water Resources Research Division (SWRRD), BSWM at telephone number (02) 920-4378.

PHOTOS BY BSWM

PHOTOS BY BSWM

A "zero waste" venture to ease fuel shortage

RITA T. DELA CRUZ

It is true that one man's junk is another man's treasure. In agriculture, farm wastes such as rice straw, bio-solids from vegetables, grasses, biodegradable feedstock, and manure do not immediately find themselves into the garbage as they could be potential alternative sources of fuel energy.

These agricultural wastes are being converted into biogas fuel through an anaerobic process. Biogas comprised primarily of methane and carbon dioxide which could be used as fuel for generating electricity at homes and farms particularly in remote areas in the province where electricity is limited. These could also be burned directly for cooking, heating, lighting and process heat, and absorption refrigeration.

One question remains. How to generate biogas fuel from these agricultural wastes?

Introducing the *portagas*

The portable biogas generator or *portagas* was developed by a group of researchers from the Bureau of Soils and Water Management (BSWM) lead by Dr. Rogelio Concepcion and Dr. Gina Nilo with Mr. Alan Anida, Mr. Carlos Serrano, Ms. Leonora de Leon, and Mr. Victorcito Babiera.

The feasibility and development of the *portagas* were undertaken for five years, from 2001 to 2006.

According to Dr. Nilo, all common biogas generators have two main parts: *digester* (where the slurry is mix and fermented to produce the gas); and *gas holder* (where the gas is collected and connected to a burner for cooking or lamp for lighting).

Prior to the development of the *portagas*, BSWM developed four biogas generators.

The first ever model is an integrated batch type generator developed in 2000. It is called "integrated batch type" because the gas holder is not separated from the digester.

In 2001, it was modified into a

PHOTOS FROM BAR ALBUM

AGRICULTURAL ENGINEERING:
Transformers of modern day agriculture

ELLAINE GRACE L. NAGPALA

Long time ago, when the cropping season for rice arrives, the sight of a carabao pulling a moldboard plow in a rice paddy field becomes a familiar scenario. Using the carabao as a draft, the farmer patiently guides the animal as it cultivates his field to have it ready for the sowing of rice's seeds.

Assuming that the farmer has a one hectare rice field, with his faithful carabao and plow, he can have his field plowed in an average of 44 hours, harrowed in 36 hours, leveled in 14 hours and side cultivated in 3 hours.

Land preparation is most time-consuming and energy consuming stage in rice production. But not until the tractor was invented, land preparation required a minimum amount of time and energy. Using a two-wheel tractor, plowing and harrowing a hectare of land can be finished in an average of 11.3 hours and 8.6 hours, respectively. A four-wheel tractor meanwhile requires an estimated 5.3 hours for plowing and 3.6 hour for harrowing.

The tractor is one of the first machines devised to assist the farmer perform his job with ease. In an agricultural country like the Philippines, the role of engineering is vital in mechanizing agricultural production and processing and for the effective management of natural resources.

Philippine agriculture performance

During the first semester of 2007, agriculture grew by 3.50 percent, wherein a sustained increase in the total output of agriculture in the first two quarters of the year was noted. At current prices, the gross value of agricultural production expanded by 5.19 percent to P466.7 billion from P443.6 billion for the same period last year.

The agriculture sector has a huge livelihood making potential, especially in the areas of production and by-products processing, expansion of areas for cultivation, and intensification and diversification of agricultural production systems.

Impacts of Agricultural Engineering

Agricultural engineering is manifested mainly on mechanization of farm activities, development of machines for processing agricultural products, and irrigation. Hence, the introduction of agriculturally engineered technologies that suite the local condition will enable the agriculture sector to fully utilize its products and by-products, cultivate lands on a sustainable production basis, and intensify and diversify farming systems.

This in turn can generate employment, open possible opportunities for the country in the local market, reduce postharvest losses, increase the value of a product through processing, and help bring equity in the access to basic production systems.

Agricultural mechanization status

The level of mechanization in the Philippines, in terms of available mechanical power in the farm is 0.52 hp/ha.

In the country, there are few agricultural commodities whose operations are mechanized:

The **sugarcane** had the highest degree of mechanization among the major agricultural crops. Large imported equipment such as four-wheel tractors, plows, semi-automatic planters, cultivators, harvesters, and mills were used making 83 percent of farm operations in sugarcane mechanized.

In **rice**, land preparation is mechanized through the use of power tiller. Pumps are widely used to facilitate irrigation. About 47 percent of rice produced is threshed with the power threshers while 98 percent of the rice farmers bring their *palay* to rice mills. There is also practically one knapsack sprayer per farmer.

In **corn**, only the shelling operation is at high level of mechanization.

For **coconut**, mechanization has taken place through the presence of oil mills, oil refineries, desiccated coconut plants, activated carbon plants, and oleochemical plants.

In **fruits**, mechanization for both production and processing is low, and there exists only a few number of processing equipments (hot water tank, sorting and grading machines, chippers/slicers, dryers, evaporators and retorts).

In **livestock**, the feed milling operation for commercial feed mills is highly mechanized with imported and locally manufactured equipment consisting of forage chopper, hammer mill, mixer and pelletizer.

In general, the level of agricultural mechanization in the country is low as compared to other countries in Asia such as Japan, Korea, China, Pakistan, and India which has a level of mechanization at 7.00, 4.11, 3.88, and 1.02 hp/ha, respectively.

"In general, the level of agricultural mechanization in the country is low as compared to other countries in Asia such as Japan, Korea, China, Pakistan and India...."

Agricultural Engineering R&D

Over the years, studies conducted on the design and development of machines were focused on rice production and processing. Other research and development (R&D) efforts on benchmark surveys, piloting, packaging, and impact evaluation technologies were also limited to rice. Moreover, there were limited studies on the development of machine standards, development of low-cost construction materials, and development of equipment for energy resources utilization.

To date, Table 1 (see page 6) shows the outstanding accomplishments in the field of agricultural engineering including the local manufacture and distribution of the following: power tiller/trailer, floating tiller, axial-flow pump, axial-flow thresher, *kiskisan* rice mill, cono rice mill, crushing type corn sheller, corn mill, grain moisture meter, forage chopper, hammer mill, mixer, and windmill.

Technological breakthroughs were also made in the areas of crop production crop protection, harvesting, drying, milling, shelling, irrigation, and alternative energy.

Challenges

Despite the presence of institutions that works for the advancement of R&D in agricultural engineering, there is a lack in coordination among these institutions. As identified by the Committee on Agricultural Mechanization of the National Agriculture and Fishery Council (CAM-NAFC), agricultural engineering R&D should initially address the following problems plaguing its growth: 1) lack of coordination of R&D activities among implementing agencies; 2) insufficient R&D facilities and funds; and 3) absence of extensive assessment of farmers' needs towards identification of viable and appropriate technologies.

Agricultural engineering has been developed without a clear vision of the economic and social impacts of the introduction of the technologies. In this regard, a comprehensive assessment and identification of the status, resource available, and need of agricultural engineering should be initiated at the national level to come up with a relevant approach to agricultural engineering.

At the moment, there are at three government agencies mandated to fund, coordinate, monitor and evaluate

Refrigeration or controlled atmosphere can extend the shelf life of vegetables further maintaining the freshness and quality of farm products.

profitability of farmers is increased".

Specifically, it aims to identify the traditional and alternative trade routes of high value crops, and provide assistance among HVCC growers and traders in the acquisition of cold chain infrastructures or facilities in the selected pilot areas of the program. The program also promotes the cold chain technology for HVCC in the country through information support, training and extension.

Refrigeration or controlled atmosphere can extend the shelf life of vegetables further maintaining the freshness and quality of farm products. In the end, markets especially the consumers will have a fresh-pick of vegetables and fruits.

Major players

The facilities in a cold chain are composed of pre coolers, packing houses and cold storage rooms and trucks for transport. Pre coolers are used to remove field heat rapidly right after harvest to acquire desired conditions. Packing houses are essential to prepare the vegetables prior to releasing it to the market such as trimming and cleaning, sorting defective products, among others. Cold storages maintain the required storage temperature of the vegetables for a high quality-produced. Refrigerated trucks/container vans collect the fresh produce from the cooler room/packing houses and transport them.

The cold chain system requires involvement of the players from the handling, storage and transport of the perishable products. These include farmers, packers, and workers and staff. Drivers, wholesalers and distribution centers, retailers, and the consumers compose the transport service.

Pilot trade routes

Four main pilot sites serve as traditional or alternative routes for marine, poultry, meat and tropical and temperate high value crops, from their production areas to high end markets mainly Metro Manila, Cebu City, and Davao City. Others include: 1) Mt. Province – Benguet – Manila Line; 2) Cagayan – Manila Line; 3) Visayas Inter-island Connections, and 4) Mindanao-Cebu-Manila Line.

Now, BPRE is extending and promoting the cold chain technology to the region through support from the Agricultural Competitiveness Enhancement Fund (ACEF). To date, three cold chain facilities have been established in three major vegetable producing areas in the country: Benguet, Cebu, and Bukidnon.

The most recent addition to the system are: 1) La Trinidad Fruit and Vegetable Minimal Processing and Packaging Plant in La Trinidad, Benguet, 2) Cold Storgae facilities stationed at the Capaz Food Terminal and Live Animal Auction Center in Capaz, Tarlac, and 3) additional cold storage warehouse for KASAMNE in Palayan City, Nueva Ecija.

This article was based on the study, "Philippine National Cold Chain Program" produced and published by Bureau of Postharvest Research and Extension (BPRE) of the Department of Agriculture (DA), CLSU Compound, Science City Muñoz, Nueva Ecija, Philippines

Source:
http://www.actahort.org/books/699/699_18.htm, "Improving Quality of Philippine Vegetables through Agricultural Tramline and Cold Chain Systems: Status, Prospects and Technology Transfer Initiatives", retrieved 10 July 2007.

PHOTO BY BPRE

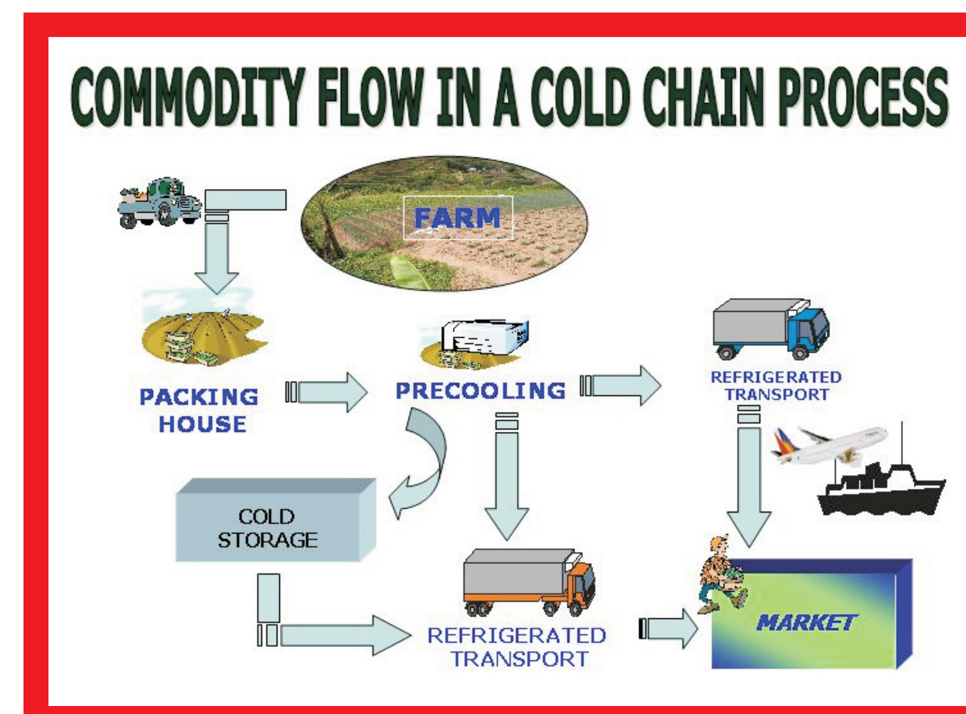

PHOTO BY BPRE

Cold chain technology

A system for fresh, quality agricultural produce

MA. ELOISA E. HERNANDEZ

Philippines has been blessed with abundant graces of vegetables and fruits, fresh meat and fish. But the production will come into ashes if we do not know how to handle them properly. Quality preservation, particularly, during transport and storage has always been a problem among farmers and traders.

The high value commercial crops (HVCC), in particular, can be a good source of income for the farmers.

In the northern part of the country, vegetables requiring cold temperature have shown great market value. Among these vegetables are lettuce, cabbage, broccoli, cauliflower, mustard, parsleys, bell pepper, celery and carrots. However, poor postharvest practices lead to the enormous postharvest losses that hindered agricultural productivity and profitability.

The Cordillera Region is the top vegetable producers in the country. Manila, Southern Luzon, and Visayas markets usually acquire vegetables from the region. Also, Mindanao particularly Davao City, Davao del Sur, Compostela Valley, Bukidnon, and Misamis Oriental, can be potential vegetable suppliers of high-end markets in Cebu and Manila.

The livestock industry also plays a vital role in the agriculture sector. However, bringing these fresh and high quality vegetables and meat to consumers seems out of reach due to lack of proper and adequate facilities to retain the temperature level required to maintain their freshness.

Cold chain technology

The current situation has prompted the Department of Agriculture (DA), through the Bureau of Postharvest Research and Extension (BPRE) to implement "The Philippine National Cold Chain Program".

This is in line with the modernization of agriculture as the national thrust of government under the Agriculture and Fisheries Modernization Act (AFMA) of 1997. The program is seen as one possible solution to address the major concerns of the agri-fishery products with perishable nature.

BPRE aims to share this technological breakthrough to many users including small farmers. The program took off in the province of Benguet in 2004. With the evident benefits derived by farmer-users, this has been made as one of the priority programs of the DA.

The cold chain system refers to the uninterrupted refrigerated handling operation of high-value crops from the farm to the market. With the system, the required temperature level is attained and therefore keeping the quality of perishable crops and meat products at every chain.

The Philippine Cold Chain Program seeks "to address the need to promote and showcase the technology. It aims to establish pilot cold chain and integrate it in the marketing operations of the small vegetable farmers for a better competitive-market advantage. It is expected that through this technology, postharvest losses are minimized and

agricultural engineering R&D. These are the Bureau of Agricultural Research (BAR), Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), and the Philippine Council for Industry and Energy Research Development (PCIERD). There are also at least three government agencies and two state universities that implement separate agricultural engineering programs. These are the Philippine Rice Research Institute (PhilRice), Bureau of Postharvest Research and Extension (BPRE), Bureau of Plant Industry (BPI), Central Luzon State University (CLSU), and University of the Philippines Los Baños (UPLB). These institutions act separately in identifying the gaps in agricultural engineering that must be addressed. This leads to lack of consultation and therefore duplication of studies.

In order to avoid duplication of works and wastage of resources, more coordination is needed with regards to the planning and implementation of agricultural engineering in R&D. Moreover, massive demonstrations and trainings on the operation of agricultural machinery at the farmers/operator's level must also be done to provide the farmers and operators of the basic know-how's of the technologies that is introduced to them.

The absence of adequate resources and funding is another story that keeps the Philippines behind other Asian countries, not only in the area of mechanization but in the whole field of agricultural engineering. The poor profitability of agricultural machinery manufacturers in the country due to the high costs of machines, the dumping and smuggling of imported agricultural machineries, and the uncontrolled entry of second-hand engines inhibits the proliferation of agricultural engineering technologies.

Desired industry situation

It is said that the agricultural engineering is a prerequisite to and a partner of industrialization. Industrialized countries have shown that regardless of socio-economic, cultural, and environmental settings, the evolutionary patterns to their industrial development can be traced down to agricultural engineering.

In the Agricultural Engineering RDE Agenda of BAR, the motivation to promote agricultural engineering in the country is clearly expressed and emphasized and the following were deemed necessary to be considered for its fulfillment:

Implementation of a National Agriculture Engineering Program Though the role of agricultural engineering in agricultural development is evident, there has not been any concrete set of policies that details how agricultural engineering should be pursued and applied.

Adoption of machinery pools as farmers' access to agricultural production machinery
Machines are too costly for the small farmers to afford. Moreover, because of small landholdings, the individual ownership of motorized machines is not viable. Through pooling machineries through cooperatives and custom-hire arrangements with private entrepreneurs, it would be easier for the farmers to access the machines that they need provided that their farms are integrated. These schemes are being implemented successfully in countries with small landholding such as Japan, Korea, and Taiwan.

Establishment of rural-based processing plants for generating employment, livelihood and additional income to farmers
The reduction of postharvest losses through primary processing is viewed as ways to increase a farmer's income at the same time generate employment and livelihood in the rural sector. These is possible through local adoption or development of processing machines and facilities.

Joint-venture arrangements for the local manufacture of critical machines

and machine parts. Through this approach, foreign manufacturers and local manufacturers can set up joint venture arrangements to set up manufacturing and assembly plants in the county.

RDE agenda and programs

When the Agriculture and Fisheries Modernization Act (AFMA) or the Republic Act No. 8435 was proposed, it was aimed to take immediate actions that will pursue the modernization of agriculture and fisheries sectors of the country to enhance their profitability and prepare the said sectors for globalization. As a part of the agriculture and fisheries sector, the development and promotion of appropriate agricultural machinery and other agricultural mechanization technologies to enhance agricultural mechanization in the countryside was given emphasis.

Consequently, the Department of Agriculture (DA) implemented the National Agri-Fishery Mechanization Program (AgFiMech) and created the National Agri-Fishery Mechanization Program Committee (CAFMech), which is the central link for coordinated planning, implementation, monitoring and evaluation of all agricultural engineering programs, projects and activities of DA.

To be able to achieve the desired industry situation for agricultural engineering, the following were identified to be the main agenda for agricultural engineering as stipulated in the Agricultural Engineering RDE Agenda:

1. Strengthen the Agricultural Engineering RDE Network to tap the active participation of research institutions and the private sector;
2. Conduct benchmark and needs surveys, policy and feasibility studies, and impact evaluation of the Mechanization Plan;
3. Adapt available matured technologies from developed/developing countries to the country's own institutions/industry;
4. Aevelop medium- to large-scale and energy-efficient technologies for machinery pools and village-level processing plants;
5. Develop technical standards to help ensure the quality of agricultural engineering technologies;
6. Pilot and package agricultural engineering technologies;
7. Conduct training on agricultural engineering technologies for engineers, technicians, extension workers and farmers; and
8. Establish a centralized information service for agricultural engineering statistics and development.

Developed breakthrough technologies in agricultural engineering through Research and Development (R&D)

AREA	BREAKTHROUGH TECHNOLOGIES
Production	rice transplanter
	rice drum seeder
	upland seeder
Crop protection	ULV-CDA sprayer
	lowland rotary weeder
Harvesting	rice reaper
	rice stripper
	grain cleaner
	corn picker
Drying	flatbed dryer
	recirculating dryer
	tray-type dryer
	flash dryer
Milling	improved village rice mill
	micro mill
	flour mill
	coco-oil mill
Shelling	non-crushing type corn sheller
	peanut sheller
Irrigation	drilling rig
	electric water pump
Alternative energy	gasifier
	biogas digester
	biomass combustor
	biomass stove

Source: Agricultural Engineering RDE Agenda and Program

The Ag Eng RDE Agenda and Programs was developed to promote appropriate agricultural engineering technologies in the countryside for enhancing agricultural productivity and agro-industrial development.

The RDE program, in general, is geared to provide accurate and timely information in support of the Agricultural Engineering Development Plan, to make available appropriate agricultural engineering technologies for the production and processing of farm products and by-products, and to develop trained manpower for the generation, manufacture and utilization of agricultural engineering technologies.

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National Agricultural Engineering Research, Development and Extension Program
Maranan, Celerina L. Comparative Evaluation of Tractor and Carabao Use in Rice Land Preparation. Journal of Philippine Development. 1980. <http://dirp4.pids.gov.ph/ris/pjd/pidsjpd85-1tractor.pdf>
Status of Agricultural Mechanization in the

PHOTOS BY BPRE and RDELACRUZ

three-point hitch.

Although tagged as corn planter, this machine is also equipped with fertilizer applicator assembly and seed covering device.

It also uses a pneumatic metering system (pms) which make it capable of planting any sizes of corn seeds. This system is advantageous since the Philippine hybrid corn seeds are not graded according to size. The pms is operated by a 5 hp gasoline engine.

It is called *pneumatic* because the machine works on the *air suction principle*. A seed coming in contact gets stuck to the holes on the plate and falls when suction is cut-off at the lowest position near the soil.

The corn planter can be installed in pairs to create two rows or depending on the horse power capability of the tractor in which the planter will be attached.

Specifications

The BPRE pneumatic corn planter consists of four major assemblies: mainframe, drive, planting, and fertilizer applicator.

The mainframe assembly consists of seven parts (frame, hitch, engine base, engine, vacuum blower, support stand, and soil opener for fertilizer) while the drive assembly has four (two ground wheels for fertilizer applicator gearbox and for seed metering gearbox, and two gearboxes for fertilizer applicator and seed metering).

The planting assembly has 10 parts: connecting arm, soil opener for seed, pneumatic seed metering, seed hopper, seed plate, scraper/trimmer, discharge tube, depth gauge/pressing wheels, seed covering device, and optional furrower. This assembly was built with adjustments for row spacing, hill spacing, and seed depth. The optional furrower creates the V-shape furrow into the soil to facilitate easy irrigation after planting, which is the common practice in among corn farm areas.

The fertilizer applicator is a six-part assembly comprising of tank, discharge roller, distribution hose, agitator, funnel and a stabilizer. This assembly has an adjustable metering device to regulate the amount of fertilizer, depending on the requirement of the soil. Also, unlike the commercially-available model, this one is made of stainless steel to protect against corrosion. Aside from the adjustable metering, it has a fertilizer application rate which could be set depending on the bags of fertilizer required per hectare.

Benefits and advantages

The development and fabrication of any new machine is only considered successful given that the prototype model has indeed achieved what it claims—high acceptability in terms of technical performance, economic viability, and suitability under local condition given the existing corn production practices.

Developers of the BPRE pneumatic corn planter tested the corn machine under different field conditions. Results were then evaluated, including its financial probability for commercialization and adoption of the technology.

Results of the study showed that the planter obtained a highest planting capacity of 3.3 ha/day, with a forward speed of 4 kph under both sandy and clay loam soil. Under the same speed, the highest hill planting efficiency was achieved at 93.73% under clay loam soil.

The field efficiency resulted from 62.4% to 77.05%, which was less of an achievement. This is to be treated subjectively since the efficiency result depends on the vastness of the field and the skill of the operator to turn and maneuver the machine.

The estimated investment cost for the BPRE pneumatic corn planter is P585,349 (reconditioned tractor and working capital included). According to the developers, given that an investor acquires the machine for custom services, financial analysis showed that the corn planter is profitable with a benefit cost ratio of 1.39 and an internal rate of return of 28.73%. The investment cost for the corn planter is recovered in 3.55 years.

At the moment, BPRE is commercializing this technology for massive adoption to increase its use and achieve a lower cost of the planter. Adoption of this technology will not only help our local corn producer to have a better, cheaper option, it will also help in the government's effort to minimize importation of expensive corn machineries and equipment.

This article was based on the study, "Design and Development of BPRE Pneumatic Corn Planter" by Engr. Ofero Capariño, Mr. Manolito Bulaong, Engr. Andres Tuates Jr., Wryan Quiel Viloria, Donald Mateo, Jimmy Esguerra,a nd Ruben Manalabe of the Bureau of Postharvest and Research Extension (BPRE), CLSU Compound, Science City Muñoz, Nueva Ecija, Philippines.

For more information, please contact the project leader, Engr. Ofero A. Capariño, chief science research specialist, at telephone nos. (044) 4560-213, 4560-290, 4560-282, or 4560-

PHOTOS COURTESY OF BPRE and BAR

"Every good standing corn starts with a good planter"

RITA T. DELA CRUZ

Some years ago, this could have been mistaken as a want ad of a farmer wanting to work in a big farm. Since everything has to be done manually, farmers have to do it by hand and so farm operations have to be specialized—someone to plow, disk, and harrow the soil, someone to plant the seeds, fertilize, cultivate, harvest, and store the crops.

Before, it was just the man, the beast, and his land to tilt. Now, with agricultural mechanization coming into view, machines and equipment have become more of a necessity to maximize farm production and profit.

Their use and application have become major inputs, particularly as management tools, towards the realization of a modernized Philippine agriculture.

For corn, the second most important crop in the country next to rice, everything starts with a good seed. And every good seed has to be carefully planted to produce good standing crops. Thus, in a highly-mechanized farm, every good standing corn starts with a good corn planter.

A corn planter suited for local condition

In as much as planting of corn seeds is the most important operation in corn production, it is also the most difficult and tedious especially for large farms. If done manually, a hectare of land requires eight-man days to finish.

Farmers have earlier resorted to the idea of buying machineries to ease the production process. Mechanized planting has a lot of advantages compared to manual planting, precision- and quality-wise.

But most corn planters available in the market are imported, thus expensive. Some of them even need further modification just to suit the local conditions. Another problem with the existing corn planters is that they are mostly suited to large farms and are not appropriate to local farm sizes. It is difficult to optimize the use of a big, bulky corn planter given that average size of individual farms in the Philippines is less than two hectares only. The investment cost for machine is not likely to be recovered.

An alternative strategy was therefore suggested to mechanize small farm holdings by introducing smaller machine that is more appropriate for average farm sizes and suited for local condition. The basic idea is to create smaller machines for smaller farms.

Given such strategy, the Bureau of Postharvest Research and Extension (BPRE) of the Department of Agriculture (DA) led by Engrs. Ofero A. Capariño and Andres M. Tuates Jr., developed and fabricated a pneumatic corn planter that is technically and financially viable to local needs.

Other researchers involved in the development of the machine were: Manolito Bulaong, Wryan Quiel Viloria, Donald Mateo, Jimmy Esguerra, and Ruben Manalabe of BPRE.

Why pneumatic?

The machine developed by BPRE is actually a tractor operated pneumatic planter. This means that the corn planter itself can be attached to the rear of any four-wheel tractor through a standard

PHOTO BY EV CIRCA

Leading agriculture modernization through postproduction mechanization and development

MA. ELOISA E. HERNANDEZ

"Postharvest is a recurring thing, if you neglect to promote good philosophy or good practices, they will return to where they were," said BPRE Executive Director Ricardo L. Cachuela, during an interview in his office.

He started at BPRE as a casual engineer with a meager Php 34.00 daily wage. From the different positions he undertook, he has worked his way up into the ladder to become its current head, sharing its humble beginnings and current accomplishments and successes.

In the early 70's, the National Food Authority (NFA) faced problems with its postharvest losses in rice and corn reaching to about 37%. This prompted the creation of a subsidiary institution, known as the National Postharvest Institute for Research and Extension (NAPHIRE) that spearheaded the development of the country's postharvest industry.

In 1980, the agency's functions included other agricultural commodities aside from rice and corn.

It was in 1986, the that NAPHIRE became an attached agency of the Department of Agriculture (DA) and another six year counted when it was renamed to the now, Bureau of Postharvest Research and Extension or BPRE.

Functions

"Efficient, sustainable and globally competitive agriculture and fishery sectors which will propel the country in becoming a food basket in East Asia." This says it all as the overarching vision of BPRE. Their goal stands up in reducing postharvest losses, maintaining quality and increasing the value of agricultural and fishery products. The bureau works on enabling the smallholders and various stakeholders in the industry to engage in profitable postharvest ventures.

Guided by its mandate, BPRE generates, extends and commercialize appropriate and problem-oriented postproduction technologies and practices that can contribute to loss reduction, food and feed quality improvement and maximizing the benefits gained by stakeholders.

The Executive Director as being assisted by a Deputy Executive Director, handles six departments responsible on planning and evaluation, finance and administrative, training and extension, postharvest engineering, food protection, and postharvest systems. The last three departments are responsible for the research and development activities of the bureau.

BPRE's research development & extension (RD&E) programs gear toward four 4) major agenda, namely: 1) efficient drying and dehydration for increased farm productivity; 2) appropriate handling, storage and processing techniques for increased food value; 3) preventing and controling mycotoxin, pests and diseases toward food preservation;(4) empowering stakeholders toward profitable entrepreneurship.

Significant breakthroughs

First agenda on drying and dehydration facilities to increase farm productivity, BPRE has able to developed and designed a grain moisture meter, mobile flash dryer, in-store dryer, and a multi-commodity solar tunnel dryer (MCSTD). The Grain moisture meter makes accurate moisture content and price levels of *palay* and corn grains. About 18% of the moisture content can also be reduced by utilizing the mobile flash dryer. MCSTD, on the other hand is considered better to that of traditional sun drying method. It has a shorter drying time with lower microbial load and cleaner appearance of the dried products.

Recent focal years of BPRE focus on the priority thrusts that enable the sector to efficiently and effectively utilize improved postharvest technologies and mechanized farming. These can be seen as a significant move for the fulfillment of a modernized and improved production of the agriculture sector.

One of the major programs of the Bureau now is on the National Tramline Program. An agricultural Tramline System (TLS) has been inaugurated at the Alimodian, Iloilo. TLS is a system of cable lines used for hauling agricultural products.

In 1994, BPRE has instituted the Philippine National Cold Chain Program. Now, it has been intensified covering five four major trade routes for high value crops in the country to high-end markets in Metro Manila, Cebu City and Davao City. The cold chain system was developed to answer problems of farmers and traders on preserving the quality and freshness of the produced high-value crops particularly during transport and storage.

BPRE has also established Technology Demonstration Centers to enable and prepare farmers, processors, and small entrepreneurs to engage in postharvest handling and processing of high value crops. Now, there have been 10 TDCs nationwide focusing on different commodities popular in the regions. Mango and rice for the Science City of Muñoz, Nueva Ecija as to durian and mangosteen for Jolo, Sulu.

This also led to strengthening linkages and coordination among various postharvest sectors. Other than the DA family, BPRE was able to gain collaboration with the other government agencies, state, colleges and universities (SCUs), and private sectors.

Notable accomplishments endeavors

Dir. Cachuela is pleased to say that the Bureau already has its own facility continuously promoting mechanical drying for rice and corn and other postharvest processes. “The development of machineries and technologies is a continuing tool,” Dir. Cachuela added. After a cycle of research and commercialization of technologies, BPRE changed its strategy with tie ups with manufactures particularly in production areas in the country.

Since some of the developed technologies are not readily acceptable to farmers, BPRE increased their capacity by establishing linkages with cooperatives. Working and dealing with them were called the *Cluster approach*, previously known as the *farmers service center* serving as a centralized system for postharvest services. “We don't rely on cooperatives alone but now we rely on groups of farmers who are now clustered by at least 100 hectares since these are easier to manage using farmers' skills effectively,” Dir. Cachuela explained.

Trainings were also facilitated under the RD and extension component. Other components include the provision of software, building up capabilities, preparation of information materials and multi-media.

Even if BPRE has no regional office, they select key pilot areas that will make the most impact. From the sites selected, practices emerge following correct procedures and application the results of commercialization. Sample pilot areas are Mindanao and Central Luzon for corn and rice, respectively. Through a Master Plan, the involvement of the local government units (LGUs) is recognized. This distinguishes the geographic advantage of the provinces which likewise determine the strengths and weaknesses of the area. Regional agricultural engineers, economists, biologists, as well as the private sectors are also tapped.

BPRE has been able to foster collaboration and strengthened linkages with other government agencies, farmer cooperatives, SCUs, LGUs and private sectors. This made the achievement of its goals possible. With BPRE's goal to reduce postharvest losses through the years, a significant reduction has been noted as a result of numerous postharvest technologies and interventions. With its array of accomplishments and major breakthroughs, BPRE would pave the way in assisting the Department in its quest for a diversified agriculture sector. And now, BPRE is lucky to have a Director who has a big heart and passion for his work, sharing big ideas not only for the Bureau and for the country as a whole.

PHOTO BY MEHERNANDEZ

Executive Director Ricardo L. Cachuela.

Making coals from Cocos through charcoal brick kiln

ELLAINE GRACE L. NAGPALA

Coconut *(Cocos nucifera)* remains to be the top cultivated crop in the Philippines. Out of the 12 million hectares of farmlands in the country, 3.1 million hectares of it is devoted to coconut production. With the vast size of farmland devoted to coconut farming, it can be said that a large percentage of the country's population still depends on coconut for their living.

Over 3.5 million coconut farmers are widely distributed in different parts of the country, mostly in Southern Luzon and in different parts of Mindanao.

To help the coconut farmers gain extra income while attending to their farm activities, the group of Engineer Rosella B. Villaruel of the Philippine Coconut Authority (PCA) in Region X1 came up with a charcoal brick kiln where coconut shells can be turned into quality charcoals.

What are kilns?

A kiln is a thermally insulated chamber used to harden, burn or dry materials, it could be utilized in drying and heating wood to produce firewood and charcoal, or in firing-materials used in ceramic-making.

Traditional means

Kilns were first utilized in Bago Oshiro, Davao City under the Philippine-German Coconut Project (PGCP) in 1995.

In the Philippines, charcoals are traditionally produced using drum kilns where a standard oil drum with an approximate capacity of 55 gallons is used. With the use of a drum kiln, charcoals can be produced from 600 pieces of split coconut shells. However, charcoal workers encountered problems with regards to the operation, durability and efficiency of the drum kiln.

The charcoal brick kiln

The batch type brick kiln was fabricated as an alternative to the traditional methods of charcoal production and to ease the operations in charcoal making of the charcoal workers.

The brick kiln is made of 2”x4”x8” standard rectangular bricks, constructed in a dome-shape. The kiln's dome structure is for the purpose of optimal carbonization process. Its inside has a base diameter of 1.2 meters and a net height of 1.10 meters with an approximate volume of 0.73 cubic meters. This prototype kiln can accommodate approximately 3,000 pieces of average split shells. This could be increased if the shells are semi-crushed.

The charcoals produced by the kiln from the coco shell wood passed the standard of a good quality charcoal which possesses a fixed carbon content of 86.5%, ash of 1.4%, volatile combustible matter of 9.6% and 2.5% moisture content.

The charcoal brick kiln is expected to last for five years or more with an initial investment of PhP 4,100 while the drum kiln has a serviceable life span of six months to one year, with each drum costing PhP 500.

User-friendly

One problem encountered by the charcoal workers with the drum kiln is its difficulty to operate. Since metals are strong conductors of heat, the drum kiln becomes difficult to handle as it turns very hot during the process.

Moreover, the smoke being emitted under the drum becomes a nuisance to the workers. As such, the

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Making coals...from page 17

PHOTO BY RVILLARUEL

brick kiln was designed to be user- friendly.

Bricks being resistors of heat makes the charcoal brick kiln easier to operate. The kiln was also designed in such a way that it will suppress the heat pressure inside and prevent it form leaking outside the kiln. In this way, the kiln will be convenient for the operators as they will no longer have trouble with the heat coming from the kiln. Also, the smoke coming from the kiln not be a problem for the workers since a 'nose' for the emission of smoke is included in the structure which is strategically placed at the top of the kiln. This way, it will be easier for the operators to recharge the kilns.

Time saving

The proper procedure for making good quality charcoals only requires 16 percent of the total time to produce charcoals with the brick kiln as compared to the drum kiln which requires 90 percent operation time.

With the charcoal brick kiln, 74 percent time more will be saved in charcoal making. For a farmer who needs to attend to his farm and his family, and his other chores, the 74 percent time that can be saved means more time to attend to his tasks.

In general, this implies that the kiln is not only designed to increase the capacity of charcoal produced but also for the benefit of the worker.

This article was based on 'A comparative study between batch type brick kilns and drum kilns using decision tree analysis' by Engineer Rose B. Villaruel and Mr. Kalvin Mesias Balucanag of the Philippine Coconut Authority in Region XI. The Batch Type Brick Kiln was funded by the Philippine Coconut Authority and the Korea Institute of Industrial Technology.

PHOTO FROM SHUNYA.NET

Brick kiln in Africa

ring. The drying, thermal and dehumidifying efficiency of the heat pump drying system were analyzed.

Drying kinetics of onion was described using the different stages: initial stage, constant rate period, and falling rate. The initial period transfers the sensible heat to the product and dramatically increases the evaporation rate resulting to high moisture content removed. The constant stage showed high drying rates without detrimental effect to the product.

The dehydration results showed that moisture content of onion was from 83.0 % to 15.0% at moisture reduction rate of 0.029 kg/hr dried for 33.0 hours. The drying efficiency of the system showed 37.83% calculated in terms of the specific moisture extraction rate. This illustrates that performance of the rotary type, heavy duty compressor is efficient vaporizing moisture for onions.

The favorable drying, thermal, and dehumidifying efficiencies of the system contributed to a dehydrated onion with reduced color degradation safe for storage.

Personal note

On a personal note, Engr. Franco stated that this intervention in agricultural engineering is deemed important in increasing productivity. "As this technology reduces waste and postharvest losses, the resulting output is a net gain, therefore, it increases productivity."

One of the benefits of the system is that it can be utilized for a multicrop application; hence, it can be used to dry other commodities like *taro*, banana, *ubi*, and *saluyot* among others.

In conclusion, Engr. Franco sees the onion industry as one of the agricultural aspects under pressure. But he mentioned pointers on how to combat this issues. Engr. Franco suggested that there should be a well-supported integrated breeding and varietal improvement program to come up with varieties adaptable to the country. He therefore mentioned the great assistance of the Bureau of Agricultural Research (BAR) provided in this endeavor. "MMSU, together with BAR through the Ilocos Integrated Agricultural Research Center (ILIARC), all the aspects from basic research, testing to cultural management and engineering, hence to commercialization will follow."

This article was based on the study, "Heat Pump Drying of Onions" by Ms. Lorcelie B. Taclan and Engr. Samuel S. Franco, Mariano Marcos State University (MMSU), Batac, Ilocos Norte, Philippines.

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Is commercializing agri and fisheries mechanization program the next step?

MARLOWE U. AQUINO, PhD

PHOTO FROM BAR ALBUM

Today's trend in Philippine agriculture and fisheries is commercialization. Is there such thing when it comes to agriculture and fisheries (A/F) mechanization? I would probably say, "Yes" and experts in the field also would agree with me that there is such thing as commercialized mechanization. What do we mean by commercialized mechanization or commercialization of A/F mechanization? At first, we ask the question like, what is this all about? Is there such thing as mechanization? Or to be more specific, what is commercialization of agriculture and fisheries mechanization? These questions would probably solicit a great deal of argument and discussions because not all are into mechanization. People may probably direct their views on specific areas like programs, activities, technologies, interactions and impacts to be part of this discourse.

In order to set direction, this article is written to illustrate that there is such thing as commercialization of agriculture and fisheries mechanization. However, opinions and views on the subject matter will be treated with utmost flexibility in order that we encourage participatory discussions among key players in the field. As a start, I post the question - Is Commercializing A/F Mechanization Program the next Step to competitiveness or business activity? My reviews and search would lead me to say, a strong "YES." Let me now convince you to share my thoughts coming from the perspective of a social scientist and development oriented practitioner.

Background of commercializing A/F mechanization

Long before the introduction of a formal process of commercialization, farm management operations and activities use small farm tools, implements and machineries including technologies; commercializing these have taken place within several farms of farmers and ponds of fishermen. These people used technologies to enhance farm work with the aid of apparatus and instruments. These are simple tools which aid in planting certain crops and machines that require faster and quicker work accomplished and to minimize manual farm labor. Based on these, it seems that there has been a historic base of continuous utility of farm implements and machineries. More so, innovative technologies led to the increase development and application of tools and machines until these are part of the improvement of farm operation and management.

Globally, engineers made sure that every farm implement, machines and technologies developed will support the increasing need to fully mechanize farm operations. From a simple garden tool to a harvesting truck or processing plant led to better quality harvest or ease post harvest operations. This was the objective in mind of engineers and inventors whose everyday concern is to make farm management better without additional cost to farms but rather increase production and profit.

Based on these, where does commercialization come in? What specific areas are commercialized in mechanization? Who are involved in mechanization? Will this commercialization activity work? These same questions led me to deal on the background or basis for commercialization of A/F mechanization. The very basic factor under these circumstances is people. People utilize the implements, machines and technologies in their respective farms, fish ponds or tanks. How are people responding to these issues, concerns and programs on mechanization? Everything led to only one thing, mechanization eases operation and management. This single notion is the ultimate basis of mechanization, be it during or after crop or animal/fish production and management.

Commercialization program of three-user friendly farm machines

The attempt and initiative of the Bureau of Agricultural Research (BAR) to start supporting the commercialization of agriculture and fisheries (A/F) mechanization started during the last quarter of 2006. It was introduced at the height of the national technology commercialization program of the Department of Agriculture (DA). Under the program, three national R&D agencies organized themselves to make a difference and contribute to the main goal of the A/F commercialization. Based on the gains of continuous R&D activities of these DA agencies, the Bureau of Post Harvest Research and Extension (BPRE), the Philippine Rice Research Institute (PhilRice) and the Fiber Industry Development Authority (FIDA) worked together to established an integrated and consolidated A/F commercialization program.

The program aims to bring to the marketplace R&D results like machines and implements. It also aims to pump-prime the sustainable utilization and commercialization of these R&D results to effect agricultural modernization and community development.

The specific objectives of the program are 1) to determine the extent of application and utilization of developed agriculture and fishery machines and small farm implements; 2) to encourage and establish partnerships among and between key players and stakeholders of the agriculture and fishery mechanization program; 3) to commercialize the different agriculture and fishery machinery for sustainable development.

With BPRE as the lead agency, the program covers the three technologies to be implemented by the three cooperating and implementing agencies. The technology(ies) from each agency will be subjected to the technology commercialization process. This commercialization process of farm mechanization is the first attempt to prove that is such thing as commercialized mechanization. The major factor is people that operates and coordinate the commercialization process. Specific processes are included to make sure that all technologies are subjected to scrutiny under the lens of commercialization. Since these processes require the intervention of people, these must be well coordinated and management to show that there is an impact on people's lives and the result will have to the agriculture and fishery sectors.

The commercialization process comprises the 1) Information and Knowledge Management Phase which include the development of information education and communication (IEC) materials, promotion, information campaign, training and seminars, 2) Industrial Promotion Phase which take account of the accreditation of local manufacturers, 3) Sustained Adoption Phase which entails the provision of technical assistance to various stakeholders, including monitoring and evaluation activities, and 4) Process Documentation wherein the different commercialization process of the technologies are documented as basis for information sharing for future activities.

The program encompasses the different mature technologies recommended by the three implementing agencies. These are the BPRE Rice Hull-Fed Furnace which is being retrofitted to match the requirements of re-circulating mechanical dryers initially for rice and eventually for other grains; the B&S PhilRice Combine Harvester (1.3m model) which combines harvesting, threshing, cleaning and bagging operations in one; and FIDA Fiber Extraction Machines which consist of Mobile Spindle Machine and Multi-Fiber Decorticating Machine. The mobile spindle can extract good quality abaca fiber because it is safe and easy to operate due to the provision of clutch mechanism while the multi-fiber decorticating machine is an improvement of the traditional raspador decorticator used for ramie fiber extraction. Given these technologies, these will drumbeat the promotion, utilization, application and commercialization activities to realize the benefits of R&D results.

The R&D of the mechanization of A/F commercialization

Unsuspectingly, there is still R&D in commercialization of A/F mechanization. A great deal is anchored on the people that use these technologies and those that promote and commercialize them - meaning the people behind this initiative. Since it deals with people, this is the social aspect of it. How does this work? Well, people are the implementers, users and actors. The underlining aspect is the social factor which means that interactions, relationships, changes and transformations these technologies contribute, affect or have impact are the vital in the process. In order to handle these properly, it is the social science that magnifies this into an R&D concern. Within this commercialization process, researches could be derived in order to show what is happening to the technology vis-à-vis the people that are using and has made impact. This is now the area where BAR requests and encourages social scientists to prepare research activity to show interactions, transformation and changes for sustainable development. When this happens, BAR would believe that A/F mechanization truly contributed in the overall sustainability of the sector with the aid of commercialization.

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PHOTOS BY BPRE

Seeder

Planter

Harvester

A heat pump drying system for onions

MA. ELOISA E. HERNANDEZ

Almost all our cooked foods have that distinct flavor of onions filling our tastebud. It is hard to imagine missing that distinctively pungent smell and taste on our sautés, soups, and other cuisine.

Chopping it might bring a tear to our eyes but we cannot afford trading these tears for a blunt flavor of our food. Our kitchen would not be that exciting and delightful as it used to be.

Onion, scientifically known as *Allium cepa*, comes from the Latin word *unio* for "single" or "one" as the onion plant produces a single bulb compared to garlic, that produces many small bulbs.

More than 130 countries in the world have been cultivating onion. In 2004, the world production reached 55,025,127 metric tons (mt).

In the Philippines, Central Luzon and Northern Luzon are the major onion producers. Particularly, Nueva Ecija contributed to about 56.80% with Ilocos Norte and Ilocos Sur producing 15% and 13.70%, respectively.

Almost 78% of the total production is consumed as food or used as food ingredient, 10% is exported, 7% is used as seeds, while 5% is for other uses.

Onion, considered as a heat sensitive crop, requires favorable dehydration process to preserve its organoleptic properties. This should be dried at low temperature of 30-50°C and relative humidity of 10-15%. It needs proper drying before they can be marketed and processed. Dried fruits and vegetables can be a good source of energy. They contain concentrated natural vitamins and minerals such as A and C, thiamine, riboflavin, niacin, iron, and potassium.

After harvest, onions are laid out on the fields for a day or two to be partially dried or farmers used alternative ways by hanging in sheds or through air drying.

Some of the issues and concerns that plagued onion production are: weight loss and rapid deterioration of bulb, lack of proper cleaning, and limited drying and storage facilities resulting to erratic supply of onions and high fluctuating market prices in the country.

Finding solutions

The above scenario led Engr. Lorcelie B. Taclan and Engr. Samuel S. Franco from the Mariano Marcos State University (MMSU) in Batac, Ilocos Norte to develop a heat pump drying system to determine the drying kinetics of onion. The heat pump drying system was designed to use recoverable energy, that is, latent heat was converted to sensible heat, thus, handles the product gently. The system operates according to a basic air conditioning cycle involving five major components: evaporator, compressor, condenser, expansion valve, and drying chamber.

A heat pump collectd heat from the condenser or the outside unit and discharges it inside through the air handler. The expansion valve assists in the flow of refrigerant as it moves in the opposite direction. The extracted heat from the air handler will be discharged to the drying chamber through the air handler.

The heat pump is a refrigeration machine that extracts heat from one place and discharges it into another where it is not wanted or makes little or no difference. The system was found to: 1) ensure hygienic process of drying; 2) produce longer period in the retention of product flavors; 3) reduce the color degradation of the food product after drying under the most favorable conditions; and (4) reduce the loss of thermal sensitive vitamins embedded in the food product.

"Heat pump drying dehydrates the onions but maintains its color and its flavor and alkaloids. Heat pump drying utilizes lesser energy than conventional mechanical drying," Engr. Franco averred.

The system

The system used a fabricated drying tray with a dimension of 1.71 ft x 1.75 ft. The drying chamber is able to accommodate a total of 21 kg of fresh onions. Green onions were used and were trimmed and sliced to desired size f 1/8"

PHOTOS COURTESY OF MMSU

function.

The improved version of the hot water tank was designed to accommodate double of its original capacity. A batch of 160 kilograms of mangoes can be accommodated by the improved hot water tank per treatment. The electric heater as a source of heat was also replaced by LPG tanks and burners to minimize the high consumption of energy brought about by the electric heater.

Inside the tank are circulating pumps that keeps the hot water circulating and well distributed throughout the treatments for the fruits to be evenly treated. A digital thermostat also accompanies the hot water tank to regulate the temperature of the water and maintain it to a desired point. The hot water tank is also accessorized with wheels to aide the mobility of the machine.

Extended function

China is among the countries where the Philippine 'Carabao' mango is being exported. Known for its strict quarantine measures, China's government ensures that the oriental fruit fly, a serious quarantine pest of mango for many importing countries, will not enter their premises. To do so, China required the process of extended hot water treatment to be employed to the mango fruits that will be imported in their country.

The extended hot water treatment (EHWT) differs from HWT in several ways: the former is used to disinfest eggs or larvae of the oriental fruit fly in the pulp of the fruit while the latter is used to control diseases. Contrary to the HWT, in EHWT, mango fruits are immersed in hot water with temperature ranging from 48-49°C until the pulp temperature reaches 46°C and will he held for fifteen minutes. Evidently, the procedure of EHWT requires a longer time than HWT to ensure that heat will go through the pulp of the fruit to kill the eggs and larvae of the oriental fruit fly.

In this regard, PHTRC, in collaboration with UPLB's College of Engineering and Agro-Industrial Technology (CEAT), is currently working to fabricate a hot water tank which can accommodate a batch of 500 fruits for the EHWT. Since EHWT requires a longer time for its procedure, the need to fabricate a larger hot water tank was deemed necessary to save time and resources.

PHOTO COURTESY OF PHTRC

"The improved version of the hot water tank was designed to accommodate double of its original capacity."

Commercialization aspect

According to Dr. Kevin Yaptengco, professor from CEAT-UPLB and research associate at the PHTRC, several steps were already taken with regards to the commercialization of the hot water tank. Various trials and demonstrations of HWT and EHWT were performed in places where mangoes are widely produced. In this way, mango traders and producers become acquainted of the two treatment methods. Blue prints of the hot water tank are also provided to parties who are interested to have their own hot water tank.

Dr. Yaptengco also mentioned that there are mango traders and exporters who already make use of HWT and EHWT. Large mango traders from Cagayan de Oro utilize HWT for disease control for the mangoes they export in Japan and Hong Kong.

With the combined efforts of PHTRC and CEAT-UPLB, the fabrication of the new hot water tank that can accommodate 500 kilograms of fruits is being looked forward, not only to showcase the hot water tank but the HWT and EHWT as well.

For more information, please contact Dr. Kevin Yaptengco, university research associate, Postharvest Horticulture Training and Research Center, Univeristy of the Philippines Los Baños, College Laguna with telephone number (049) 536-2444.

PHOTO BY RDELACRUZ

Batch-type coffee roaster:

A brewing opportunity for smallscale coffee business

RITA T. DELA CRUZ

No coffee can be good in the mouth that does not first send a sweet offering of odor to the nostrils. Thus, the famous line of Henry Ward Beecher, which has now found its way in the personalized coffee mugs sold nationwide.

Filipinos love to drink coffee. Drinking coffee is a favorite pastime and an engaging social activity for many of us. The sprouting of various coffee shops in almost every corner of the metro has become the most evident indication that the coffee shop industry is a thriving business.

Our love for coffee was basically brought about by the colonization of the country by the Spaniards more than two centuries ago when they turned our highlands into coffee plantations. They loved the perfect mix of heat, humidity and cold plus the wet and dry tropical climate that made the cultivation of coffee well suited in the Philippines.

Growing coffee became such a profitable venture that for a while, the Philippines was one of the leading coffee-producing nations during the 19th century. But due to the coffee rust disease such reputation was cut short. It was during this time that the Latin American countries battled it out and dominated the global coffee market.

In the Philippines, the coffee plantations are mostly concentrated in the mountains of Batangas, Bukidnon, Benguet, Cavite, Kalinga-Apayao, Davao , Claveria, and Misamis Oriental. Approximately 60,000 - 80,000 families with roughly 120,000 hectares of productive land grow coffee. These lands are both home and production unit for our local coffee growers.

The key to good coffee is bean roasting

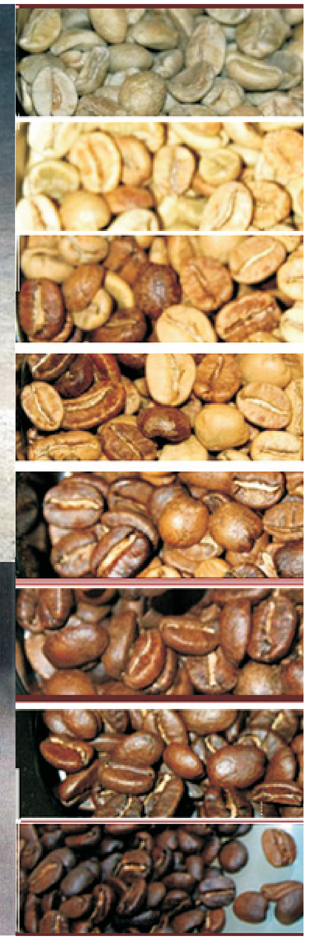
In a recent market study conducted by Ronald Mark G. Omaña of the Center for Food and Agri Business University of Asia and the Pacific, he cited "coffee bean roasting formula as the critical factor" among major specialty coffee shop owners in the Philippines as " it is this stage where the coffee bean releases its fullest flavor potential. Poorly roasted beans would yield poor-tasting coffee drink."

For coffee connoisseur and self-confessed addicts, the difference always lies in how the coffee was prepared. Before, we were used to drinking instant coffees, simply because they are ubiquitous and are easy to prepare.

But with the emergence of specialty coffee shops both foreign and local brands, even the tongue that was once used to drinking instant coffees are now craving for the "real coffee"—made from coffee beans grown in ideal climates and prepared according to standards, thus the distinct rich taste and flavor.

Before your rich coffee ends in your favorite mug and be enjoyed, it must first undergo several processes, one of which is roasting.

Roasting coffee is the process of applying heat to transform the chemical and physical properties of green coffee beans into roasted coffee products. By applying heat, impurities in the beans are dried off for oxidizing products. This process is integral in producing a savory cup of coffee. Right amount of heat, right



Top photo: Batch-type roaster developed by Engr. Ruel Mojica
Below photo: A shovel of fresh roasted coffee beans.
Left: Coffee beans change color after roasting.

PHOTOS COURTESY OF RMOJICA

timing, in a uniform manner are required to achieve the desired flavor from the beans.

The heat problem in coffee roasting

Coffee shops in the Philippines continue to thrive by the numbers. But most of them are under franchising arrangements with big, foreign companies. These franchising companies can afford expensive roasters and other costly equipment.

With huge processing equipment, an ordinary coffee grower cannot compete with them. There might be a few available coffee roasters for smallscale roasting but they may not turn out as efficient as the expensive ones, resulting to poor quality roasted beans.

Since coffee roasting involves proper heat application, common problems encountered include the uneven distribution of heat inside the roasting chamber and the lack of insulating materials which results to excessive heat loss.

There is, therefore, a need for locally manufactured coffee roaster specifically for smallscale roasting purposes to boost the smallscale coffee growers in the country.

Low cost coffee roaster for smallscale business

Responding to this problem, Engr. Ruel M. Mojica of the Cavite State University (CaVSU) and Dr. Engelbert K. Peralta of the University of the Philippines Los Baños (UPLB) developed the first ever batch-type coffee roaster that can be used for small-scale roasting.

The coffee roaster was designed and fabricated at the College of Engineering and Agro-Industrial Technology in UPLB wherein the machine's performance was also evaluated. The prototype coffee roaster is made up of six major parts: roasting chamber, outside drum, auger, heating plate, and burner. Parameters used during the evaluation included: auger speed, roasting time, valve opening, and fuel consumption.

Results of the performance evaluation, showed that the machine had varying levels of auger speed. However, the varying speed made no significant effect on all the response variables. They also found an increase in roasting time which decreased the weight and moisture content of the roasted beans.

Varying the levels of valve opening was found to have significant effects on the weight and moisture content of the roasted beans as well as the fuel consumption of the machine. No significant effect was noted on the roasting capacity of the machine.

In terms of sensory evaluation, coffee obtained using treatment combination of 40-rpm auger speed, 60-minute roasting time, and 3/4 open valve obtained the highest coffee rating of 86.1.

In the cost and return analysis, results showed that using this coffee roaster for smallscale custom work can be a profitable business venture with a potential net income of P63, 451.49 annually.

Some innovations

The prototype model of the batch-type coffee roaster was first completed in 2005 but further innovations are being done to further improve the capability of the developed machine.

These are: 1) evaluation of the machine using other coffee varieties (e.g. Arabica, Liberica, etc.); 2) development of a microcontroller-based temperature control unit and software that would control the operation of the machine for a given period of time, 3) evaluation of the machine using other crops (e.g. cacao, peanut) aside from coffee; and 4) use of Response Surface Methodology (RSM) to determine the optimum operating conditions of the machine.

This article was based on the study, "Development and Evaluation of Batch-type Coffee Roaster for Small-Scale Roasting" by Engr. Ruel M. Mojica of the Cavite State University (CaVSU), Indang, Cavite, Philippines.

For more information, please contact the project leader, Engr. Ruel M. Mojica at the Department of Agricultural and Food Engineering, CaVSU at telephone no. (046) 415-0021 or fax no. (046) 415-0012 or through his mobile number: 09272510497 or e-mail him at ruelmojica@yahoo.com

Hot water tank

ELLAINE GRACE L. NAGPALA

PHOTOS EGNAGPALA

a tool for disinfestations and disease control

What could be the other ways to control the prevalence of diseases and insect pests that infests our crops aside from treating them with pesticides? Are there any? And if yes, is it efficient?

During the 1970's, Dr. Arcadio Quimio and Dr. Tricita Quimio of the Department of Plant Pathology at the University of the Philippines Los Baños (UPLB) developed a technology to control the two major diseases of mango: anthracnose (Colletotrichum gloeosporioides) and stem-end rot (Lasiodiplodia theobromae). The technology, known as the hot water treatment (HWT) involves the immersion of green mature mango fruits in a water bath for ten minutes at a temperature range of 52-55°C. Through the said method, the development of the diseases in the infected fruits will be arrested because of the unfavorable environment for the pathogens brought about by the water's high temperature. Studies have shown that the thermal death point of the disease-causing organisms for mango is at 51°C.

Through several laboratory tests, HWT was found to be effective in controlling the mango anthracnose and stem-end rot. Hence, the method was introduced to mango traders and was used in a commercial scale. Halves of large drums served as the hot water tanks with wood fire and kerosene as the source of heat. Later on, HWT was preferred over the used of fungicides in controlling the development of the mentioned diseases of mango considering that it was cheaper and safer.

The hot water tank

The first hot water tank was designed for the purpose of disease control through the HWT. To fully maximize the potential of HWT in controlling the disease of mango, scientists at the Postharvest Horticulture Training and Research Center (PHTRC) in UPLB fabricated a hot water tank that can accommodate a larger number of fruits relative to the drums. With an electronic heater as the source of heat, the hot water tank was designed to accommodate a batch of eighty kilograms of mangoes for disease treatment.

The prototype hot water tank is made up of galvanized sheets and coated with commercial paint to retard corrosion of the material. However, the painting of the hot water tank is discouraged since chemicals that paint contains may diffuse to the fruits, hence may lead to its rejection in the international market. Instead, in the commercial scale, the use of stainless steel for the construction of a hot water tank is recommended in replacement of the galvanized sheets.

Improved version

When the HWT treatment was used in a commercial scale, batches of eighty kilograms of mangoes are being accommodated by the hot water tank one after the other. To take maximum utility of time and resources, another hot water tank was fabricated by the same group of scientists in PHTRC, this time larger and fueled by LPG tanks to