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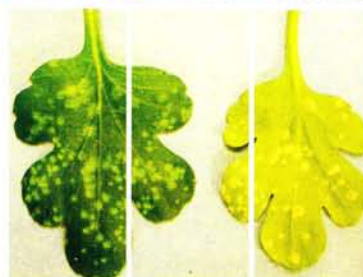
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The new BAR R&D Digest

In college, I was a member of INK, an association of campus writers. Why the name? Because we dabbled in various forms of writing, on topics mostly about love. The members jestingly proclaimed that ink, a writing liquid that was only black or blue during our time, was running through our veins. For sometime, that ink profusely coursed through my veins that I was able to publish many articles. As a professional and due to other inclinations, little by little the ink in my veins was flushed out but my love for the written word remained strong. This love manifested itself in later years through my published articles, that were no longer tinged with pink, for writing about love could be outgrown, and also by publications and technical journals that I edited. I still have this ink in my blood but this time it is now colored blue-green, blue for fisheries and green for agriculture. I work for fisheries

and agriculture and see to it that the products of R&D reach the intended beneficiaries in a form they can easily understand. It is a commitment.

This R&D Digest, BAR's quarterly publication, comes out with a new and modest format starting with this issue, in keeping with financially difficult times. The articles are still written simply and understandably but no longer as colorful. We try to publish in every issue as many information and technologies as we can which our R&D system in agriculture and fisheries generated and developed. But we assure you that we are going to deliver.

Our scientists are now alarmed of the threats to our pollinators- the honeybees especially that there is a correlation between their population and the honey produced. They are threatened by the size and spatial

arrangements of plant populations, parasites and predators that are integral part of the ecosystem, and indiscriminate pesticide application. They live best in an agro-ecosystem that is managed (page 21). Our mouths water while slicing a ripe and luscious mango only to find a pulp weevil inside. How soon will this mango disease be eradicated? Our scientists say that knowing the sex of the pulp weevil may be the first step in its eradication (page 15). How about plant pests? The use of sex pheromone traps is not new but a better understanding of the insect pest one tries to trap should be a step to a better use of it and there should be ways to encourage the farmers to use it (page 17). While our chrysanthemum has a great export potential, the growers have problems with this flower's white rust. Our scientists, however, have found that chrysanthemum white rust could be controlled with

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PALAYAMANAN Project: A model for farmer empowerment

By: Likha C. Cuevas
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Farmers along the national highway in Pias, Currimao, Ilocos Norte used to harvest 3-4 t/ha or 60-80 cavans/ha of rice due to limited water supply (farms are rainfed) and different soil types like sandy soils, clay loam with numerous dead corals one meter deep below (the place is 1 km east of South China Sea), and sandy loam. These soils have low organic matter content, low water holding capacity, and a relatively high pH. The farmers also have limited production technologies for rice and other crops.

In 2001, Palayamanan, a project by Lorraine Idelfonso, Presentacion Alquiza, and Reynaldo Castro of the Philippine Rice Research Institute (PhilRice), Batac, Ilocos Norte entered the scene. Palayamanan aims to increase the yield and income of farmers through interventions of new and appropriate technologies and introduction of diverse crops and livestock in traditional farming systems. In the project, the farmers' capabilities are enhanced through trainings and as such were encouraged to do extension activities. The farmer cooperators were not only farmer scientists but also extensionists, according to the team.

The project had seven farmer-cooperators with four hectares of land utilized in the demo-farm.

Wet Season 2001

The PhilRice team introduced six new rice lines (PJ 7, PJ 3-1, PJ 17, PJ 3-5, PJ [T] 4 and PJ [G] 6) and five PSB varieties (PSBRc 18, PSBRc 28, PSBRc 64, PSBRc 72H, and PSBRc 80). They also introduced a new seeding rate (40 kg/ha), new way of planting (straight row with 20x20 cm distance), use of basal fertilizer (5 bags 14-14-14), and the use of organic fertilizer. With these new methods, the demo farm yield increased by 35%, ranging from 4.2 t/ha to 6.5 t/ha (average of 5.35 t/ha). They earned an average of P67,780.

Different farming systems were also introduced to the farmers working on the demo farm: 2.3 hectares was used for monoculture crops while areas not suited for rice production (sandy and upland areas with low water holding capacity) were planted with mungbean and cowpeas. Levees and dikes were planted with vegetables like bush sitao. This way land is maximized since uncultivated areas become productive and this provides farmers with vegetables for



BAR Director William Medrano (middle) at the CPAR site with Dr. Reynaldo Castro (right) and a farmer-cooperator (left)

subsistence. The 0.07735 ha piece of land earned the farmers P4,989.

To impound water from the rain, an existing small farm water reservoir (SFR) was reconstructed, which the farmers used to raise 400 pieces of tilapia. After a month, hito (catfish) was introduced when the tilapia had grown enough to compete. The fishes were harvested after four months and farmers earned P11,000.

After four and a half months during the wet season of 2001, the (less than) four-hectare demo farm earned P83,769 --- and this does not include the income from other non-farming activities.

Dry Season 2001- 2002

To compensate for the lack

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Rice



of rainwater and make the land more productive, the crops planted during this season are glutinous corn, hybrid corn (IPB 911), peanut, cowpea, watermelon, tomato, pepper, ampalaya, and eggplant. These were cultivated as monoculture crops that do not need to be rainfed.

Another cropping system introduced was zero tillage (with mulch) with mungbean and cowpea. Cowpea was intercropped with corn and zero tillage with mulch was done to conserve limited moisture during the dry season. Tilled intercropping was done on mungbean and corn in double rows. With this mixture of cropping systems, farmers were able to earn P189,639 from 3.7502 ha.

It was not a bad year for Palayamanan farmers. With barely four hectares of land and 10 and half months of farming, they earned P277,673.

Second phase

In wet season 2002, the same farming system was adopted as the previous year's wet season. The project proponents recorded a 500 kg-increase in the rice yield (from the 3.65 ha area) compared to the previous year. Income from the yield doubled (P143,563), which the PhilRice team attributed to the introduction of the aromatic and glutinous rice that commanded higher prices in the market.

On a piece of waterlogged

land (0.46 ha), three rice varieties were planted using direct seeding, wet bed method. These were PSBRc 96, PJ7, and MS 6 (an aromatic rice) from which a piece of the demo farm (0.456 ha) earned P2, 551. Even though the yield and income was a lot lower compared to the income generated from the larger rice field, it was considered good since the waterlogged area was made productive.

The vegetables that the farmers planted this season earned them P15,980. The tilapia harvested from the SFR was 190 kg, which earned a net income of P12,700.

This season, the total earnings from crops and fish was P172,243.

During the dry season of 2002-2003, the demo farm earned a net income of P153,717 from the monocrop (corn) and P22,226 from harvest using the intercropping system. It's not only corn that the farmers sold; the vegetative parts were also in demand as fodder. They also use this for their own livestock. The demo farm earned P21,928 from vegetable crops that was planted in 0.13 ha of land.

For the third cropping set, the farmers insisted on planting mungbean again even if they did not earn much from it the previous year. They knew the benefits of planting mungbean. Mungbean is a legume that hosts nitrogen-fixing bacteria in its roots. These nitrogen fixers are much welcome to a land where the soil has a high pH and low organic content. The third set of crops earned P9,285 for just over 0.35 ha this year. The total earnings for this year was P381,950 (37% increase).

Livestock integration

At the start of the project, six carabaos, 17 cows, 24 goats, 12 pigs, and 259 chickens were introduced to the demo farm. One carabao and six cows were sold to buy a water pump for irrigation. Goats and chickens were sold to augment household expenses and pay for social activities.

Nothing gets wasted here in Palayamanan. Even poultry manure was used as organic fertilizers. Two hundred nineteen chickens can provide 117 bags/year of processed manure, which was enough for a whole cropping year.

Farmers as extensionists and farmer-scientists

Whatever the farmer cooperators learned from their trainings and experiences, they shared with fellow farmers through the Palayamanan, a farmer field school. The farmer cooperators serve as resource speakers in Palayamanan. Now, farmers from the neighborhood, nearby barangays, and towns get their seeds from the Palayamanan demo farm --- a testament of the program's credibility.

"It is in their farms," Dr. Reynaldo Castro said, "where farmer-cooperators conduct simple researches that adopt the general technology recommendations for their areas. Through this, the farmers generate location-specific technologies. Since they're the ones developing these technologies, the farmer-cooperators are confident in disseminating the knowledge to fellow farmers."

Palaytandaan is the information dissemination component to enhance Palayamanan. Palaytandaan includes a radio program and learning centers, which the farmers themselves established. Here,

Conserving Lingayen Gulf resources

By: Rita T. de la Cruz
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As a major area for capture fisheries and coastal aquaculture in Northwestern Luzon, Lingayen Gulf provides 1.5% the country's fish supply. It provides livelihood and food to small-scale fishermen living along the coastal areas with an average catch of 6,000 metric tons annually. Its highest contribution is in aquaculture which is 74% of the gulf's total production. But the gulf now faces various problems like fishkills. The fishermen fear that the fishery resources may soon come to a "dead end".

In the study of Dr. Sotero M. Aban of Pangasinan State University, he cited seven problems that need to be addressed by the municipality and that could also serve as important basis to design a management scheme for the conservation of the coastal resources of Lingayen Gulf. Among the critical issues and problems identified were: poverty, illegal fishing, fishkills, overfishing, pollution, low catch, and squatting.

Identifying the root cause of the problem

The fisherfolk in Lingayen Gulf sees poverty as the main problem why the coastal resources are nearing depletion. The specific concerns under poverty include: low family income, low educational attainment, lack of employment, high population growth rate, and the lack of awareness on coastal resources management (CRM).

Another main problem is

illegal fishing, the most common practice among the fishermen of Lingayen Gulf. This problem is caused by unregulated trading of illegal fishing materials and chemicals due to the ineffective enforcement of fishery laws and ordinances. The lack of alternative livelihood also pushes fishermen to fish illegally.

Fishkill was identified to be another cause of the exhaustion of the coastal resources. Massive fishkills occurred in all municipalities in 1994. Fishkill occurred due to the abuse of aquaculture technology that was adopted by a large number of fish farmers particularly in Binmaley, Dagupan City, and Lingayen and recently by the fisherfarmers of Bolinao and Bani. Other causes of fishkills are poor domestic waste disposal, coastal pollution, and soil erosion and siltation.

High dependence on fishing as the primary source of income seemed to be the biggest root cause of overfishing in Lingayen Gulf, which again, is rooted on the lack of an alternative livelihood.

Other equally important issues and concerns are pollution, low catch, and squatting.

Pollution was aggravated due to excess feeding and deposits of waste from mariculture of milkfish in pens and cages, and the improper disposal of chemicals from ponds, improper disposal of industrial and domestic wastes, and dynamite and cyanide fishing. Fisherfolk blame low catch to overfishing in the municipal waters and the influx of transient fishermen while the unavailability of housing facilities and lack of permanent residence forced some fishermen to squat near the coast. Squatting has become rampant also because of the underdeveloped tourist attraction and facilities.

Solutions and possible actions

The threat against the possible depletion of the coastal resources of Lingayen Gulf could be solved with the appropriate management plan of conservation but this, too, needs the cooperation of the fisherfolk themselves. The coastal

Lingayen Gulf



The bright potential of the sea cucumber

I never thought that the 'thing' I've stepped on in Matabungkay when I was a kid would be very important to humankind one day. I just know that this bottom-dweller, filter feeder is anything but beautiful.

Little did I know that the ugly sea cucumber I unwittingly killed has a cancer-fighting agent in its long body. Scientists from the University of the Philippines Los Baños (UPLB) found that lectin in the body walls and internal organs of brown, black, and white sea cucumbers (*Holothuria* sp.) has the potential to kill cancer cells. Aleli Elizabeth E. Gana and Florinia E. Merca purified and characterized the lectin found in the brown sea cucumber since it has the highest agglutination activity. Agglutination is the clumping together of cells due to the binding of agglutinin molecules (like lectin) on each cell's surface, clumping, mitosis-multiplication or division of a cell forming two daughter cells.

What is lectin?

According to Jun Hirabayashi of Teikyo University, lectins are, "proteins which specifically bind (or crosslink) carbohydrates." Lectins bind to sugar moieties (one of two equal parts) in cell walls or membranes and thereby change the physiology of the membrane to cause agglutination, mitosis, or other biochemical changes in the cell. As of today, lectins found in animals, according to Hirabayashi, are not potential toxins to humans as some

plant counterparts are.

Some lectins from plant sources have some therapeutic value to human immunodeficiency virus (HIV). Lectins activate proliferation and enhance the mitogenic (cell division) activity of lymphocytes (group of white blood cells that fight infections or diseases). Lectins are also used as prognostic indicators of the presence of tumors and may also be involved in the neutralization and exclusion of disease-causing agents (like virus or bacterium).

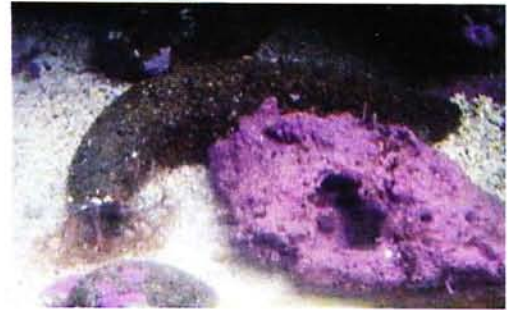
Such is the importance of lectins to the medical world that these glycoproteins already command high prices in the world market. Even if many lectins are already purified and sold commercially in the country, we still have to import it at US\$ 25-150 per milligram.

At that price, we have to source out lectin locally.

The beauty of sea cucumber

According to Gana and Merca, organisms from the sea are potential sources of lectins. "The reason for recommending sea cucumber for treatment of some diseases may be attributed to its lectin content," they said.

We won't have to worry about sea cucumber supply since the Philippines is now the second major producer and exporter of dried sea cucumber in the world. The study done by the State Polytechnic College of Palawan mentioned that harvesting and



Brown sea cucumber

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processing of sea cucumbers into trepang (edible sea cucumbers) has been a source of income for many Filipino families. "Holothurians are collected during low tide, mainly during the night. They are collected by hand while walking along the inter-tidal zone with a lamp. It is mainly the women who collect sea cucumbers from shallow areas, while the men skin dive or use an air-compressor connected to a breathing hose to reach deeper areas," the study described.

Promising cucumber lectins

Gana and Merca determined the potential of sea cucumber as lectin source. They isolated these glycoproteins and purified them. Later, they determined its chemical and biological properties.

Results showed that sea cucumber lectin has 0.15% total sugars, 11% glucose, 10% galactose, and 74% oligosaccharide mixture that contains sucrose and maltose.

Gana and Merca found that cucumber lectin is non-blood type-specific because it

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The bright...

agglutinated all the human blood types (A, B, AB, and O). It also agglutinated with cattle and goat erythrocytes (red blood cells). "It is classified as a complete lectin because it does not require prior treatment or the red blood cells with trypsin (an enzyme that breaks down proteins into smaller polypeptide units) to exhibit lectin activity," the research team said.

The lectin has mitogenic activity on lymphocytes. "Three-day incubation of the lymphocytes with the lectin resulted in the formation of lymphoblasts (immature lymphocytes)," Gana and Merca observed. The study also revealed that lectin can also kill mouse cancer cells (cytotoxic) and human lung cancer cells.

Given these beneficial things that cucumber lectin can do to the medical world, there's really more to the 'ugly' sea cucumber than meets the eye.

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- 1) Gana, Aleli Elizabeth E. and Merca, Florina E. Isolation and purification of a cytotoxic lectin from brown sea cucumber by affinity chromatography. *The Philippine Agricultural Scientist*. Vol. 85, No.3, 236-247; 2) Schoppe, Sabine Sea cucumber fishery in the Philippines. *State Polytechnic College of Palawan, Aquatic Science and Technology Institute, Santa Monica, Puerto Princesa City, Palawan, Philippines*; 3) Hirabayashi, Jun. Introduction to "Lectin". Teikyo University. www.glycoforum.gr.jp 4) Sullivan, Krispin. *Lectin Report*. www.krispin.com

PALAYAMANAN...

farmers are constantly reminded of activities and are updated on developments. Excellent farmers are featured in the radio program.

Farmers' lives improve not because of dole-outs. They are empowered when they are active participants in a scientific endeavor rather than spectators.

These Ilocano farmers from Pias, Currimao are able to defy the limiting conditions of their farmlands with sheer hard work, innovation, and Palayamanan.

Reference:

Idefonso, Lorraine A., Alquiza, Presentacion C., and Castro, Reynaldo C. *The Palayamanan Project: An Experience in Ilocos Norte*

The new...

combined application of three microorganisms instead of the calendar-based spraying of insecticides (page 19). They also found that the Asian corn borer, the most deadly corn pest/nemesis of corn growers can be killed by the parasitoid *Trichomma cnapalocrocis* (page 16).

Our natural resources are declining but we can make some amelioration to make them productive. For instance, we can still make an acidic soil productive with the addition of high amount of phosphorous in combination with *Bradyrhizobium*, a kind of fungi that form symbiotic relationship with the roots of plants. This is just the start, our scientists say, but it will help in the long run (page 10). Specific soil problems need specific solutions, thus, the importance of knowing the micronutrients and macronutrients of the different soil types (page). The farmers in Ilocos Norte have been growing Bontoc pepper without a package of technology. They apply high

rates of fertilizer that caused nitrogen deficiency through leaching and consequently, contaminate their groundwater source (page 11). What happens next when the groundwater is contaminated and this is the source of drinking water in the rural areas?

We have a wealth of marine resources. We are the 4th largest producer of seaweeds and the 8th largest producer of carageenan in the world. Carageenans have many uses in the food industries, beauty products as well as industrial uses. This should keep us thinking of the great potential of our seaweeds. But can we produce enough quality seaweeds and how? (page 5) A marine animal, the sea cucumber has a cancer-fighting agent in its body called lectin. Lectin activates proliferation and enhances the mitogenic (cell division) activity of the lymphocytes group of white blood cells that fight infections and diseases. Lectins are also used as prognostic indicators of the presence of tumors and may also be involved in the

neutralization and exclusion of disease-causing agents (page 7). Paradoxically, there are areas in the country like Lingayen Gulf that feels a kind of dead-end among the fisherfolk (page 6).

Looking for a nut that is not only delicious but also good for the heart? The proteins in pili (*Canarium ovatum*) are as important as those proteins from commercially important oilseeds (page 20).

To come full circle in R&D, the outputs that are for the farmers and fisherfolk should be given them in way that involves their participation. The Palayamanan project combines the on-farm-research approach with that of community participation for real learning for real farming (page 12).

We cannot afford to waste resources. We cannot disregard the ultimate users of our effort any more when we plan and develop our programs. As our GIS expert says, "GIS technology serves in establishing concrete and useful programs not on the basis of whims and friendships among decision makers (page 12).



Growing vegetables organically

By: Rita T. de la Cruz
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In Region 10, particularly in Claveria, Misamis Oriental and various municipalities of Bukidnon, growing vegetables the organic way promises to be a winning venture for the farmers. The soil is fertile and the climate is favorable for a whole year of production. With intensive vegetable production, Region 10 could now supply various markets in Luzon and Visayas especially during off-season months when vegetables command a high price.

Changing attitudes

Farmers in Region 10 are still largely influenced by the wrong concept of "high yield, high input technology." This may be true in some aspects since a farmer would usually spend more in buying costly fertilizers and pesticides, not to mention investing on high yielding seeds. This scenario is particularly difficult for the small farmers who are usually tied up with loans and later fail to pay, making their vegetable production suffer.

But the problem is basically attitudinal. Farmers refuse to adopt new technologies because embedded in their minds are wrong notions of production like additional cost and new adjustments. If this attitudinal problem is solved and farmers are able to see that it is possible to produce more with less, they would eventually adopt the technology.

The agriculturists in Claveria Experiment Station, headed by Mr. Carlos A. Osip conducted a technology demonstration on organically grown vegetables in contoured farms. Basically, the techno-demo aimed to showcase the effect of various organic fertilizer, soil conservation practices and various pest management practices on the production of vegetables and compare the package of technologies' economic advantage over those that were inorganically grown. The techno-demo also tried to prove that with organic farming the farmers could earn more, particularly among small farmers who are still bound by the wrong concept of "producing more with more."

Technology demonstrated

The technology demonstration was conducted in a contoured area with 10-15 % slope. Contouring the area is one way of conserving the soil and efficiently managing soil nutrients and avoid soil erosion. Planted in the demo site were high-value vegetable crops like tomato, sweet pepper, eggplant, carrots, lettuce, common cabbage, Chinese cabbage, snap beans, and sweet peas.

For the nutrient sources, the techno-demo used various organic fertilizers mostly from farm waste such as sheep and

chicken manure that were applied at five tons per hectare and 10 bags per hectare of commercial organic fertilizer.

Integrated approach to pest management was also observed during the techno-demo following a two-month fallow period, crop rotation, thorough land preparation, and application of botanical insecticides and fungicides.

Profit is ensured with organic farming

Results of the field trial showed that in terms of yield, crops that were applied with animal manure performed better compared to those crops that were grown with commercial organic fertilizer and recommended rate of inorganic fertilizer alone. This is because, according to the researchers, the slow release of nutrients from the animal manure minimizes the nutrient losses in the soil resulting to the efficient nutrient uptake of crops resulting in higher yield. Animal manure also serves as a valuable conditioner of the soil, retaining humidity and improving structure and internal drainage.

In terms of marketability, farmers found it easier to sell their crops. Considering people's preference for healthy food

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Solving soil acidity

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Soil acidity is a big problem for farmers and agriculturists.

Corn, mungbean, soybean, and peanut were reported to have low yield when planted in acidic soils. This kind of condition limits plant growth and development.

It's a known fact that leguminous crops like mungbean host nitrogen-fixing bacteria at their roots that's why many farmers and scientists recommend planting legumes together with major crops like corn to provide them with nitrogen or green manure. However, acidic soils are also not ideal environments for rhizobia, a kind of nitrogen-fixing bacteria. Studies have shown that high concentrations of aluminum, manganese, or iron in acidic soils are detrimental to rhizobia. If these nitrogen fixers couldn't live in acidic soils, the soil would be without the much-needed nutrients in an already hostile environment.

Nitrogen is an essential nutrient for life because it is an important component of proteins, nucleic acids, and other cellular constituents of living and some non-living (viruses, prions, etc.) organisms on earth. Although 78% of the atmosphere is composed of nitrogen (N_2), organisms cannot use this in its gaseous form. Plants can only use nitrogen in the form of nitrate or ammonium ions and animals can only use it in organic forms, which they get by consuming plants or other animals. One way of converting nitrogen

into usable forms is by the use of a microbial process called 'nitrogen fixation'.

Solution to acidic problems

Evelyn Delfin, Erlinda Paterno, Apolonio Ocampo, and Felecito Rodriguez, researchers from the University of the Philippines Los Baños (UPLB), did a study to solve this problem. They investigated the performance of two lines of acid tolerant mungbean in Antipolo clay, which is an extremely acidic soil. The researchers wanted to increase productivity of acidic soils through the use of acid-tolerant legume and the addition of mycorrhiza (vesicular arbuscular mycorrhiza or VAM) and acid-tolerant rhizobia with less fertilizer input. Mycorrhiza is a kind of fungi that forms symbiotic relationships with roots of plants.

Why add fungi? The presence of mycorrhiza in the soil was reported to have beneficial effects on the growth and nodulation of rhizobia. However, mycorrhiza survives in conditions where there is phosphorous. To complicate matters, phosphorous is not available when the soil is acidic. Application of high amount of phosphorous fertilizer is recommended to provide the soil with adequate phosphorous to enable the mycorrhiza to live.

Results of the study showed that, "acidic soils like the

Antipolo clay can be made productive with the addition of high amount of phosphorous in combination with Bradyrhizobium strain BVR9 or inorganic nitrogen," the researchers concluded. This strain of Bradyrhizobium is a slow-growing rhizobium bacterium that is acid-tolerant. However, it is more economical to add the rhizobium bacteria than inorganic nitrogen.

Complications

Things are a little more complicated than we think. This is not just about adding the soil with the acid-tolerant rhizobia. Application of high amount of phosphorous fertilizer may not be cost-effective since mungbean is not a high value crop. If there is low or no phosphorous, the mycorrhiza that helps the growth of rhizobia do not live. Without the rhizobia, there is no available usable nitrogen for the crops, unless expensive inorganic nitrogen from fertilizers is applied.

"Alternative strategies should be evaluated to improve crop productivity," the researchers recommended. "Research efforts," they suggested, "should focus on the selection of acid-tolerant mungbean genotypes that are also tolerant to low phosphorous."

Solving the problem of acidic soils is a tough job but with studies like this, slowly but surely





Bringing out the best in Bontoc pepper

By: Ma. Lizbeth Baroña
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Bontoc pepper, a vegetable scientifically known as *Capsicum annum*, adapts and grows well in Ilocos Norte and has high profit potential. However, farmers have been growing this crop on their own without following any existing package of technology and management. The application of high rates of fertilizer and weekly flooding - following the traditional farmer's practices - cause nitrogen deficiency through leaching, which in turn, would contaminate the groundwater source. The crop's ability to reach its optimum yield potential is also in question.

Researchers headed by Dionisio S. Bucac at the Mariano Marcos State University(MMSU)

evaluated the response of Bontoc pepper, grown after lowland rice, to water and nitrogen management.

Capsicum annum

Pepper (*Capsicum*) belongs to the "night shade family", the Solanaceae. It is extensively cultivated throughout tropical Asia and equatorial America for its edible, pungent fruits. *Capsicum* comprises all the varied forms of fleshy-fruited peppers grown as herbaceous annuals - the red, green, and yellow pepper, which are rich in vitamins A and C. They can be used as seasoning and as vegetable. *Capsicum* includes paprika, chili pepper, red pepper (cayenne), and bell pepper. Bell pepper, to which Bontoc pepper is identified with - is considered and eaten as a vegetable. The pungency of pepper, along with its color makes it a valuable culinary commodity

Testing

A rainfed area in Batac, Ilocos Norte, which was previously grown to rice during the preceding wet season, was the site of the experiment. The soil is a Vertisol, classified under the San Fernando series. It has a clayey texture, and is gray to black in the surface, and dark gray to black underneath. The soil's nitrogen content is low, has adequate exchangeable potassium, and has medium

amount of phosphorus and organic matter.

The experiments tested different irrigation depths at 20,30,40, and 50 mm, and done after 7,11, and 15 days at nitrogen levels of 0,70,140, and 210 kg of nitrogen(N) per ha⁻¹. The treatments were replicated three times. All plots with seedlings transplanted at 40cm x 60cm were irrigated uniformly after transplanting. Irrigation started at 35 days after transplanting(DAT). Effects of the treatment were evaluated using these parameters: weekly soil moisture status, consumptive use, efficiency of using water and nitrogen, growth and yield, and net income.

Results

The researchers observed that depth and frequency of irrigation and nitrogen level affected plant vigor. The plants irrigated at depths of 30,40, and 50mm were more vigorous than those irrigated at 20mm. Increasing the nitrogen level in the soil also elicited positive response from the plant. But the effect of the N level is affected by its combination with frequency of irrigation.

However, the plants responded to the changes in N level. Plants fertilized with 210 kg and 140 kg of N grew 63.59 cm and 61.28 cm, respectively while untreated plants were only 46.85 cm. The last harvest showed

How do...

we will be able to combat the problem of unproductive harsh environments like acidic soils.

Reference:

Delfin, Evelyn F., Paterno, Erlinda S., Ocampo, Apolonio M., and Rodriguez, Felicito C. "Growth, yield and nutrient uptake of mungbean (*Vigna radiata* L.) grown in Antipolo clay amended with lime, nitrogen, and phosphorous fertilizers and microbial inoculants". *The Philippine Agricultural Scientist*. Vol. 86, No.1 75-83. March 2003.

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Bringing...

significant effects from irrigation treatments and N level. Plants treated with 210 kg of N were the tallest compared to those applied with 140, and 70 kg of N in decreasing order. The plants irrigated with 40mm and 50mm were significantly taller than those irrigated at 30mm and 20mm depths.

Results showed that optimum growth happened when the crops were fertilized with 210 kg N/ha, and irrigated at 40mm depth.

Yield also increased with an increasing level of N applied, regardless of the depth and frequency of irrigation. Yield is also affected by inadequate soil moisture: it is reduced by too much, or too little moisture. Inadequate moisture causes stress

and tension in the plant resulting to low yield.

Adding more N fertilizer does not always result to a higher yield. This is because high soil moisture and frequent irrigation cause N leaching.

The recommendations generated in the study is a "shot in the arm" for the pepper industry for they will supplement the indigenous practices of Ilocano farmers in bringing out the best in Bontoc pepper.

Sources:

"Response of Bontoc pepper (*Capsicum annum* L.) grown after rice to depth and frequency of irrigation and N level", Dionisio S. Buciao, Epifania O. Agustin, Artemio B. Alcoy, Charito G. Acosta, Mariano Marcos State University
www.harvestfields.netfirms.com

Station-DA RFU 10, Lanise, Claveria, Misamis Oriental. "Technology

also used as a binder, moisture holder, and gelling agent for meat products such as hams and sausages.

In other industries, it is used for film coating, culture media (agar substitute), water-based paints, personal care products like shampoos, creams and lotions and toothpastes as well as pharmaceutical products.

Into the future

While the Philippines is one of the leading suppliers (80%) of *Eucheuma* in the world, the stakeholders are not resting on their laurels. In fact, they are already looking for other markets in the Americas (such as North, South and Canada) and exerting more efforts in improving the product through research and development.

Scientists from BFAR and SEAFDEC-AQD have focused on the primary concerns of the industry such as strain improvement of commercially important seaweeds, high yielding and disease resistant seedstocks, and high agar and carrageenan quality seaweeds. They are also exerting more efforts in improving and introducing relevant technologies, establishing seaweed hatcheries and seaweed farms, health and disease management, manpower development and management, post-harvest processes, post harvest facilities, and research funding.

Source:

Virginia Valde and Gilda Abao of the DA-Bureau of Fisheries and Aquatic Resources Region 10. "Hanging method of drying the seaweed (*Kappaphycus alvarezii*) at Dimalooc Cove, Panguil Bay Area". 2003

Growing...

nowadays, organic vegetables command a higher price both in the local and international markets. Farmers also save on inputs since farm wastes like animal manure are readily available and a lot cheaper than inorganic fertilizers.

Researchers also recommended soil conservation farming systems to minimize soil losses due to erosion in upland areas. For acidic soils and areas receiving high rainfall, it is important that farmers apply farm waste since it could increase the yield of crops without spending extra money on fertilizers.

Source:

Carlos A. Osip, Carlota S. Madriaga, Cherie A. Simene, and Ruben L. Pimentel of Claveria Experiment

The potentials...

tough or tender with high or low melting point. The gelation requires no refrigeration and the gels can be made stable through repeated freeze-thaw cycles. Its variety of uses includes fat and foam stabilization, emulsion stabilization, and gelation,

Carrageenan is used in food industries as an emulsifier/thickener, clarifying and gelling agent, and stabilizer. For instance, it is added as an enhancer for dairy products and desserts like whipped creams and toppings, cream cheese and cottage cheese, and yogurt. It is

Mango pulp weevil: A 'he' or a 'she'?

By: Likha C. Cuevas
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It's such a disappointment when you open a luscious and perfect-looking mango and find a wormy thing burrowed inside. It ruins your appetite.

That 'wormy thing' inside the mango fruit is the mango pulp weevil or *Sternochetus frigidus* (Fabr.) to the scientific world. This pest is found only in Palawan here in the country but it also poses problems in India, Bangladesh, Burma, Thailand, Malaysia, Singapore, and Indonesia.

Aside from making the prospective consumer lose his appetite, the mango pulp weevil (MPW) destroys the fruit, rendering it inedible. The immature weevil eats the fruit's pulp where it also develops and grows into an adult.

However, according to Louella Rowena A. de Jesus (Department of Agriculture Regional Field Unit 4), Jose R. Medina (University of the Philippine Los Baños or UPLB), and Satoshi Nojima and Kanju Ohsawa (Tokyo University), the chemical basis for the weevil's preference for mango over other crops remains a mystery. Before these scientists venture into this issue and on the weevil's behavior, they have to know the sex of the weevils and look for the best method in telling them apart.

So, first thing's first.

The mango pulp weevil threat

What's the big deal with these weevils? Before that can be

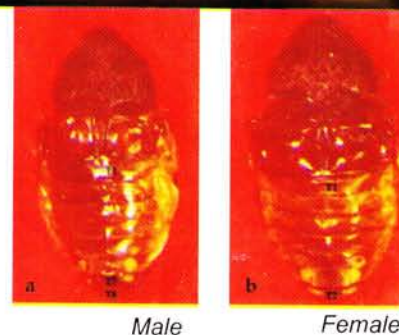
answered, we first have to look at the context of how important mango is to the country.

The Philippines is the 6th largest producer of mangoes and has 9% share in the world market valued at \$34 million in 2000. According to reports, the Philippines is expecting to capture about \$70-million for the export of fresh mangoes in the US market which is currently dominated by Mexico.

Dr. Hernani Golez, National Mango Research Development, and Extension (RDE) Network team leader, took 14 years to persuade the U.S. to certify that mangoes from Guimaras in Visayas is free from mango-pulp weevil and to permit mangoes from Guimaras to enter the U.S.

"But Mr. Golez's efforts to meet U.S. standards have been drawn out," Margot Cohen of the Truth About Trade and Technology wrote. "The first big hurdle came in 1987, when a survey of 33 mango-producing provinces discovered evidence of mango-pulp weevils in Palawan. Mr. Golez agreed to U.S. demands for quarantine while seeking alternate sources of mangoes. Guimaras, surrounded by water, was a natural place to start. It took until 1993 for the U.S. to declare Guimaras mangoes weevil-free after a series of fruit samples turned up negative."

The threat of this pest is so alarming that the Bureau of



Plant Industry has a program specifically for the weevil, "Delimiting and Monitoring Survey of Mango Pulp Weevil". This program launched specifically for Palawan aims to confine the mango pulp weevil in its present location to ensure protection of MPW-free areas in Palawan. The Department of Agriculture Regional Field Unit 4 (DA-RFU4), the Palawan Local Government (through the Office of the City Agriculturist), and the BPI- Plant Quarantine Section are also conducting various researches on the weevil in support of the control program to strengthen domestic quarantine for MPW.

Sex discrimination

It's now imperative to solve this mystery why these pests love mangoes --- and knowing the sex

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The Asian corn borer's deadly enemy

Measuring only 1/50 of an inch, parasitoids are the Asian corn borer's worst enemy and the corn farmers' dearest ally in their war against Asia's most important corn pest. Parasitoids kill by laying their eggs inside the pupa of the Asian corn borer. The hatched newborns feed off the body, eventually killing the host or the borer.

A study by Drs. Gloria Camarao and Belen Morallo-Rejesus of UP Mindanao and UP Los Baños, respectively, evaluated three parasitoids- *Xanthopimpla themmator*, *Brachymeria obscurata* and *Trichomma cnapalocrocis*. The scientists reported that *T. cnapalocrocis* showed the highest potential in controlling the corn borers since it was the most abundant and most capable of parasitizing the borers in the field.

A deadly agent

T. cnapalocrocis parasitizes the pupa of the borers for at least 40 days starting as early as the silk stage until the corn plant is already mature. Parasitized pupa can be distinguished from the unparasitized pupa as smaller, rigid and darker in color. The parasitoids emerge from the parasitized corn borer pupa 1 to 5 days after the pupal period (5 to 8 days) of the corn borers.

Courtship starts immediately after emergence. The male would scratch the female's ovipositor and crawl on the dorsal part of the abdomen touching the

body of the female. Afterwards, the male would pin down the female by gripping the female's abdomen with its legs. The female

becomes still while the male continues to scratch the female's body after which the male attaches its claspers into the serrated rear of the female's ovipositor. When this is done, the mating pair turns away from each other while still attached at their rear ends. This position enables the pair to fly even during copulation. The scientists reported that *T. cnapalocrocis* usually mate from 8 am to 5 pm for 3-4 hours.

The *T. cnapalocrocis* female lay its eggs on corn borer larvae that are found outside the corn stalks. Adult parasitoids emerge from the pupa and the third, fourth, and fifth instar larvae. The scientists reported that percent parasitization could range from 60 to 86%. This means that before corn borer larvae (3rd or 4th instar) move into the corn stalks, they already harbor the parasitoids. It was also found that the female parasitoid prefers to lay its eggs on older than younger larvae since adult parasitoids only emerge from the older larvae.



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Its potential

Among the three larval-pupal parasitoids, *T. cnapalocrocis* showed the most promise as an effective biological control agent against the Asian corn borer. It has the potential; for commercialization and mass rearing. The scientists are optimistic that if this potential is tapped, *T. cnapalocrocis* can be used to control Asian corn borer at the whorl stage of the corn plant.

Source:

Gloria Camarao of the University of the Philippines Mindanao and Belen Morallo-Rejesus of the Department of Entomology, College of Agriculture, University of the Philippines Los Baños. "Parasitoids of the Asian corn borer, *Ostrinia furnacalis* (Guenee) and their biological attributes".

Sex pheromone minimizes pesticide use

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Spodoptera exigua

Too much pesticide or using it for the wrong reason could kill even the helpful insects and ruin the ground for future growth, not to mention the health risks and the damage to the environment. Even more difficult is that some pesticides do not break down easily and can remain in the environment for years. Moreover, continuous use could eventually induce resistance in the pests they are designed to control, thus requiring farmers to switch to more toxic substances.

A new and important technology that could lessen the use of pesticides and even overcome many of the limitations of other pest monitoring methods, particularly in the area of sensitivity, is the sex pheromone trap. This is a result of a two-year study of the group of Dr. G.S. Arida of the Integrated Pest Management Collaborative Research Support Program (IPM-CRSP) of the Philippine Rice Research Institute (PhilRice). His team determined the efficacy of timing insecticide applications based on the amount of defoliators (*S. litura* and *S. exigua*) that the sex pheromone trap catches.

What are sex pheromone traps?

Pheromone traps use synthetic chemicals that resemble insect sex attractants that lure and then trap insect pests. They can be used in two ways: as control

method or as monitoring method. They could be an effective control method if they are able to attract sufficient numbers of the insect pests. They are also used to monitor the presence and level of pest infestations in order to improve the timing of pesticide applications.

On the part of the farmers, sex pheromone traps could help them avoid risks through better decision-making for improved timing and work planning. Consequently, they would refrain from unnecessary applications of pesticides, thus, reducing their expenses and the destruction of the environment.

Sex pheromone traps unlike pesticides are environment-friendly. They reduce environmental contamination caused by too much pesticide use.

Sex pheromone traps in action

The study of sex pheromones as bait traps for insects started in the Philippines in 1975 with the identification of the sex pheromones of the striped and pink rice stem borers. After using it as an attractant, the researchers found that attracting the borer takes its peak before the egg-laying period. Sex pheromones found in female insects are consciously being emitted to lure male insects for mating. And since male insects

have receptors in their antennae, they could easily detect the sex pheromones and fall for the bait.

Today, sex pheromones are not only used for mating purposes but an effective device to detect and monitor specific pests and to specifically indicate whether there is a need for chemical control for a particular crop. With the availability of synthetic pheromones now, setting up the traps becomes much easier.

The study of Dr. Arida used sex pheromone traps to control well-known onion defoliators: armyworms (*S. litura*) and cutworms (*S. exigua*). The researchers conducted the field studies in Bongabon, Nueva Ecija to evaluate the effectiveness of the sex pheromone baited traps as indicator for timing the insecticide applications against onion defoliators. The results showed that the peak in adult trap catches was recorded 27 days after transplanting.

Plots under field trials were sprayed with insecticides at 3, 5 and 7 days after the peak catches of defoliators. Crop yield analysis showed that the yields in these plots were similar to the crop yield of plots that have been sprayed weekly.

With sex pheromone traps, the weekly application of

Conserving...

ecosystems of Lingayen Gulf represent a huge and natural economic resource not only for the province of Pangasinan by providing food and livelihood for the people living along the area but it has wider implication to the whole economy of the country. And so when the fisherfolk were asked what solutions are needed to solve the threat against the possible depletion of fishery resources they immediately recommended for the provisions of appropriate alternative livelihood and creation of employment opportunities through eco-tourism development. If farmers have other means to live, they would not have to fully rely on fishing as source of food and livelihood, thus illegal fishing, fishkills and squatting are minimized (if not stopped).

The fishermen also stressed the importance of a strict implementation of fishery laws and ordinances to control, if not to stop illegal fishing, altogether. Policymakers must have the political will and intensified advocacy, information, education and communication campaign to effectively conserve and better protect the coastal resources.

Likewise, it is also important to have coastal zoning and dismantling of illegal fishpens and cages in the rivers and coastal waters to avoid the occurrence of fishkills. Pollution is best resolved with proper discipline among the people living in the area themselves through continuous cleaning of the coastal areas and regulation of mariculture operations in rivers and ponds within the Gulf.

According to the result of the study, local and national government interventions are also important in this endeavor to conserve the coastal resources of

Lingayen Gulf. Institutional development initiatives and actions had been taken by national government agencies to immediately address major issues and problems. Unfortunately, despite these institutional efforts and initiatives, the dwindling state of the fishery resources remains. On the part of the people living along the coastal areas, there is also a need for the fishermen to be aware of the real root of the problems and their role and participation in solving these problems. Hopefully, with an increased level of awareness and an effective management plan to conserve the area, the threat of coastal resources depletion becomes a no "dead end" for the fishermen in Lingayen Gulf.

Source:

Dr. Sotero M. Aban of the College of Fisheries, Binmaley Campus, Pangasinan State University, Pangasinan, Philippines. "Status of the Fisheries Resources Management in Sectors I and II of Lingayen Gulf"

Is it a he...

may lead us to the answer.

As of now, the only method of telling whether the weevil is a male or a female is by dissecting dead weevils since the sex can't be determined through ocular inspection. "No morphological differences are known," the team said. Usually for coleopterans (or insects like the mango pulp weevil), you can tell the difference between the male and female through their antennae, upper body, and the sternum. But the MPW's case is different. Color can't even be a reliable indicator (like that in other animals) since it changes as the weevils age.

But now, these scientists

have found an accurate way of telling a live weevil if it's a he or a she.

The mango pulp weevil has *tergites*, which are the top or back part of the segments in the weevil's body. When you clip the elytra (pair of anterior wings) of the weevil, you will see that the end part (or the terminal tergite) of the male is truncated while the female's end is tapered. Another identification mark is the number of male tergite. The male has seven but the terminal tergite is divided in to two so it has an 8th tergite whereas the female has the usual seven.

The scientists have said that this is the first time that this method of differentiating a live male and female mango pulp weevil was documented. This study may provide the springboard for other mango pulp weevil researches.

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The battle against chrysanthemum white rust



With its high demand in the global market, chrysanthemum (*Dendranthema grandiflora*) is considered a high value cash crop in the Philippines. From 1985 to 1993, chrysanthemum growers enjoyed a tremendous increase in production resulting to a stable growth of cutflower exports. Japan was the Philippines' largest importer of chrysanthemums accounting for the 97% of its total export of cutflowers.

Although there was a great increase in export for quite sometime, chrysanthemums are unable to penetrate the global market due to the inability of local growers to meet the quality and quantity standards. One well-known nemesis of chrysanthemum growers is white rust, a major disease in chrysanthemum that could seriously affect its overall production.

War against white rust

Chrysanthemum white rust was first discovered in the Philippines in 1961, seven decades after it was first reported in China and Japan in 1895. White rust is caused by *Puccinia horiana* Henn, a filamentous fungus that grows and reproduces on host plants. The disease first appears as yellow spots on the upper surface of the leaves, which would later become sunken and necrotic. Prominent pustules develop subsequently on

the lower surface of the leaves. They appear beige colored at first and then the pustules mature to a waxy white. The disease affects mainly the leaves but it could also spread to stems, bracts, or even the flowers. Severely infected leaves dry up and hang along the stem. When the white rust attacks during the early stage, the damage could result up to 80% yield loss.

Helpful microorganisms fight back

A major concern of chrysanthemum growers is how to effectively manage white rust with cheap and environment-friendly technology.

A research team from the Department of Plant Pathology of the Benguet State University (BSU) composed of Dr Luciana M. Villanueva (project leader), Ms Teresita Masangcay and Ms Nordalyn Pedroche developed an efficient biocontrol technology for commercial chrysanthemum production using helpful microorganisms: a fungal hyperparasite and two bacterial antagonists. They compared their efficacy with the farmer's existing practice in managing the white rust, a calendar-based spraying of fungicides.

The researchers used a fungal hyperparasite (*Verticillium* sp.) and two bacteria antagonists (*Pseudomonas* sp. and *Flavobacterium* sp.) As biocontrol agents. They also identified some



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indigenous materials that carry these microbial antagonists, namely: arrowroot, canna, cassava, *galiang*, potato, sweet potato, taro, yam, and bentonite. According to the result of their study, *Verticillium* sp. was higher in potato, followed by bentonite and canna while *Pseudomonas* sp. and *Flavobacterium* sp grew better in arrowroot and canna, respectively.

To test the efficacy of the newly developed biocontrol technology, the study was conducted under greenhouse condition vis-à-vis the existing farmer's practice and the untreated plants.

The researchers found that the combined application of the three microorganisms resulted to a significantly lower disease incidence compared to the calendar-based fungicide spraying, which is the existing management

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Pili: An extraordinary nut

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Pili (*Canarium ovatum*), or the Philippine nut has been called an extraordinary nut. It is food to millions of people from around the world, is delicious and good for the heart and scientists from the University of Guelph, Canada and our Department of Science and Technology (DOST) recently reported that proteins in pili are as important as the proteins found in commercially important oilseeds.

The pili nut

Of the family Burseraceae, pili is native to the Philippines and can be found in some parts of the Visayas and Mindanao and in Southern Luzon especially in Sorsogon, Albay, Camarines Sur, in the Bicol region where it is an important crop and source of

income of many families. Its local names are: *pili*, *anangi*, *basiad*, *liputi*, *pilau*, and *pili-pilau*.

Pili is a shady tree with resinous wood that grows up to 20 meters. It has compound alternate leaves with odd-pinnate leaflets and it bears flower clusters at the tip of its shoots. Pinnate leaves look like a feather with a central axis or stem that has parts branching off it.

Pollination is by insects. Pili bears flowers often which turn to fruits over time. The ovary or the female part of the flower contains three locules or chambers each with two ovules (immature eggs), but most of the time only one ovule develops.

The fruit that develops is a drupe or a stone fruit. A drupe or stone fruit has a thin outer skin, a pulpy middle and a hard

stony central part that contains the seed. The fruit is usually 4 to 7 cm long, 2.3 to 3.8 cm in diameter, and weighs 15.7 to 45.7 g.

The skin (exocarp) is smooth, thin, shiny, and turns purplish black as the fruit ripens; the pulp (mesocarp) is fibrous, fleshy, and greenish yellow, and the hard shell (endocarp) within protects a normally dicotyledonous embryo. The basal end of the shell (endocarp) is pointed and the apical end is more or less blunt; between the seed and the hard shell (endocarp) is a thin, brownish, fibrous seed coat developed from the inner layer of the endocarp. This thin coat usually adheres tightly to the shell and/or the seed. Much of the kernel weight is made up of the cotyledons, which are about 4.1 to 16.6% of the whole fruit; it is composed of approximately 8% carbohydrate, 11.5 to 13.9% protein, and 70% fat. Kernels from some trees may be bitter fibrous or have a turpentine odor.

Its many uses

Pili is a versatile nut being used for a variety of products. The nut kernel is the most important product. It can be eaten raw or roasted where its mild, nutty taste and tender-crispy texture can compare with and even found better than an almond. Pili kernel is also used in chocolate, icecream, and baked goods.

Pili is known for its high oil content which is light-yellow and

The battle...

practice of chrysanthemum growers against white rust.

Moreover, chrysanthemums sprayed with the microbial antagonists gave significantly lower disease severity rating than the unsprayed plants although, the scientists admit that the result was still at par with the farmers' practice.

On the financial benefit, the researchers found that the use of microorganisms gave a slightly higher return of investment, at 56.41%, over the farmers' practice with 53.32%. Moreover, the reduction of fungicide expenses

enables farmers to save up to P59,000 per hectare.

The study entitled: "Indigenous Microorganisms for Cost-Effective Management of Chrysanthemum White Rust" is a high impact project funded by the Bureau of Agricultural Research, Department of Agriculture.

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All about apiculture

1) Know more about honeybees

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Apis cerana

While almost anybody may confess to a weakness for golden honey, it is rare to find someone who would voluntarily want to meet these intrepid little workers because of their notorious "sting".

However, not only do these little insects turn many a simple breakfast of pancakes or pandesal into a delicious feast, they are also nature's helpers in pollination. Honeybees pollinate or transfer pollen from the male structure of a plant (such as the anther) to the female structure of a plant (such as the stigma), and fertilize it resulting to a higher yield. In fact, studies have shown that honeybees can increase a yield by as much as 40 %.

In the Philippines, honey is mostly consumed as health food, as base for cough syrups and energy drinks, or as ingredient for cosmetic products. Pollen and royal jelly are components of energy pills and capsules.

Getting to know the honeybees

Called *laywan* in Tagalog or *ligwan* in Cebuano, the Eastern or Oriental honeybee (*Apis cerana*) are aggressive, mobile, and prolific insects. They can produce 1-10 kg of honey per colony consisting of 10,000 worker bees. They have

smaller bodies compared to other honeybees.

While they are native to the Philippines, they are also found in tropical, sub-tropical and temperate areas in Asia such as India, Sri Lanka, Indonesia, China, USSR, Korea, and Japan.

Because of its wide distribution, the Eastern honeybee has evolved certain characteristics specific to its geographic location. Scientists reported wide differences in workers' body size, nest size, colony population, swarming, and absconding behavior.

Honeybees from temperate and sub-tropical areas store greater quantities of food compared to those found in tropical countries. Also, tropical honeybees are more mobile, tending to swarm, abscond and migrate quite frequently.

In a related study, scientists from the Institute of Biological Sciences of the University of the Philippines Los Baños (UPLB) and J.W. Goethe University of Germany found that there is a lot of variation among the *A. cerana* species in the Philippines. Using morphometric methods, they reported that bees from Luzon differed from bees in the Visayas and Mindanao and that even within Luzon, bees from the highlands are distinct from

bees found in the lowlands.

Building honeycombs

Like other honeybees in the wild, Eastern honeybees build their nests in dark enclosures such as caves, rock cavities and hollow tree trunks. Eastern honeybees' nests are multiple combs that are built parallel to each other with a uniform "bee distance" separating one comb from the next.

Its brood comb consists of cells of two sizes: smaller for the worker brood and larger for the drone brood. The queen cells are built on the lower edge of the comb. As in the other *Apis* species, honey is stored in the upper part of the combs and also in the outer combs, adjacent to the hive walls.

Modern beekeeping methods

Today, even with the introduction of modern bee keeping methods such as movable-frame hives, many beekeepers in the countryside still use traditional hives to culture honeybees.

Apis cerana is hived in boxes with frames. It has bee space that measures about 0.5 cm. The frames in the hives for both species are arranged horizontally, duplicating the combs of wild species.

In honeybee culture, it is important that the colony be

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2) Where honeybees grow best

disturbed as little as possible since this could adversely affect the production of honey, pollen, royal jelly, and wax.

One good thing about Eastern honeybees is that they are not seriously affected by varroa mites. Thus, there is very little or no need to apply or use antibiotics, miticides, and nematocides, which can contaminate bee products.

There's money in honey

Since commercial beekeeping was introduced in the 1960s, demand for honey locally and internationally has increased attracting more entrepreneurs and farmers to raise native or imported bees.

The huge demand and insufficient supply has pushed up the price of honey products. Scientists reported that honey sells for as much as P350 per kilo; beeswax at P500; royal jelly, P150 per 10 grams; pollen at P2,000 per kilo; *Apis mellifera* nucleus hive at P4,000; and *Apis cerana* hive up to P2,500. Furthermore, studies have reported that we have spent billions on imported honey from 1989 to the present.

In a related study, a coconut farmer who incorporates bee culture in his coconut farm can harvest 2,600 - 4,000 kg of honey per hectare. At a wholesale price of Php 100/kg, he can gross from Php 266,700 - 400,000 per hectare per year. Indeed, working with these notorious insects is definitely worth more than a 'sting'.

Sources:

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2) Antonio Baconawa. "A guide to beekeeping in the Philippines". http://www.beekeeping.com/articles/u/s/beekeeping_philippines.htm

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If an inflamed bee sting is one reason for a kid to abstain from

throwing stones at beehives lodged in their rooftops, environmental causes and the sheer love for honey should also be reasons for grown-ups to teach their kids to leave the bees alone. Human interference has gotten in the way of bees in performing their role as pollinators and producers of honey.

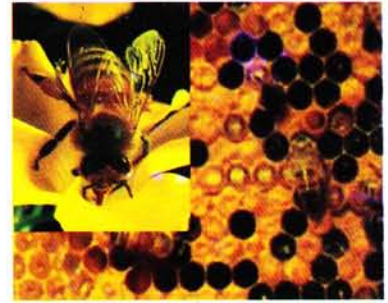
Dr. Cleofas Cervancia and Analinda Fajardo of the University of the Philippines of Los Baños (UPLB) studied the effect of rapid environmental changes that the province is undergoing with regard to animal species in area, one of which is the honeybee, scientifically known as *Apis mellifera*. Proponents of the study hypothesized that increasing human interference have detrimental effects on bees and their products.

Urbanization creeps in

Laguna was once an ideal environment especially with its forest reserve in Mt. Makiling. But now, the rice fields and sugar lands have given way to industrial complexes, giant factories, and residential subdivisions. Although great pains are made to preserve its uniqueness as an environmental haven, concerns on the effects of urbanization to the exotic biodiversity of the province have been raised.

Threat to pollinators

Bees are the dominant pollinators in tropical



environments. The study cited that plant pollinators are sensitive to changes in both the size and spatial arrangements of plant populations, therefore, affecting their number and activity in an area.

Parasites and predators, which are integral to natural ecosystems, are factors in the regulation of species. Since *A. mellifera* is not endemic to the Philippines, it is susceptible to pests compared to native species and is more likely to be affected by abiotic pressures.

Farm practices like indiscriminate pesticide application have also caused contamination of nectar resources, and consequently, bee poisoning.

Industrial and urban areas can serve as habitat for these pollinators as long as there are plants in the vicinity. But industrial emissions, and smog have contaminated their pollen and food resources. Population of bees is indicative of the density and kind of vegetation present in a habitat, and since natural vegetation is becoming scarce, bees have to depend largely on cultivated crops for pollen and nectar resources, the study says.

Where can they live best?

The study tested three kinds of habitat to determine the effects of three ecosystems on

➔ Next page

Where...

population growth of *A. mellifera*, and the quality of their bee products.

The first ecosystem was the Makiling Forest Reserve in UPLB, representing the forest environment. Dipterocarps are the dominant species in the area with patches of grassland.

The Canlubang Industrial Estate in Calamba City, representing an industrial environment, is a former agro-ecosystem where sugarcane was previously planted. Now an industrial zone, the site produces metals, semiconductor products, electronics and other export products. The site still has open fields dominated with grasslands, and shrubs.

The third habitat, a farm in Bay, Laguna, representing an agro-ecosystem, was planted with rice, and vegetables like eggplant, pechay, bitter gourd, corn and ornamental plants.

Colonies of bees were distributed in the three ecosystems. In each ecosystem, there were two treatments managed, and unmanaged. Managed treatments involved feeding, brood manipulation, and insertion of wax foundation if necessary. In the unmanaged treatment, only the wax insertion was incorporated.

Results showed that the highest population growth, both for the managed and unmanaged treatments was observed in the farm in Bay or in the agro-ecosystem, followed by that in the Canlubang Industrial Estate, and that bees in the Makiling Forest Reserve as the lowest.

What helped the bees to reproduce more in the agro ecosystem was the abundance of melliferous plants and pollen and nectar sources. Although these sources are also available in the

industrial environment, the lesser density in population was attributed to limited foraging area of the bees, as well as different human activities like lawn mowing, which further depleted the habitat of the bees. The forest environment was full of predators leading to aggression and pressures.

Furthermore, population density was highest in the managed colonies, compared to the unmanaged ones. This implies that rearing *A. mellifera* in a tropical setting requires high management skills for raising bees to become a worthwhile endeavor.

The scientists also observed a correlation in the amount of honey produced and population growth, which implies a logically sound relation, that higher population density means more honey.

Even though *A. mellifera* has not adopted well in a forest ecosystem with exotic species, their performance in the study showed what needs to be done for them to thrive and produce more honey.

Source:

Analinda C. Maniia-Fajardo, and Cleofas R. Cervancia of the University of the Philippines Los Baños, 2003. "Performance of honeybees (*Apis mellifera* L.) in three ecosystems in Laguna, Philippines".

Pili...

contains 59.6% oleic glycerides and 38.2% palmitic glycerides which are similar to olive oil. The young shoots and the fruit pulp are edible. The shoots are used in salads, and the pulp is eaten after it is boiled and seasoned. Boiled pili pulp resembles the sweet potato in texture, it is oily

(about 12%) and is considered to have food value similar to that of avocado. Pulp oil can be extracted and used for cooking or as a substitute for cottonseed oil in the manufacture of soap and edible products. The stony shells are excellent fuel or growth medium for orchids and ornamental plants.

Testing for protein

To extract the storage proteins from pili, the scientists used the modified Osborne protein fractionation scheme. They only focused on the storage proteins since they are the most abundant proteins in nuts. Results showed that 60.3% of pili's storage proteins are globulins while albumins consist of a very small fraction (2.9%). These results indicated that the proteins in pili are very similar to the proteins in common oilseeds such as soybean, and peanut.

Mature pili nuts used in this test were gathered from Sorsogon in summer 1999. The fruits were first placed in a retting pond to soften the pulp and the nuts were cleaned using a perforated basket flushed with water. Then the nuts were sun-dried and cracked to extract the kernels. Finally the kernels were soaked in warm water, its outer skins removed and the kernels air-dried before they were used for the tests.

Cultivating pili

Pili is a tall, shady tree that grows well in deep, fertile, well-drained soil, warm temperatures, and well distributed rainfall. It cannot tolerate the slightest frost or low temperatures and studies have shown that seeds stored in low temperatures lose their ability to grow or germinate.

There are three pili cultivars grown in the Philippines: *katutubo*, *mayon* and *oas*. Aside from using seeds, they can be

Future agriculture: The integration of GIS and CPAR

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When our forefathers stood on their farms wondering how much more they can get from their patch of land, they might be amused to know that advanced technology has provided answers to that query by first answering the question of "knowing exactly where". And the Bureau of Agricultural Research (BAR) is right on track in getting to the answer through GIS and the Community Participatory Action Research (CPAR).

Geographic Information System (GIS) expert Dr. Esteban Godilano suggested a new avenue that can be tapped to turn the agriculture industry around. Dr. Godilano presented the advantages of integrating GIS technology to the CPAR approach, and other agricultural endeavors.

GIS and Agriculture

We are focused now on increasing production to feed the population. The challenge lies on how we can produce enough food in a sustainable manner without damaging the natural resource base.

Today, signs of fatigue in the natural resource base have already appeared which should be a cause for serious concern to the planners, decision-makers and researchers alike, in the agriculture and fisheries sector.

The enabling technology that could address this concern is

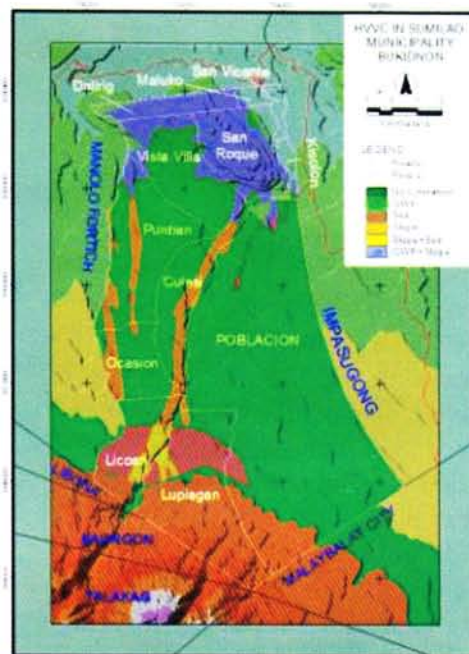
the principle of managing spatial and of-time variables associated with all aspects of improving agricultural production and preserving the environment.

In agriculture, research, development, and extension (RD&E) involve decisions that are multi-disciplinary in nature, and are commodity and discipline oriented. But technologies like GIS can help establish a cross-sectoral communication by providing powerful tools for analyzing land-use. GIS is a more efficient tool in decision-making that would help stakeholders see and understand what researches are being proposed, and in what place can they be best undertaken. Problems that are most likely to occur during the implementation of the project, will be pinpointed as early as during the decision-making process using GIS.

BAR embraces GIS

BAR has been proposing GIS application because it allows for precision decision-making.

For one, an agency that is beset with budget issues thus having to streamline its activities would benefit from a tool that would provide a spatial point-of-view of the arena where the meager resources of the agency is painstakingly distributed.



Dr. Godilano said investments in RD&E, which are carried out by SCUs and other partner R&D institutions, yield voluminous reports and statistical data that are published and archived, but never mapped. Mapping out will enable us to answer vital questions of: where else; to what extent, who are the target clients; where are they situated; and to provide "what if" scenarios.

GIS and CPAR

The prerequisites of the GIS to be CPAR-friendly would be data or information defined by the experts.

For example, if you want to know the suitability of planting high value vegetable crops in Mindanao, you would need data on rainfall, climate, elevation range, soil characteristics, ground

water potential. These criteria are then translated into cartographic models, which are in turn executed by a GIS software. Socio-economic and demographic data are incorporated in the final maps.

This information generates color-coded maps showing the regions that are highly, moderately, or not suitable areas for planting. The maps are easier understood than a table of data, especially for policy-makers, extensionists, and farmers. The map aids in tactical planning by our extension technicians, and helps financial institutions come up with favorable and confident decisions because uncertainties are minimized.

"GIS technology also serves in establishing concrete and useful programs based on real needs, not on the basis of whims and friendships among decision-makers", Dr Godilano explains.

"Since technology and suitability of crops can now be geographically located through maps, the area can also be calculated by a software that goes down even to specific plots," Dr Godilano adds. Once a suitable area has been identified, the technology can also identify specific farmers based on demographic data on income, level of literacy, or incidence of poverty.

A good example of this is the mango suitability map that has previously been created. "Results of the GIS analysis showed that at least 11 provinces in the country that have been already planted with mango are actually not suitable. But on the other hand, 3.5 million hectares were identified as highly suitable areas. This map helps establish the 'mango estate'," Dr Godilano reveals.

In fact, after BAR spearheaded the establishment of

the DA-GIS Network, it reaped an early result: the Bureau of Animal Industry(BAI) is on the planning stage of implementing GIS by using it as tool for the monitoring, evaluation, and devising mitigating measures for foot and mouth disease(FMD) as one of its major component.

Dr. Godilano adds that he thought of integrating GIS in CPAR because of a problem he himself encountered as a scientist at the International Rice Research Institute (IRRI). "Our greatest problem during that time was, after determining the best alternative systems using on-farm-research(OFR), we needed to extrapolate the results to wider areas covering provinces and regions. But the methodology in identifying the extrapolation domain has never been perfected. It was a hit and miss method, because GIS was not available then."

"There is so much to be worked on the awareness of the stakeholders and policy makers on the benefits of GIS. Every government agency should have a geographic resource officer and a trained GIS analyst," he offers as one practical solution. He also says there should be more sharing in data and information among concerned

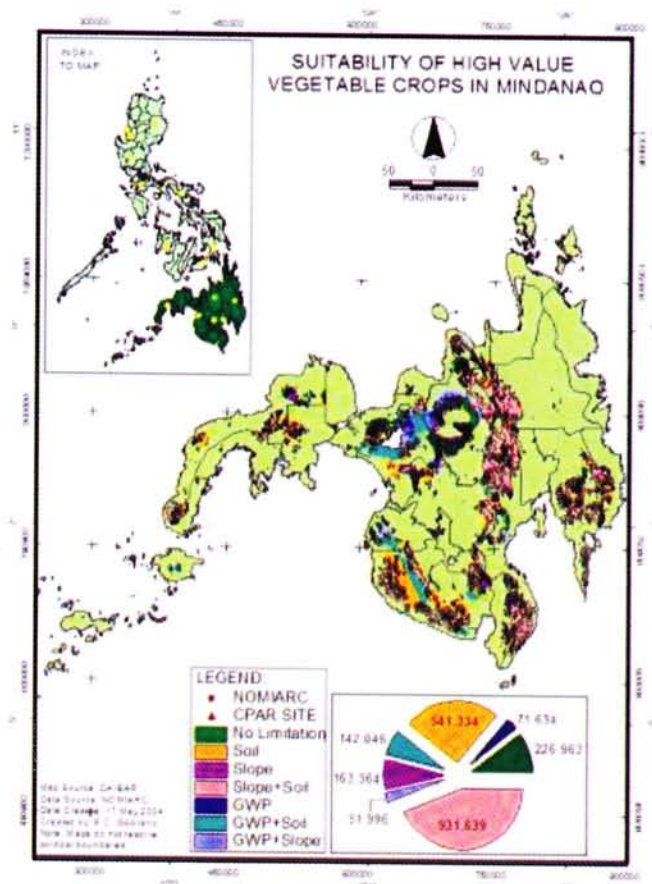
institutions.

Into the future

While we work for a burgeoning population amidst dwindling resources, we are not without help. GIS is a tool that can revolutionize agriculture into precision farming. What was once referred to by the GIS expert as the "missing link" in the Agriculture and Fisheries Modernization Act(AFMA) has been identified, and GIS has become an imperative, not an option.

Sources:

1) Integrating GIS in CPAR, Dr. Esteban Godilano, Knowledge Management Seminar Series, BSWM; 2) GIS Technology: Increasing Agricultural Productivity and Resource Efficiency, Dr. Godilano, SEAMEO-SEARCA; 3) DA-BAR Adopts 3's Technology by Dr. Godilano



Pili...

cultivated through patch budding or marcotting. A good pili tree can produce 100 to 150 kg of in-shell nuts per harvest. Most of the production in the Philippines are from trees that developed from seedlings and are highly variable in kernel qualities and production. Harvesting is from May to October, peaking in June to August, and requires several pickings. Fruits are de-pulped, cleaned and dried to 3 - 5% moisture content (30C for 27 to 28 h). Nut in shell with a moisture content of 2.5 to 4.6% can be stored in the shade for one year without deterioration of qualities.

Source: Massimo Marcone, Yukio kakuda, Firouz Jahaniaval, and Ricky Yada of the Department of Food Science, Ontario Agricultural College, University of Guelph, Guelph, Ontario, Canada and Lourdes Montevirgen of the Department of Science and Technology (DOST), Bicutan, Taguig, Metro Manila. "Characterization of the proteins of pili nut (*Canarium ovatum* Engl)" 2003.

Sex pheromone...

insecticide from 16 to 20 times was substantially reduced to only 1-3 applications per cropping season without reducing the yields. This also reduced the farmers' exposure to harmful chemical pesticides. With this result, researchers are confident that farmers have now a better choice of improving their existing ways of farming.

Source: G.S. Arida, B.S. Punzal, C.C. Ravina, V.P. Gapud, E.G. Rajotte, and N.S. Talekar. "Monitoring adult populations with sex pheromone traps for effective timing of interventions against defoliators in onion grown after rice".

Newsbits

APRIL

Agri R&D finds a new home at RDMIC

Key officials and staff of the Bureau of Agricultural Research (BAR) gathered to celebrate the blessing of the new Research and Development Management Information Center (RDMIC) building. Coinciding with this activity was BAR Dir. William C. Medrano's 47th birthday. A whole-day Executive Committee Meeting held after the blessing was the first official business in the new building. The RDMIC building houses the BAR offices and the R&D knowledge center.

ICRISAT Director General gets second term

Dr. William D. Dar, director general of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), former Department of Agriculture - Bureau of Agricultural Research (DA-BAR) director and DA secretary, was given a new five-year term of office starting 1 January 2005. The decision was made at the 50th ICRISAT Governing Board meeting held at the ICRISAT headquarters in Patancheru (near

Hyderabad), India on 29 April 2004.

MAY

Sec. Lorenzo gives recognition to 6 successful Bt corn farmers

Six corn farmers who were successful in the growing of Bt corn were recognized on 18 May 2004 at the BSWM Convention Hall. The Department of Agriculture (DA) Secretary Luis P. Lorenzo, Jr. handed them their plaque of recognition during the *Kasaganaan sa Mais Pangkabuhayan Tekno Fair*. This activity was part of the Farmers and Fisherfolk Month celebration, which started on 17 May 2004.

JUNE

DA-BAR, LandBank sign MOU for national technology commercialization program

To facilitate the immediate promotion and utilization of R&D results to farmers and fisherfolk, the Department of Agriculture - Bureau of Agricultural Research (DA-BAR) signed a memorandum of agreement (MOU) with LandBank of the Philippines (LBP) to implement the "DA-BAR-LBP National Technology Commercialization Program".

Research and Development
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