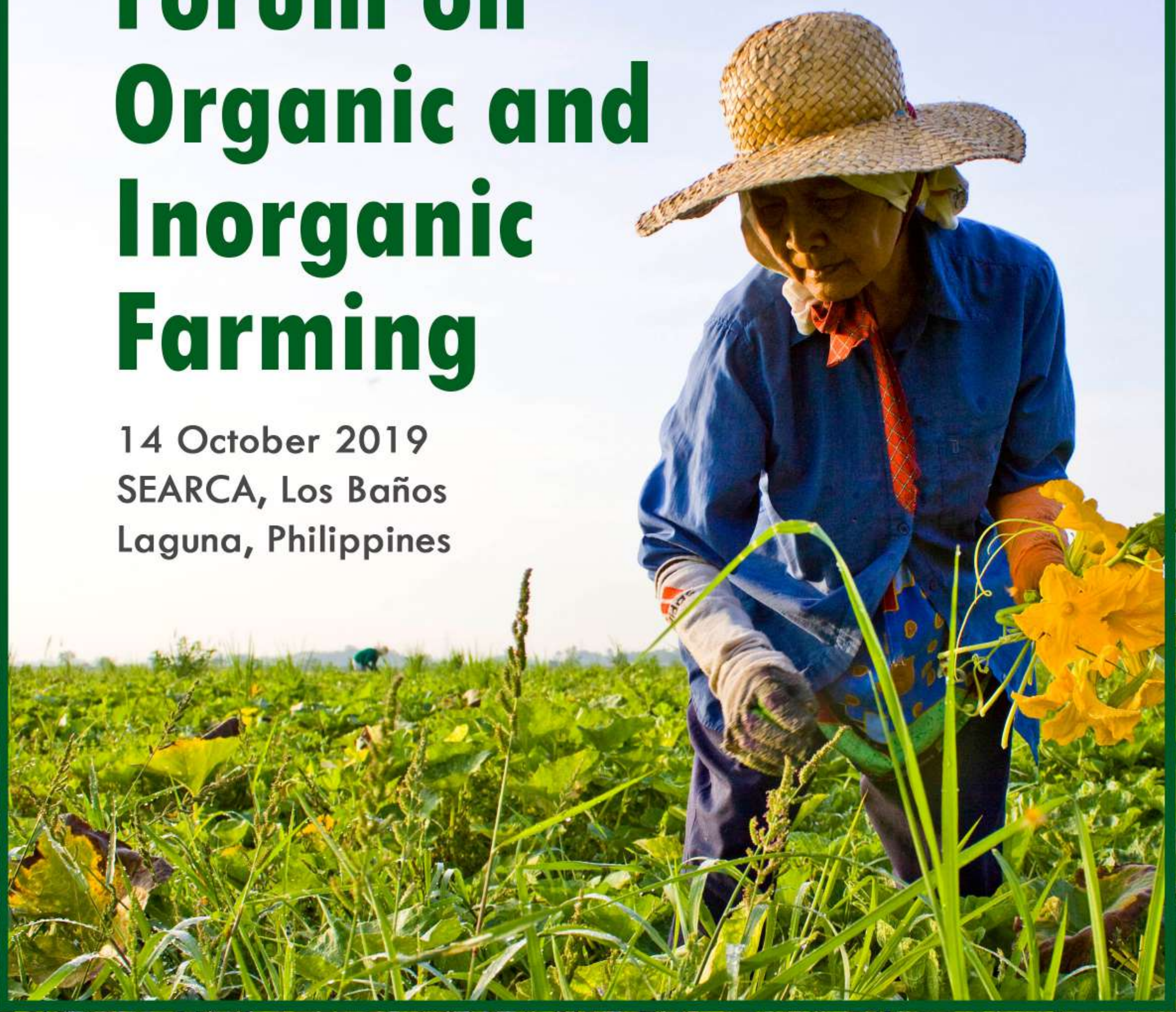
PROCEEDINGS

Forum on Organic and Inorganic Farming

14 October 2019
SEARCA, Los Baños
Laguna, Philippines



FORUM ON ORGANIC AND INORGANIC FARMING: PROCEEDINGS

14 OCTOBER 2019
SEARCA, COLLEGE, LOS BAÑOS, LAGUNA, PHILIPPINES

Organized by:

Coalition for Agriculture Modernization in the Philippines, Inc. (CAMP)

In Partnership with:

Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)

Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD)

Institute of Plant Breeding (IPB) - University of the Philippines Los Baños (UPLB)

FORUM ON ORGANIC AND INORGANIC FARMING: PROCEEDINGS

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ABOUT THE ORGANIZERS

The **Coalition for Agriculture Modernization in the Philippines, Inc.,** (CAMP) is a SEC-registered non-stock and non-profit non-government organization. Its members are volunteer men and women from agriculture, agribusiness, industry, academe, government, professional groups and international organizations. With a vision of a productive, profitable, globally competitive, modernized, and sustainable Philippine agriculture for inclusive national development, CAMP advocates and promotes sound agriculture policies and programs, massive utilization of climate resilient and environment friendly agricultural innovations, and improved governance and management systems to help improve the livelihoods of Filipino farmers and fisherfolk. CAMP members contribute talents and expertise to infuse new vision, systems, and strategies in the country's agriculture and fisheries policies and programs, especially in light of climate change, ASEAN integration, and other new challenges. More specifically, CAMP provides position papers, policy recommendations, technical advice, and other forms of strategic knowledge sharing services to help modernize the agricultural and fisheries sectors. It does this through consultations, dialogues, conferences, and symposia. CAMP also provides technical assistance in partnership with public, private, and civil society organizations.

The **Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA)** is one of the 26 regional centers of excellence of the Southeast Asian Ministers of Education Organization (SEAMEO). Founded on 27 November 1966, SEARCA is mandated to strengthen institutional capacities in agricultural and rural development in Southeast Asia through graduate scholarship, research and development, and knowledge management. It serves the 11 SEAMEO member countries, namely, Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand, Timor Leste, and Vietnam. SEARCA is hosted by the Government of the Philippines on the campus of the University of the Philippines Los Baños (UPLB) in Laguna, Philippines. It is supported by donations from SEAMEO members and associate member states, other governments, and various international donor agencies.

The **Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD)** is one of the sectoral councils under the Department of Science and Technology (DOST). It was formed on 22 June 2011 pursuant to Executive Order No. 366. The Council provides a unified and focused direction for the country's agricultural research and serves as an apex organization that supports and manages the national network of government and higher education institutions involved in crops, livestock, forestry, fisheries, soil and water, mineral resources, and socio-economic research and development (R&D). The Council formulates policies, plans, and programs for science and technology-based R&D in the different sectors under its concern. It coordinates, evaluates, and monitors the national R&D efforts in the agriculture, aquatic, and natural resources (AANR) sector. It also allocates government and external funds for R&D and generates resources to support its program.

The **Institute of Plant Breeding (IPB)** was created on 5 June 1975 by virtue of Presidential Decree (P.D.) 729. It was established under the then College of Agriculture (now the College of Agriculture and Food Science or CAFS) of the University of the Philippines Los Baños (UPLB). Two years later, P.D. 1046-A established within IPB the National Plant Genetic Resources Laboratory (NPGRL) as the national center for germplasm collection and maintenance of important and potentially useful agricultural crops. Since then, IPB has been in the forefront of plant breeding research and applications. With the enactment of R.A. 7308, otherwise known as the Seed Industry Development Act of 1992, IPB was identified as the lead agency for crop biotechnology research. The IPB is mandated to develop new and improved varieties of important agricultural crops; undertake investigations in plant breeding and allied disciplines related to crop improvement; systematically collect, introduce, preserve and maintain a germplasm bank of important and potentially useful agricultural crops; and assist other agencies in the multiplication of quality seeds and vegetative materials of recommended crop varieties.

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EXECUTIVE SUMMARY

Organic farming and inorganic farming have been on the opposite ends of a polarizing issue in agriculture for many years. Owing to the many challenges facing the agriculture sector today, including the growing population, food insecurity, and climate change, there is a need to find ways to make these two practices work together. Thus, the Coalition for Agriculture Modernization in the Philippines, Inc. (CAMP), advises a win-win strategy that integrates both organic and inorganic practices, depending on farmers' ability and situation. This integration will assure complementarity while benefiting from the two systems, with soil organic matter enhancing the efficiency of nutrient use from chemical fertilizers. With the integration of good farming practices, CAMP believes that there is a greater chance to improve and sustain soil productivity and high yields in order to meet the needs of our ever-increasing population, and provide for a cleaner environment.

To support this stand, CAMP has organized a ***Forum on Organic and Inorganic Farming*** in partnership with the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA); Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD); and the Institute of Plant Breeding (IPB) of the University of the Philippines Los Baños (UPLB). Through this event, CAMP aimed to come out with a policy paper highlighting the position shared with SEARCA, PCAARRD, and IPB; and a book of proceedings to be produced by PCAARRD based on documentation from SEARCA. The forum was held on 14 October 2019 at SEARCA, UPLB, Los Baños, Laguna, Philippines.

The forum brought together esteemed scientists and practitioners in agriculture to give a balanced discussion on the science and practice of both organic and inorganic agriculture, and the ways and means of integrating the two opposite and often conflicting perspectives to farming to achieve food security. The topics and speakers were as follows:

1. Science and Practice of Organic Farming	Dr. Rodel G. Maghirang Vegetable Breeder Director, IPB-UPLB
2. Experiences and Advocacies of Organic Farming	Mr. Pablito M. Villegas Owner and Entrepreneur Villegas OrganiKs and Hobby Farm
3. Science and Practices of Inorganic Farming	Dr. Pearl B. Sanchez Director, Agricultural Systems Institute, UPLB
4. Scientific Bases of Integrated Organic and Inorganic Farming in the Philippines	Dr. Eufemio T. Rasco Jr. Member, CAMP
5. Enjoying the Best of Both Worlds: Mainstreaming Organic Practices in Conventional Agriculture	National Scientist Emil Q. Javier Chair, CAMP

In the end, CAMP members and participants agreed that an integrated approach is the best way to marry the good aspects of both organic and inorganic faming. The participants also agreed that this is a timely and relevant issue, and commended the well-organized forum. As an initial output, CAMP developed a position paper based on the forum discussions.

INTRODUCTION

Since the passage of RA 10068, otherwise known as Organic Agriculture Act of 2010, the popularity of organic agriculture in the Philippines has increased. In fact, this became one of the key programs of a recent past administration of the Department of Agriculture (DA). However, despite government support and funding and spirited championing by some non-government organizations (NGOs), the widespread adoption of organic agriculture among farmers has been slow and its initial impacts are less convincing.

Organic farming has also become controversial because of certain myths perpetuated about it. The most controversial is its aversion to the use of inorganic fertilizer, chemical pesticides, and genetically modified products or GMOs. The practical downsides of organic farming have also become apparent, particularly the required application of organic matter at 20 tons per hectare, which presents a logistical problem. Aside from the challenges of sourcing that much organic material, there is also the logistical difficulty of moving and evenly distributing it over the area. Therefore, while organic materials may be cheaper than inorganic fertilizer per volume, there are other costs and inconveniences that farmers have to face in practicing organic farming.

On the claim regarding the superiority of organic farming over inorganic-based systems in the production of more healthful food nutrients for humans, studies have shown little to no evidence. Moreover, there is the downside of over-using of large volumes of organic materials. When these materials decompose, it can release carbon dioxide and methane into the atmosphere. It can also pollute ground and surface water in the form of nitrates generated from animal manure.

With these, the **Coalition for Agriculture Modernization in the Philippines, Inc. (CAMP)** finds it prudent to advise a win-win strategy that integrates both organic and inorganic practices, depending on farmers' abilities and situations. This integration will assure complementarity while benefiting from the two systems, with soil organic matter enhancing the efficiency of nutrient use from chemical fertilizers.

With the integration of good farming practices, CAMP believes that there is a greater chance to improve and sustain soil productivity and high yields in order to meet the needs of our ever-increasing population, and provide for a cleaner environment.

To support this stand, CAMP has organized a ***Forum on Organic and Inorganic Farming*** in partnership with the Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA); Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD); and the Institute of Plant Breeding (IPB) of the University of the Philippines Los Baños (UPLB). The forum was held on 14 October 2019 at the Umali Auditorium at SEARCA, College, Los Baños, Laguna, Philippines.

OBJECTIVES AND OUTPUTS

The forum was organized to put into perspective the roles of organic and inorganic farming in modern agriculture in the Philippines and to ind the optimal and sustainable way to fertilize the soil. More specifically, it allowed CAMP members and forum participants to formalize a position on the organic and inorganic farming debate. Related to this, two outputs were expected to come out of the forum:

1. A policy paper highlighting the position of the group and shared by all organizers including CAMP, SEARCA, PCAARRD, and IPB.
2. A book of proceedings, to be developed by PCAARRD based on documentation from SEARCA.

FORUM PARTICIPANTS

The forum brought together 92 participants from various organizations, with CAMP members and officers being the largest contingent. Participants also included scientists and practitioners advocating for organic or conventional farming, as well as representatives from the DA, local government units (LGU), and the academe, particularly from the Southern Tagalog Region. Below are the institutions and groups represented during the forum:

- Batangas State University
- CAMP
- Department of Agriculture
- Fertilizer and Pesticide Authority
- International Rice Research Institute (IRRI)
- Malvar Organic Farmers Agriculture Cooperative (MOFAC)
- PCAARRD
- PCOop
- Philippine Rice Research Institute (PhilRice)
- Private farmers
- SEARCA
- UPLB, including the following:
  - BIOTECH
  - College of Agriculture and Food Science (CAFS)

- College of Engineering and Agro-Industrial Technology (CEAT
- College of Forestry and Natural Resources (CFNR)
- College of Public Affairs and Development (CPAf
- Graduate School (GS)

FORUM PROGRAM

The table below shows the flow of the program during the four-hour forum. After a short opening program, the speakers were given about 30-45 minutes each to discuss their respective topics.

The program allowed for a balanced discussion among organic and inorganic farming advocates, while the last two speakers presented the bases for CAMP's stand of integrating organic farming with conventional farming. After the presentations, about 30 minutes were allotted for the open forum with the audience. A brief and concise summary capped the forum in the end.

Table 1. Forum program

Opening Program	
Opening Prayer National Anthem	
Opening Remarks	**Dr. Benigno D. Pecson** President, CAMP
Welcome Remarks	**Dr. Glenn B. Gregorio** Director, SEARCA (represented by Dr. Maria Celeste H. Cadiz)
Message	**Dr. Reynaldo V. Ebora** Executive Director, PCAARRD
Forum Introduction	**Dr. Rogelio V. Cuyno** Secretary, CAMP
Presentations	
Science and Practice of Organic Farming	**Dr. Rodel G. Maghirang** Vegetable Breeder Director, IPB-UPLB
Experiences and Advocacies of Organic Farming	**Mr. Pablito M. Villegas** Owner and Entrepreneur Villegas OrganiKs and Hobby Farm
Science and Practices of Inorganic Farming	**Dr. Pearl B. Sanchez** Director, Agricultural Systems Institute, UPLB
Scientific Bases of Integrated Organic and Inorganic Farming in the Philippines	**Dr. Eufemio T. Rasco, Jr.** Member, CAMP
Enjoying the Best of Both Worlds: Mainstreaming Organic Practices in Conventional Agriculture	National Scientist Emil Q. Javier Chair, CAMP
Open Forum	
Summary and Closing Remarks	**Dr. Ruben L. Villareal** Board Member, CAMP

Almost 100 participants filled the Umali Auditorium during the Forum on Organic and Inorganic Farming.

OPENING PROGRAM

The forum began with the Philippine National Anthem led by the SEARCA Choir and a prayer. Opening messages were then given by Dr. Benigno D. Pecson, CAMP President; Dr. Glenn B. Gregorio, SEARCA Director, read by Dr. Maria Celeste H. Cadiz; and Dr. Reynaldo V. Ebora, PCAARRD Executive Director. Dr. Rogelio V. Cuyno, CAMP Secretary, provided a short background of the forum as well as introduced the speakers. He also served as the master of ceremonies.

OPENING REMARKS
Dr. Benigno D. Pecson

Dr. Pecson said that the present population of earth stands at around 7.7 billion. With a growth rate of 1.08 percent annually, there will be eight billion humans in 2023 and 10 billion humans by 2057.

Filipinos comprise about 1.4 percent of humans at this time. There are about 108,500,000 Filipinos today. With a growth rate of 1.37 percent, about 1.5 million Filipinos are added to the population annually. That comes out to about 4,000 additional Filipinos daily.

He noted that food security is among the top needs of these millions of Filipinos. CAMP wants to help attain food security by championing modernization of Philippine agriculture. One major factor in agriculture modernization is fertilization. There is need to balance food demand with ecological sustainability. This forum, he said, would address this issue through presentations followed by discussions.

Dr. Pecson delivers his opening remarks.

He thanked the partners of CAMP, namely, SEARCA, PCAARRD, and IPB for making the forum possible. Very special thanks was accorded to Dr. Tito Contado, CAMP Board Member and Chair of the Forum, who put in a lot of time and effort in making the event possible; Dr. Roger Cuyno, who somehow made all enabling activities possible; and Dr. Ricardo Lantican, who started the ball rolling on the project.

He cited an advertisement on television that espouses the cause "Every Filipino is a Hero." He encouraged everyone to aspire to be modern-day heroes by contributing capabilities and energies through involvement in the forum.

WELCOME REMARKS
Dr. Glenn B. Gregorio, read by Dr. Maria Celeste H. Cadiz

Dr. Cadiz said that Dr. Gregorio would have wanted to personally join the Forum, which has a topic that is very close to his heart as a plant breeder. However, he was currently at Kansas State University in the US to sign a milestone Memorandum of Understanding with the University to implement complementary programs in the areas of Conservation Agriculture for Organic Agriculture (CA4OA) and the upscaling of SEARCA's School-plus-Home Gardens Program in some areas in the Philippines and Cambodia – programs that are well aligned with the Forum's topic.

Dr. Gregorio stressed that SEARCA will always be a supportive ally of CAMP in its activities and advocacies, since these two organizations share a common belief that there is an urgent need to turn Philippine agriculture around, to modernize it, and make it more productive and competitive. It has long been realized that as agriculture goes, so does our country; since majority of our people depend on it for food and livelihood. SEARCA is particularly focused on helping the smallholder farmers who ironically bear the big responsibility to not only provide for their families but also feed the nation's population that is growing by leaps and bounds. This is against a backdrop of limited production resources, including credit, capital, technology, and information. Added to this mix are the adverse effects of climate change and the degradation of land resources that are getting worse every minute.

To address these concerns, SEARCA is currently developing its 11th Five-Year Plan (FYP), which will be implemented starting July 2020. It will focus on the academe - industry - government interconnectivity that will strengthen agricultural innovations and promote market-driven agribusiness development in the Philippines and the rest of Southeast Asia. It means promoting agribusiness and entrepreneurship, and value chain development for agricultural commodities through increased investments in research and

Dr. Cadiz welcomes the participants on behalf of Dr. Gregorio, SEARCA Director.

development, capacity building, and access to technologies and information through extension services. All of these are hoped to contribute to the goal of modernizing the agriculture sector while promoting greater participation of smallholder farmers to increase their farm incomes.

The Plan emphasizes that farmers should be provided with adequate information on new developments and innovations in agriculture that would have impacts in their livelihood. This will help them make informed decisions on which innovations and technologies they must adopt. Hence, the Forum is an opportunity to enlighten everyone including our farmers on the benefits and consequences of organic and inorganic farming. It is hoped that this will guide them in their decision on which farming practice they should adopt based on their preferences as affected by their physical and socio-economic environments.

SEARCA is pleased to be part of this project, and will help in coming up with the proceedings that would be used in moving the agenda forward.

Dr. Cadiz reiterated what a pleasure and honor it is for SEARCA to engage with CAMP on matters important to Philippine agriculture. She noted that SEARCA looks forward to opportunities to work together in promoting the modernization of agriculture in our country.

MESSAGE
Dr. Reynaldo Ebora

On behalf of the Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development of the Department of Science and Technology (DOST-PCAARRD), Dr. Ebora expressed his warmest congratulations to the CAMP for organizing this very important and timely event, which he hoped will contribute

Dr. Ebora of PCAARRD delivers his message.

to the improvement of agriculture in the country and make it more competitive.

He also thanked all the participants for coming, as this is an indication of their interest in the two important agricultural production systems, organic and inorganic or conventional farming. It has generally been observed that when there are discussions during workshops, forums, and other related activities regarding the most appropriate agricultural production system that the government has to support and actively promote, there are always two distinct groups passionately expressing their views and opinions on the matter. He noted that the activity hoped to serve as a venue for in-depth discussion and sharing of best practices that will allow for a much better understanding and appreciation of both types of farming, and how they can be effectively practiced and co-exist, harmonized, integrated, and adopted.

Dr. Ebora said that the activity was timely, and the output of the discussion may serve as basis or inputs in developing different approaches to modernize Philippine agriculture. Some of the questions that need to be answered were: Can we achieve agro-industrialization through organic and inorganic or conventional farming? Can they co-exist? How do we harmonize or integrate the two approaches in order to attain higher productivity in terms of quantity and quality of yield, and improve production efficiency?

The activity is also relevant, because discussion on amendments to the Organic Agriculture Act of 2010 (RA 10068) was ongoing. These possible amendments highlight the inclusion of participatory guarantee systems (PGS), which will help facilitate the certification of organic products. The public hearing was conducted recently in relation to modifications on RA 10068.

DOST-PCAARD supports the R&D initiatives for both organic and inorganic farming that would result to higher productivity and in achieving sustainability in agriculture. It is well-known that there are pros and cons to these two types of farming, depending on one's perspective and farming situation. For instance, the use of organic fertilizer will have positive impact on the environment and will significantly contribute to the improvement of soil health. However, this might require a big volume of biomass to produce, which may not be available in sufficient quantity in the farms and thus, supplementing its use with inorganic fertilizer might be a more viable alternative.

In terms of policy related engagements, DOST–PCAARRD sits in various committees for both types of farming. DOST-PCAARRD is a member of the National Organic Agriculture Board (NOAB) that serves as a policy making body for the implementation of the National Organic Agriculture Program (NOAP). The DOST-PCAARRD is in charge of screening, nomination, and endorsement of the academe's representative to the NOAP.

For inorganic farming, on the other hand, DOST-PCAARRD is involved in various committees for the implementation of different programs on agricultural biotechnology, pest management, biodiversity, climate change, and many others. PCAARRD serves as chair or member of these committees.

Moreover, PCAARRD provides R&D funds both for organic and inorganic farming. For example, PCAARRD supported the National R&D Program on Organic Vegetables long before the implementation of RA 10068. It also supports the implementation of the Organic Coffee R&D program and that for Organic Muscovado Sugar. In addition, PCAARRD also supported the S&T-based Farms on selected crops in different areas of the country, which aimed to increase adoption of organic agriculture practices in the country.

Likewise, DOST-PCAARRD has numerous R&D initiatives on conventional farming involving the use of various inorganic and organic agricultural inputs like chemical fertilizers, biofertilizers, chemical pesticides, biopesticides, natural enemies, and various approaches in the implementation of integrated pest management systems, taking into consideration not only productivity but also sustainability.

The programs and activities at DOST-PCAARRD are complementing the various programs of the DA towards improved agricultural productivity and in achieving sustainability through the implementation of organic and inorganic farming and their integration.

Dr. Ebora expressed his hope that the exchange of information and sharing of best practices in the forum would clarify issues and concerns about organic and inorganic farming. He wished everyone a highly productive discussion that will further enrich the participants' knowledge and deepen everyone's understanding and appreciation of these topics.

The forum speakers (left to right): Dr. Rasco, Dr. Javier, Dr. Sanchez, Dr. Maghirang, and Mr. Villegas.

PRESENTATIONS

The presentations focused on five topics to give a balanced discussion between the two camps — organic and inorganic farming — and to justify the basis for advocating an integrated approach.
In developing their presentations, the speakers were requested to highlight the following issues:

- Nutrition and safety issues
- Soil/land and environment issues
- Standards and certification issues
- Fertilizer needs and requirements of different crops issues
- Source/suppliers capacity issues
- Economics/cost and return issues

SCIENCE AND PRACTICE OF ORGANIC FARMING
Dr. Rodel G. Maghirang

To start off his presentation on the Science and Practice of Organic Farming, Dr. Maghirang explained that he reorganized the issues so as to be able to discuss them in the context of organic agriculture while keeping discussions balanced. He also decided to focus and tackle two main topics: nutrition and safety issues and the economics of organic farming.

He then continued by giving the standard definition of organic agriculture: a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity, and cycles adapted to local conditions, rather than on the use of inputs that turn out adverse effects. Organic agriculture combines tradition, innovation, and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. Dr. Maghirang presented an infographic showing the state of organic agriculture for the year 2017, published in 2019 (Figure 1). It showed a worldwide growth of 4.7 percent from the previous year (2016), as well as increases in area at 69.8 million hectares (has) and in the organic market at 92 billion euros. The largest market globally is the US, but in Asia, China has the largest demand. Therefore, China is now the target of local organic exporters. Different countries have their own organic standards and requirements, even the Philippines, but China's standards are

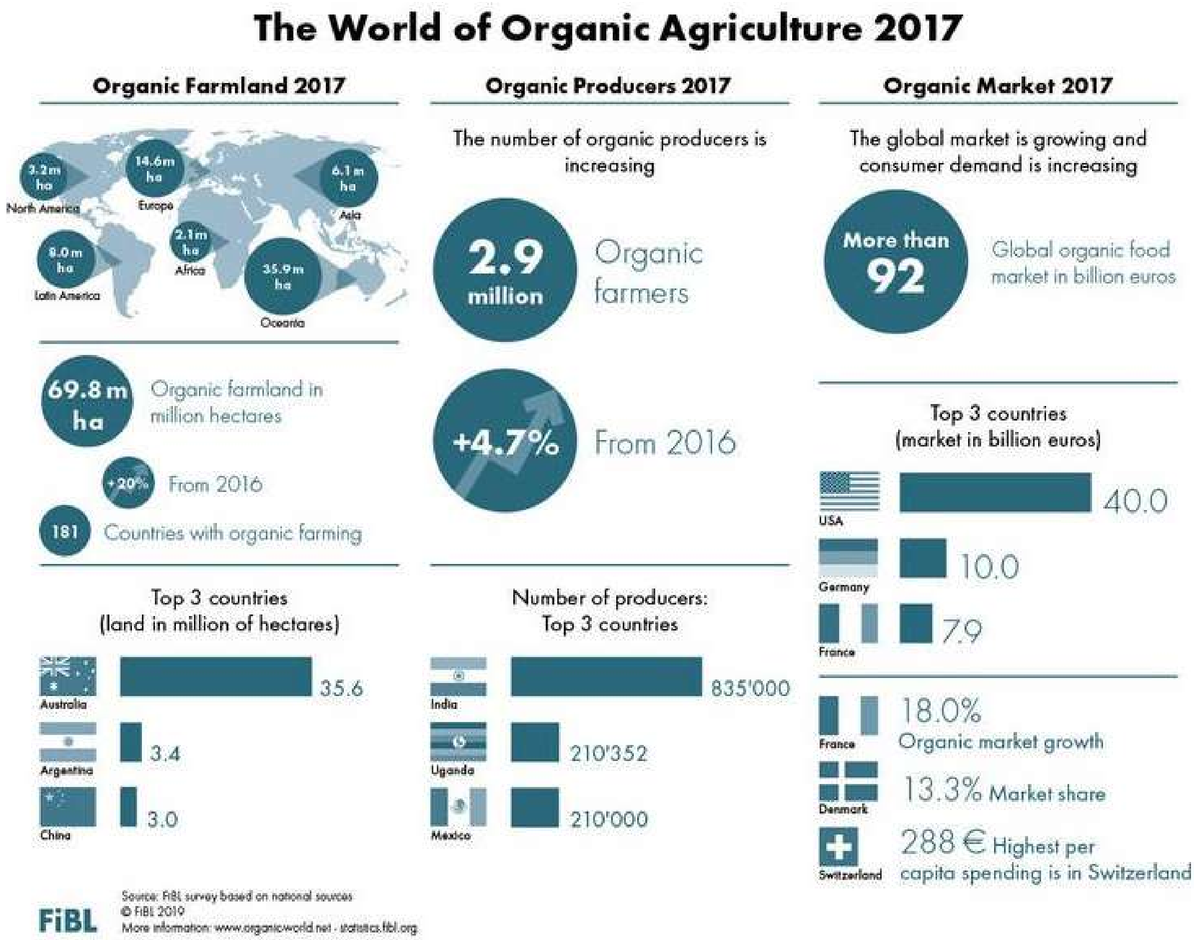


Figure 1. The world of organic agriculture (2017) (FiBL 2019)

even higher and requirements are more stringent than western countries. For instance, all documents need to be translated to Chinese and interpreters are needed during inspections. This makes costs for exporting to China higher.

In Asia, China and India are the top two countries with the most organic agriculture land. The Philippines is fifth but this has gone down from previous years. Globally, the Philippines also ranked fifth among the countries with the highest number of organic producers at 166,000. Dr. Maghirang explained that the Philippines has shown some growth in organic production area at 200,065 ha, but this is still lower than in 2015 when the country had more than 234,000 ha. Moreover, the number of certified organic operators is only 85, which is still low; but this has increased from previous years. Many of these farms produce organic products for export and have been certified by international certifiers.

Dr. Maghirang surmised that the increasing area and number of organic farms in the Philippines is due to the increasing demand for organic coconut product and the most popular coconut product in the Philippine export market today is packaged coconut water. Data show more than 100 percent increase in export sales of coconut water in 2015 and this is expected to have accelerated growth in the coming years. There are even new trends of flavored and sparkling coconut water. Majority of coconut water exports go to the US market (58.5%) and Japan and Korea (32.8%). Organic virgin coconut oil is another common product with high global demand, as well as desiccated coconut and coconut flour. These products use different parts of the coconut, which ensures minimum waste and optimal profits. Dr. Maghirang then showed a photo of organic coconut water in its original container or in the coconut shell, which many believe is a great idea from producers in the Philippines and is hoped would be the next popular trend. Aside from coconut, another good idea from organic exporters in the country is organic, in-shell pili nuts.

Dr. Maghirang also showed photos of organic vegetables produced for the local organic market. It showed organic vegetables grown under state-of-the-art greenhouses, processed in modern and clean processing areas, and packaged in high-quality containers. He explained that there is some impression that local organic produce are often packaged simply with no branding, but we actually have high-class, locally produced organic products like this. He mentioned that the Philippines has about eight ha of organic greenhouse farms that have good packaging facilities and follow high processing standards.

He then explained that organic markets in the Philippines are showing the following food trends:

- natural and organic products
- free from GMOs
- Gluten-free

DA Secretary William Dar shows in-shell organic coconut water from the Philippines.

- Corporate Social Responsibility (CSR)
- Fair Trade certification
- sustainability, particularly in terms of yield.

As mentioned earlier, every country has its own organic standards and certification requirements, which has to be met to be able to label products as organic. For instance, the US follows the US Department of Agriculture (USDA) Organic Standards or its National Organic Program (NOP). But even more stringent than this is the Regenerative Organic Certification, which goes beyond sustainability and aims to improve soil quality and health; and involves the integration of livestock. Similarly, the European Union (EU) follows the EU Organic Certification, but a little bit higher than the EU standards is the German Association for Organic Agriculture's NaturLand Certification. It follows EU standards at the minimum, but has additional and more stringent requirements. The figure on the right shows the organic certification marks for various countries. Likewise, the Philippines has its own Philippine National Standard for Organic Agriculture (PNSOA). Dr. Maghirang stressed that in many countries, one also needs to be Fair Trade-certified to export organic products. He further noted that competition is growing among local organic exporters in the country.

Figure 2. Seal of organic certification of various country standards

He then listed some of the existing Voluntary Sustainability Standards in the world market that some countries look for on top of their organic and fair trade certifications. Almost every industry or commodity for export requires sustainability standards, such as coffee, cotton, and sugar. A popular standard is UTZ certification, which accredits sustainable farming of coffee, cocoa, and tea.

Dr. Maghirang also presented a series of slides showing the comparison of organic and conventional agriculture against various metrics. Figure 3 shows that conventional farming produces higher yield at lower total costs, but in all other aspects like nutritional quality, ecosystem services, workers' health, and profitability, organic farming produces better results.

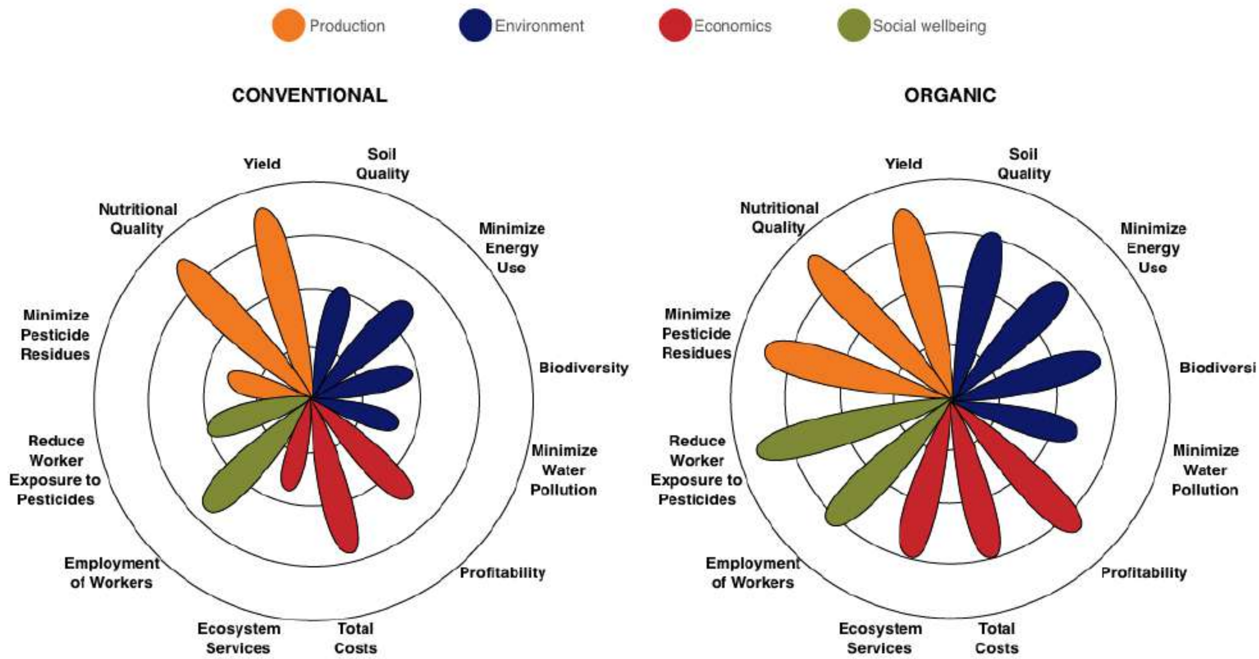


Figure 3. Comparison of organic and inorganic farming (Source: http://www.primalgroup.com/strengthening-global-food-security-organic-farming/)

Looking further into nutritional quality, comparing mineral content from conventional and organic vegetables shows that in all cases, organic vegetables have higher levels of calcium, magnesium, potassium, sodium, manganese, iron, and copper. In terms of nutrient density, data from the Rodale Institute show that protein content of conventionally farmed produce are lower.

Dr. Maghirang then showed an equation commonly used to explain variability in crop performance, especially in terms of yield:

$$P = G + E + GxE$$

Wherein phenotype or production (P) is the product of genotype (G), environment (E), and its interaction (GxE). He explained that in measuring the performance of organic production, most is ascribed to the environment (E) while there is limited consideration on genotype (G). In doing so, most assessments of yield performance against organic and conventional farming use conventional varieties instead of those that are better-suited to organic farming. Moreover, assessments usually only look at the physical considerations on environment, while exploration of the biological component of the environment is limited. Of these, more attention is given to above-ground biological environment or microbials than below-ground, which potentially show important interactions.

To illustrate his point, Dr. Maghirang discussed a PCAARRD-funded program he is involved with called the

National R&D Program on Organic Vegetables. It is implemented in CAR and Regions 1, 2, 3, 4, and 10. The project developed a total of 115 varieties of 19 priority crops, bred and selected under organic conditions for optimum performance in the six regions. These varieties have been recommended for registration with the Germplasm and Technology Registration and Release Office (GTRRO) of the IPB, while some have already been approved including varieties of cucumber (Princesa, Urduja, Milagros), pole sitao (Tikagan, Generosa), squash (Amour, Luisa, Sonrisa), roselle (Reina), and eggplant.

Aside from the varieties and seeds produced, the program contributed to the organic vegetable industry. These include the development of biofertilizers or microbials for enhancing soil fertility, and biopesticides or biocontrol agents and systems against common pests. In terms of post-harvest activities, the project studied and recommended procedures for segregation, proper handling, organic packaging, and processing methods. For market development, the program conducted supply chain documentation and analysis and recommended and helped install separate organic corners in major markets. It also assisted organic producers in proper promotion and labelling of their products. All these, in turn, provided benefit for consumers including increased supply of safe and nutritious organic vegetables, improved packaging, reasonable prices, and increased preference for organic produce.

Dr. Maghirang also discussed the environmental impacts of organic fertilizers in farming, including impacts to soil or land health. He showed a figure from the Rodale Institute showing long-term comparison of soil organic matter between manure, legume, and conventional fertilizer, where the

Organic corn (left) fared better than its conventional counterpart (right) during the 1995 drought (Rodale Institute).

percentage of organic matter in the soil had higher increases for manure and legume over a 35-year period. Long-term studies like these are better than the short-term project duration usually done in the Philippines. In terms of organic production under stress like drought, photographic evidence shows that organic corn performed better with better infiltration, retention, and delivery to plants that helped avoid drought damage. At the same time, greenhouse gas (GHG) emissions of organic fertilization is lower than conventional farming across different sources like N_2O emission from soil, diesel fuel, compost production, and mineral fertilizer production.

Moreover, he discussed the three pillars of Regenerative Organic Agriculture or ROA, namely, soil health, animal welfare, and social fairness. He explained that ROA focuses on protecting the soil, diversity of crops, and the integration of a livestock component. Social fairness, on the other hand, espouses the concepts supported by fair trade.

To expound further on the economics of organic farming and how it compares with conventional farming, Dr. Maghirang presented several data from both local and international studies. According to the Rodale Institute, long-term analysis has shown that organic systems are competitive with conventional yields, usually after a five-year transition period. Yields are also higher during stress conditions like drought. Moreover, organic farming has less negative environmental impacts like chemical leaching, energy consumption, and carbon emissions. This is supported by corn yield comparisons, where organic manure fertilization has higher yield per area in dollars at USD 1,809 for no till and USD 1,593 for tilled using organic manure. A study that Rodale Institute conducted from 2008-2010 revealed that organic systems were nearly three times more profitable than conventional farming systems.

Local studies also supported the competitive yield of organic systems, including those that Dr. Maghirang and colleagues conducted under the National R&D Program on Organic Vegetables. Their replicated yield trials of various varieties of cucumber and pole sitao under organic conditions show that organic yields can compete with yields of conventional hybrids. The results showed that while not all lines are good, given the right genotype, higher yields under organic condition can be attained.

Dr. Maghirang also presented a rundown of locally implemented research, which showed competitive yields and income from organic farms in the Philippines compared with conventional farms. For instance, results from organic rice farms showed higher average yields at 5.3 tons/ha (t/ha) and lower production costs at PHP 6.26/kg, compared with the national average yield and production cost at 4 t/ha and PHP 12.00/kg, respectively. A study detailing the comparison of income between conventional and organic MASIPAG rice farmers in Bukidnon showed highly significant improvement in net income for MASIPAG organic and in conversion farmers, compared with chemical farming, even though yields are lower. This is attributed to higher prices of organic rice. Similar studies in Asia also supported this result, wherein smallholder organic rice in the Philippines, soybeans in China, and cotton in India had higher net revenues despite lower yields than their conventional counterparts.

These studies also touched upon a common misconception of organic farming, which is thought to be labor intensive, thus increasing labor costs. These studies revealed comparative production costs, and in many cases lower for organic farming, while keeping competitive yields. More data from success stories in organic rice production in the Philippines also showed that labor costs are only minimally higher for organic farmers, but total production costs are still lower than conventional farming. Meanwhile, the same results showed that there is no doubt that yields and net income are higher for organic farming.

Meanwhile, surveys conducted by PhilRice showed variable performance from different rice varieties evaluated under organic farming systems. Dr. Maghirang noted that these varieties are conventional genotypes that were not developed specifically for organic farming. The variable performance of these varieties and the higher yields from those planted in Mindoro showed that cropping season and location both have high significant influence over yield.

Moreover, value chain analysis from the Philippine Rural Development Project (PRDP) showed wide differences in yield and income from organic rice across different approaches including MASIPAG, rice-duck, and biodynamic approaches. These approaches, like the rice-duck system, has multiple benefits including increased yields from rice and overall net income from the farm.

Conversely, there are also results that showed lower yields from organic agriculture. This included a supply chain in CAR, where yields are significantly lower for organic vegetables. However, net income is still higher because of higher selling prices. Upon investigation, the surprisingly lower yields could be attributed to the use of compost as fertilizer which is lower in nitrogen (N). Additional data on peanuts grown under organic and conventional systems also showed some reduction in yield or a yield penalty for organic peanuts, averaged across all varieties. However, different varieties showed variable results, with some showing lower or higher yield penalty, or none in some varieties.

Dr. Maghirang explained that the yield penalty for organic agriculture may be attributed to three factors. First is the use of organic varieties instead of conventional varieties. Second is proper nutrient management. Farmers need to analyze soil nutrient requirements and regulate fertilizer application, instead of haphazardly applying organic materials as fertilizers. Most organic farmers also follow the common recommendation of one-time basal application, but this will deplete soil nutrients in three months. Therefore, farmers need to regulate and to apply side dressing even with organic farming to ensure availability of nutrients to crops. The third factor is what can be called the art of farming. Grower A will be different from grower B, and each may have their own capabilities or talents in farming, which can spell the difference in the performance of organic crops.

Dr. Maghirang also discussed some issues in the standards and certification of organic fertilizer production by showing the specifications and requirements for organic fertilizer and compost, liquid organic fertilizer, and organic plant supplements. His first concern is high certification costs. As of August 2019, there are two officially accredited organic certifying bodies: Negros Island Certification Services, Inc. (NICERT) and OCCP-Inspection and Certification Services, Inc. (OCCP-ICSI). As previously mentioned, the Philippines has 85 certified organic operators as of July 2019. Most produce crops (49%) for export, with agricultural inputs coming in second (28%). A small number produce livestock and poultry and processed products. The small number of organic operators can be attributed to the high certification costs, as high as PHP70,000/year that many organic farmers cannot afford, particularly smallholder farmers.

Another concern involves the strict standards in organic soil amendments in the Philippines. A cap or limit is set on the total NPK of 5-10 percent. This may be unjustified and unnecessary, as there are no such limits in other countries. Going lower than five percent or higher than 10 percent may cause many to fail certification or change classification. Another excessive and unnecessary requirement aside from the cap mentioned above pertains to fertilizer trials called the experimental use permit (EUP). Each fertilizer for certification needs to be tested against each crop. This can easily become very expensive and costs may go as high as PHP 100,000. Dr. Maghirang said that their recommendation is to no longer require the EUP and instead merely rely on the analysis for information. Another pertinent issue is the inconsistent quality of some organic fertilizers. To end his discussion, he reiterated that standards are essential.

The next topic tackled focused on the availability of raw materials and cost of organic fertilizers. One main contention against organic fertilizers is the unavailability of biomass. Based on the most recent data from the Philippine Statistics Authority (PSA), Dr. Maghirang computed the estimated manure production from livestock and poultry, totaling 94 million metric tons (MT) per year. Based on 5 t/ha application rate, this can cover over 19 million hectares, which is a lot already. However, this is assuming 100 percent efficiency and recovery. The best recovery rate in more advanced countries is 90-95 percent. Even then, that is still a lot of biomass, which may be sufficient to supply organic fertilizer demands.

Other potential biomass sources are agricultural residues like rice straw and hull, sugarcane bagasse, and coconut husk, fronds, and shell. Of these, rice straw has the highest production at 11 MT/year. Another potential biomass source is municipal solid waste, which can amount to as much as 12.8 million t/year. Of course, not all of these can be used for organic fertilizer production; but they can be significant biomass sources.

On the other hand, some farmers practice the organic farming approach of permaculture. It uses biomass and wastes that come directly from the farm as organic fertilizers, like wastes from hedgerows and wild areas, avoiding the need to resort to additional or external sources. Just like permaculture practitioners, farmers need to be resourceful in finding renewables, methods of converting wastes into organic fertilizers, and on-farm generation of renewables. There are also a lot of R&D opportunities in this area.

Dr. Maghirang then showed photos of some of the organic fertilizer production facilities in the Philippines, which included large-scale ones that are already operating. One of the biggest is in Nueva Ecija, where the system and formulation already passed organic fertilizer certification in China. China aims to plant across the China-Russia border and this would require huge amounts, which, unfortunately, the facility was unable to supply since it would require large amounts of biomass. Therefore, they were only able to supply the activator to China.

There is an even bigger one in Pampanga, which is also one of the largest poultry farms in Southeast Asia. They use poultry waste and convert it to organic fertilizer. There are also facilities in Sumilao, Bukidnon, Butuan, and South Cotabato. These facilities often use wastes from their own poultry or piggery farms, and produce organic fertilizers as part of their waste management system allowing them to profit from waste products. Other facilities use seaweeds and waste fish parts such as the head. Fish processors used to just dump unused fish parts, which then required large spaces. Therefore, they opted to process and convert them to organic

Large-scale organic fertilizer production facilities operate in the Philippines.

fertilizers, solving their waste problem and augmenting their income.

Additionally, Dr. Maghirang discussed some of the negative impacts of using inorganic fertilizers, including:

1. Water pollution, which leads to eutrophication or algal bloom
2. Nitrate pollution
3. Soil acidification
4. Accumulation of toxic elements like cadmium and fluoride and radioactive elements from phosphorous fertilizers
5. Trace mineral depletion, which results to decreasing concentrations of elements such as iron, zinc, copper and magnesium in many foods over the last 50–60 years
6. Change in soil biology;
7. Energy consumption and sustainability
8. Contribution to climate change, wherein 1 kg of fertilizer-N Fert equates to 8.6 kg CO2
9. Depletion of phosphorous reserves, which could run out in 40-80 years

Lastly, Dr. Maghirang made the following recommendations:

- Take advantage of the organic export and local markets.
- Optimize organic yields with proper genotypes and cultural management.
- Increase science in organic practice and practice in organic science.
- Make maximum and responsible use of available raw materials and technologies for organic fertilizers following the standards.

- Farm policies or local legislation to maximize benefits from N-fixation from practices like crop rotation.
- Technologies and systems to minimize adverse effects of inorganic inputs like compliance to Good Agricultural Practice (GAP) to promote nutrient sustainability.
- To maximize farmers' incomes, extend farmers' ownership of the produce up to retail level, including shortening the supply chain as much as possible and promoting localized production systems.

In closing, Dr. Maghirang showed a graphic illustrating how much countries invest in R&D, with the US, China, Japan, and Germany leading. He said that R&D investments are a leading indicator of long-term economic strength, and therefore we need to be "crazy about research*."

EXPERIENCES AND ADVOCACIES OF ORGANIC FARMING
Mr. Pablito M. Villegas

Before talking about his experience and advocacies on organic farming, Mr. Villegas first talked about his experience helping in his father's farm at a very young age in the 1950s. They were already practicing diversified and organic farming then and did not use pesticides. When he took up agriculture at UPLB, he learned about the Green Revolution and he taught his father to use chemical pesticides and fertilizers. When he started working at the DA, he was involved with the Masagana 99 Program, which also applied concepts of the Green Revolution. Even in Landbank, they also prescribed chemical fertilizers to farmers.

When he retired at 40, he joined the United Nations and his first assignment was in Papua New Guinea. While there, he saw that the indigenous peoples (IPs) had high quality and robust crops like taro, beans, and vegetables, even without using chemical fertilizers. He thought that they are probably doing something right, and this sparked his interest in organic agriculture. When he returned to the Philippines, he used his retirement funds and savings from Landbank to buy agricultural lands and in 2003, he decided to return to the farm. After going around the world as an international consultant, he has gone full circle and is now a farmer with a six-hectare farm in Malvar, Batangas.

Moving on to his presentation, Mr. Villegas first discussed the challenges and constraints in agricultural and rural development faced by the Philippines. On the top of the list is poverty among rural and agricultural communities. About 30 percent of households or 16.8 million people in rural areas live

**Dr. Maghirang was referring to a quote from Philippine Senator Cynthia Villar who said "Parang lahat ng inyong budget puro research? Baliw na baliw kayo sa research. Aanhin ninyo ba yung research?" (It seems like all of your budget goes to research. You are so crazy about research. What will you do with those research?) during the Senate budget hearing for the DA and its attached agencies. Source: https://newsinfo.inquirer.net/1175450/villar-hits-da-for-high-budget-on-corn-research-baliw-na-baliw-kayo-sa-research#ixzz6HgFNUXvA* below the poverty line. Second is the high vulnerability of rural communities to the harsh impacts of climate change. Third is food insecurity and malnutrition. These three are the greatest challenges among rural communities and they are interrelated, forming what is called the vicious cycle of poverty (Figure 4). He stipulated that organic agriculture must be able to address the vicious cycle of poverty, particularly in providing the food and nutrition requirements of the country.

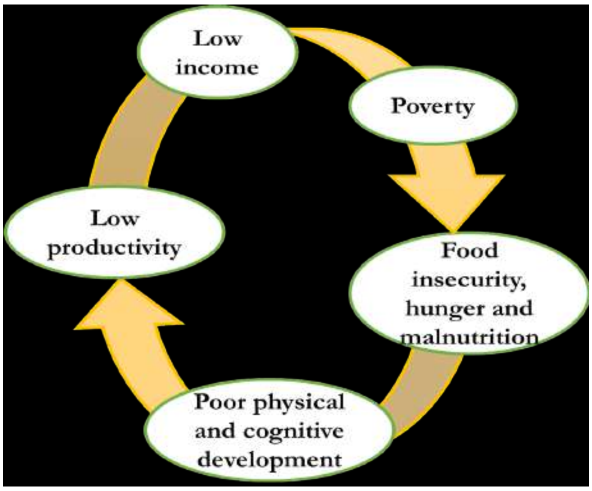


Figure 4. The viscous cyle of poverty

He then explained that his presentation draws from his experiential learnings in on-farm adaptive research trials and best practices, particularly in addressing climate change effects and impacts in agriculture and farming systems. At the same time, he said he would share his experiences with the consulting and management advisory services of the Villegas Organic and Hobby (VOHO) Farms and the four cooperatives he belongs to. The VOHO Farms Complex has a technology demonstration farm, agritourism inn, sustainable agriculture and entrepreneurship learning center, agri-processing center, and nursery and biofertilizer plant.

The following are the macro to meso principles that VOHO is trying to demonstrate in its farms:

1. food security and access to available, adequate, affordable, safe and health promoting foods;
2. water sufficiency and resilience to drought and prolonged dry season;
3. environmental and ecological stability of an agro-forestry ecosystem;
4. human and ecosystems health and healthy/wellness lifestyle; and
5. climate change impacts and farm resiliency for increasing and sustaining agricultural productivity and enhancing farm income ("*Masaganang Ani at Malaking Kita*" translated as "prosperous harvest and high income").

Mr. Villegas pointed out that all this can be done with organic agriculture. In fact, the previous presentation by Dr. Maghirang already showed that it can be done. To further support this, he discussed the strategies and processes or methods that VOHO is applying in its farms, which he referred to as their "solutions framework."

The first strategy is developing and nurturing a network. He explained that aside from the cooperatives, their farm networks also involve both local and international organizations that have helped their farms flourish. Furthermore, the second strategy comprises the technology interventions applied in their farms to address the aforementioned issues. These include:

1. Improving soil nutrition by recycling organic matter, including carbon capture, minimum tillage, and converting organic wastes into organic fertilizer;
2. Producing bio-organic fertilizer (BOF) via enhanced composting using beneficial microbes and adopting vermiculture and vermicomposting;
3. Producing vermi-tea, fermented fruits and plant juices, fish amino acid, and calcium *cum* potassium concoctions;
4. Maintaining mineral and micro-nutrients balance;
5. Improving pest and disease management and control by using an integrated pest and disease management approach;
6. Adopting better water use efficiency via drip irrigation;
7. Increasing soil organic matter content;
8. Using better weed control methods using biomass and/or plastic mulching materials;
9. Adapting and adopting eco-functional intensification (relay planting, crop-legume farming) and multi-storey crop-livestock agro-forestry diversification; and
10. Use of "solar" technology and digital technology.

Mr. Villegas detailed below the results and outcomes of these strategies as applied in VOHO Farms:

Activities at the VOHO Farms follow the principles espoused by organic agriculture.

1. In VOHO, when the mineralized water from the pond or mini lagoon become murky, it is pumped out and used to “fertigate” or fertilize and irrigate the crops and fruit/agro-forest trees. The recycled water is rich in bio-nutrients and minerals for enriching the already fertile volcanic soils of Batangas.
2. The farm maintains plant biodiversity with more than 180 species of plants and weeds found in the integrated farm, as well as insect predators. The farm boundaries are also landscaped with edible gardens planted with medicinal and culinary herbs, mushroom, vegetables, and dragon fruit.
3. Plants with known pesticidal properties such as neem tree, jatropha, makabuhay, lemon grass, citronella, marigold, kakawate, spring onions, lagundi, banaba and oregano as well as hot chillies, garlic, and onions are made into bio-pesticides and used as deterrent or repellant (bio-crop protection) for the control of insect pests and plant diseases. When fermented with molasses or brown sugar, they are also used as bio-fertilizers and crop protection concoctions.
4. The use of *rhizobia*, *azospirillum*, *mycorrhiza* and *trichoderma* as well as effective and indigenous micro-organism (E/IMOs) technologies from UPLB and elsewhere are also being commercially adopted in the nucleus and satellite farm clusters.
5. Nitrogen-rich plants, such as kakawate (madre de cacao), malungay (moringa), Trichantera (madre de agua), mulberry, and ipil-ipil (leucaena) leaves as well as colapogonium, rensonii, and stylosanthes legumes, are harvested, chopped, and used as feed supplement to free-range chicken and turkey grown for meat and egg production; as well as served as feed crops for cattle and carabaos.
6. Oregano, mint, basil, tarragon, and other herbs like lagundi, yerba buena, and malungay leaves are crushed for their juices and/or fermented and mixed with feeds and used as organic feed and medicine for free-range poultry.
7. The farm maintains its commercial on-farm applied R&D trials by in-house scientists and some organic technologists and scientists on call. The production technology and practices are continually validated in the farm, thus making these technological innovations and best practices more location-specific.

In talking about these results, Mr. Villegas shared specific experiences in VOHO farms. For instance, they had to stop their poultry farm when they transitioned into farm tourism. This was to avoid the foul odor that might disturb the guests. He also talked about the farm’s experience with the devastatiing coconut scale insect (CSI), which affected their coconut trees. Through the help of their consultant scientists, they found that the use of natural predators (parasitoids) and gliricidia-based (virgin coconut oil) and deumataceus concoctions have proven to be cost effective in controlling the highly virulent and menacing pest. Applying these, plus the strong wind and high water saturation brought by Typhoon Glenda in 2014, saved their two-hectare coconut farm from CSI total damage with minimal cutting of dead trees. New coconut harvests have started in 2016 with the adoption of balanced fertilization and GAP technology. They also have new hybrid coconut plants. Moreover, the farm is planning a nursery and organic fertilizer production project.

All these technological advances and practices have been shared with and adopted by a network of at least 30 satellite farms and more than 100 trainees of the cooperative. These are also being institutionalized through several approaches. First is the Nucleus and Satellite Organic Farm Clustering (NuSOFaC) scheme and Value Chain Optimization modalities. Mr. Villegas explained that the goal is to help farmers achieve economies of scale by consolidating produce for marketing, which is why they are not stopping even if it is sometimes difficult to implement.

The second approach is capacity building using techno-demo and training through VOHO's Sustainable Agriculture and Entrepreneurship (SAGE) Learning Center. Aside from farmers, VOHO also trains professionals including those from international agencies.

Participants join in a hands-on training session at the SAGE Learning Center.

The third approach is through small grants and aids and their consulting and advisory services. Some examples include:

- A small grant from the Korean Federation of Sustainable Agriculture (KFSA) and IFOAM in 2011 for the improvement of learning and training facilities for organic agriculture technology development and promotion.
- A small grant from the Saemaul Undong Forum of Korea and the Cheongdo-Gun in 2015 for the propagation of guyabano and cacao or cocoa in Malvar, Batangas. VOHO is also promoting kapeng barako (local brewing coffee variety) in Batangas.
- An ongoing project on the Resettlement of Informal Settlers with Employment and Upliftment (RISE UP) with the Alson Group and Aboitiz Group of Companies through the Lima Land Inc. is now being implemented with the setting up of an organic farm village. The more than 40,000 employees of the Lima Land Industrial Technology Park will be the local market outlet of organic produce at prices equivalent to supermarket prices of non-organic produce.
- DA outreach projects on urban gardening implemented in Fairmont Park, Fairview, Quezon City and Marikina City.
- VOHO provided consulting, advisory and management services to the ABS-CBN Gawad Kapamilya Foundation, Inc. for the completion of a feasibility study and revival of their Iba (Zambales) Organic Farm and commercialization of their eco-tourism business. The focus is on building the basic foundation of organic agriculture such as organic materials and inputs production, strict observance of the principles of health, ecology, care, and fairness. However, they had problems with the weak implementation and adoption of their technologies.
- VOHO prepared a consortium-based feasibility study and business plan for the establishment of a coconut processing plant for non-traditional coconut products like virgin coconut oil using at least 20,000 nuts per day from naturally and organically grown coconuts of very poor farmers and laborers in San Juan and Rosario, Batangas, Philippines. They helped organize the cooperative and facilitated direct market contract with Japanese trading firms. For climate change resiliency, VOHO will promote and adopt crop-livestock diversification via multi-storey farming systems under coconut groves simultaneously with setting up of organic composting and water harvesting and catchment facilities.
- VOHO conducted master planning and feasibility study/business plan for the Batangas/CALABARZON Strategic Food and Commodity Exchanges (SFACE) and its satellite

Regional SFACE in Visayas and Mindanao and its feeder and Farmers Agricultural Commodity Exchange (FAME).

- Master/meso planning and agro-industrial and eco-tourism business planning of the 62,000 has of the Taal Volcano/Lake Protected Landscape (TVPL) covering 13 municipalities and two cities of Batangas and Tagaytay City. The goal is to achieve agro-based industrialization through agroforestry and agro-based commodities.
- Garden ni Nanay Organic Vegetable Production Project with Agrikultura Associates. The advocacy concept of this project is to plant 10-18 most healthy and day-to-day vegetables around the house of the beneficiaries to provide enough healthy food for the family. The mother is a key to this project because she takes care of the daily needs of the family and she has time to tend to a small garden with no money output. The scheme will adopt the traditional Bahay Kubo home gardening technology.
- In collaboration with the Bahay Kubo Global Systems, Inc., the agri-preneur farmer partners of the VOHO Farms are currently in the process of setting up and institutionalizing the growing of Bahay Kubo (Bamboo House) homestead cropping of 18 vegetables that were cited in the famous Bahay Kubo cultural song of the Philippines. Added to the 18 crops will be indigenous and introduced vegetables and fruits expanding into 28, 36, and up to 48 mixed fruits and vegetables that will support household food security and livelihood systems, not only in the rural areas but also in schools and barangays or village eco-farms.

Mr. Villegas said that VOHO hopes it can partner with CAMP in their TVPL project, and noted that SEARCA is also promoting school and home gardening technologies.

Further, Mr. Villegas shared that in implementing these activities, he has learned that the key barrier to sustainable organic technology transfer is the farmer himself. While farm supervisors and laborers can be equipped with knowledge and skills in organic agriculture and farming systems, and provide farming inputs such as seeds, houses, and vehicles, farmers cannot immediately adopt attitudinal or value change. This includes negative attitudes and unsatisfactory working habits observed with farmhands having low educational attainment, limited practice of the principles of care or *malasakit* and fairness, and the lack or limited concern for sustainable and ecological agricultural technologies and farming systems. These are major setbacks in implementing organic farming technologies, including higher costs due to inefficient labor. Lower labor-output ratio and generally higher labor costs, compounded with the inherent labor-intensiveness of organic farming, leads to higher production costs for organic farming.

Based on his experiences in practicing organic farming, Mr. Villegas presented lessons learned and subsequent recommendations, summarized below.

First, Mr. Villegas recommended the adoption of family-based farm labor entrepreneurship through a profit sharing scheme as his farm currently practices, where the organic farm entrepreneur provides the land, capital, technology, and overall management while the family (husband, wife, and youth) provides the labor and farm management. After deducting operating costs and capital expenses recovery, they may equally share the net revenue. At VOHO, agripreneurs get all the revenue from the fruits of their labor and also receive token capital for seeds/seedlings, organic fertilizers, and crop protection concoctions. Mr. Villegas strongly vouched for social enterprise and not exploiting laborers.

Concerning the overall issue of sustainability of the VOHO Farm Complex and its SAGE Learning Center, plans are underway to transform the integrated organic farming and capacity building enterprise into a legacy project. Business plans are also being developed to enter into an investment and management consortium agreement with the Countryside Builders Multi-Purpose Cooperative of Land Bank Alumni Retirees and Employees and the Malvar Organic Farmers Agriculture Cooperative.

The VOHO Farm experience has also confirmed that organic farm yields tend to be much lower than conventional or chemical farming at the outset, particularly in organic-in-conversion or in-transition farms. This is because the build-up of humus and organic matter takes time (from “dead soils” or “killing fields” farming system to “living soils” farming system). At the same time, VOHO also learned that the alleged cheaper food prices under chemical agriculture are only market and price distortions, since they only measure financial or accounting prices and not impacts to health and the environment. Therefore, there is a need to include or consider the environmental or ecological costs, health and wellness costs, and other social costs of food, which tend to be higher for chemical-based industrial agricultural systems and will make organic farming more favored, as Dr. Maghirang had discussed earlier.

Mr. Villegas also recommended balanced fertilization and bio-pest management as the ideal starting point to organic farming for what can be referred to as farms that are organic-in-conversion or in transition regimes. He mentioned that VOHO Farms are not “purists,” as it is difficult to practice purely organic farming, especially in fruit farms.

Thus, Mr. Villegas advocates balanced fertilization using both organic and chemical-based products, which is now being implemented in the Villegas Organic Orchard (ORO). A study the Farm conducted and documented by the Bureau of Soils and Water Management of the DA has proven that a balanced fertilization strategy can reduce costs by about 20-50 percent and simultaneously increase yields by 15-25 percent.

Another issue that VOHO encountered over the years is that farmers find it difficult to overproduce due to the lack of economies of scale and difficulty in accessing organic markets, particularly due to problems in handling perishable organic produce like vegetables, herbs, and fruits. To address this, Mr. Villegas recommends proactively promoting and institutionalizing community-supported agriculture (CSA), where the consumers and end-users could directly link with organic farm producers that are organized at the community level. To this end, VOHO is negotiating with the Malvar LGU for the free use of vacant stalls at the Malvar Organic Trading Post and rental of at least three stalls for wholesaling/retailing of vegetables, fruits, and fishes that will bypass the multi-layered traders and middlemen.

Farmers must also be given access to postharvest handling and village-based processing through agro-based industrial clustering. Giving farmers control over the value chain will help increase profits and provide savings to retailers and end-users. In fact, Mr. Villegas' farm is setting up a Village Processing Center in a 1,500 m2 lot of the Villegas Family. The farm is also developing community-based food processing industries as well as basic harvest and postharvest handling with easy access to cold chain technology of the DA Philippine Center for Post-Harvest and Agricultural Mechanization Systems (PhilMech) and shared facilities projects of DOST and DTI.

In conclusion, Mr. Villegas proposed that organic-based agricultural methods and best practices must significantly increase to meet the growing demand for food and fiber globally. More specifically, he recommends recycling organic wastes back to the farm for their nutrients, reducing environmental degradation associated with conventional agriculture (toxic pesticides, greenhouse gas emissions), and reducing meat consumption so more food stuff can go to humans rather than animals. He asserted an urgent need to adopt the organic farm cluster development approaches and methodology of the VOHO Farms and Cooperative to achieve economies of scale and facilitate access to market and fair trade. These VOHO approaches include the establishment of Nucleus and Satellite Organic Farm Clusters (NuSOFaCs), supply and value-adding value chains, and links optimization modalities.

Based on their experiential learnings over the years, the Villegas OrganiKs is now developing into a more diverse project and business that will become his family's legacy in the coming years.

To end his presentation, Mr. Villegas showed photos of the new developments in VOHO Farm, including the following:

1. Voho Eco-Tourism Farm
    - Villegas Veranda and Agritourism (VIVA) Inn
    - Bamboo Farm House with Surrounding Veranda
2. Villegas Organic Orchard (ORO) And Agro-forest Farm Lots
3. SAGE Learning Center and Villegas Agribusiness and Organic Agriculture (AGORA) Consulting and Management Services in partnership with MOFAC and Countryside Builders Multi-Purpose Cooperative of Land bank Retirees/Alumni.

This bamboo farm house is one of the recent additions at the VOHO Farms.

SCIENCE AND PRACTICE OF INORGANIC FARMING
Dr. Pearl B. Sanchez

After hearing about organic farming, Dr. Sanchez' presentation shifted focus to the science and practice of inorganic farming. Before beginning her presentation, Dr. Sanchez disclosed that it was her honor to sit next to academicians and other speakers, but at the same time it made her nervous. She also commended Mr. Villegas for his presentation and rich experience as an organic farming practitioner and thanked Dr. Maghirang for already discussing some aspects of the practice of inorganic agriculture in his presentation. This will now allow her to focus on the science of inorganic farming, which she said would hopefully help in developing a nutrient management plan whether for a combined organic and inorganic or a purely organic or inorganic farming system. She showed the outline of her presentation, as follows:

1. Introduction
2. Global and national consumption of inorganic fertilizers
3. Advantages of inorganic fertilizers
4. Economics of inorganic farming
5. Environmental issues
6. Challenges in inorganic farming

In her introduction, Dr. Sanchez centered on the definition of inorganic or conventional farming, which is a production system that uses synthetic fertilizers, plant growth regulators, and pesticides. Her presentation would focus on the use of synthetic fertilizers. Inorganic fertilizers, as defined by the International Organization for Standardization (ISO), are those in which the declared nutrients are inorganic salts obtained by extraction and/or by industrial, physical, and/or chemical processes.

In general, fertilizers are any substance, organic or inorganic, solid or liquid, natural or synthetic, which are applied to the soil or to the plant to improve its nutrition, growth, yield, and quality. Fertilizers, whether organic or inorganic, function to improve or maintain soil fertility so that crops can grow better and produce higher yields of better quality, improve the level and supply of nutrients, and replenish the nutrients removed by crops. She stressed the importance of replacing the nutrients taken up by the crops, which is one of the bases of fertilizer application. Table 2 shows the essential nutrients for plant growth most commonly taken up by plants.

Dr. Sanchez explained that the first three — carbon, hydrogen, and oxygen — are obtained from the atmosphere and water. Those in yellow are macronutrients or

Table 2. Essential nutrients or elements for plant growth and the chemical forms most commonly taken up by plants

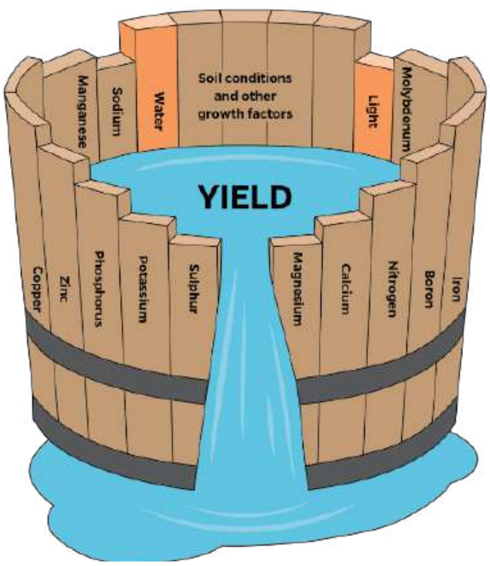
Nutrients	Available Forms	Nutrients	Available Forms
Carbon (C)	CO_2	Iron	Fe^{2+}
Hydrogen (H)	H_2O	Manganese (Mn)	Mn^{2+}
Oxygen (O)	O_2	Zinc (Zn)	Zn^{2+}
Nitrogen (N)	NH_4^+, NO_3^-	Copper (Cu)	Cu^{2+}
Phosphorus (P)	$H_2PO_4^-$, HPO_4^{2-}	Boron (B)	H_3BO_3,BO_3^{3-}, $B_4O_7^{2-}$
Potassium (K)	K^+	Molybdenum (Mo)	MoO_4^{2-}
Calcium (Ca)	Ca^{2+}	Chlorine (Cl)	Cl–
Magnesium (Mg)	Mg^{2+}		
Sulfur (S)	SO_4^{2-}		

nutrients required by the plants in larger quantities. She then brought attention to the available forms, which are the forms of these nutrients that can be taken up by plants, whatever the fertilizer source is. Therefore, when organic fertilizers are applied, they need to be converted to these forms in order to be taken up by plants. Meanwhile, those in green are micronutrients and the available forms are usually in ions or in inorganic forms.

She then explained an important principle in agronomy, called Liebig's Law of Minimum. It states that "if one of the essential plant nutrients is deficient, plant growth will be poor even when all other essential nutrients are abundant." This is illustrated by a barrel of water, which shows that the nutrient in deficient amount will limit the yield. For example, in rice, zinc is a micronutrient needed only in very small amounts but can still limit rice yield when deficient.

Various amounts are needed for each nutrient, depending on the crop. For example, to produce one ton of grain yield in a one-hectare field, 15-20 kg of nitrogen, 2-3 kg of phosphorus, and 15-20 kg of potassium are needed. Potassium can be reduced to 3-5 kg if all straw is returned and evenly distributed, since rice straw is high in potassium. For corn, one ton of grain yield requires 27 kg of nitrogen, 7.5 kg of phosphorus, and 20 kg of potassium. This is for one ton, so if the goal is to produce four tons, the amount needs to be multiplied by four. This much amount is needed, particularly because not all of the nutrients applied are taken up by plants as there are also losses. Relevant to this, Dr. Sanchez also showed general fertilizer recommendations for common crops in the Philippines. She pointed out that these recommendations may vary according to soil nutrient analyses.

In discussing the consumption of inorganic fertilizers, Dr. Sanchez said that the discovery of inorganic fertilizers, together with the use of high-yielding varieties (HYV) and pesticides, led to a marked increase in food production during the Green Revolution. The goal then was to increase production to cope with the increasing population. About 30-50 percent of the crop yield in the 1950s to the 1960s is attributable to commercial fertilizer nutrient inputs. As shown in Figure 5, a 93 percent increase in fertilizer consumption correlates



A barrel of water illustrates Liebig's Law of Minimum.

with a 31 percent increase in grain yield. She then mentioned that fertilizer consumption continued to increase up to present years, leading to some increase in grain yield. This increase, however, is not proportionate to the marginal increase in yield. Between nitrogen and phosphorous, nitrogen has significantly higher consumption rates.

In terms of common fertilizer types, most farmers in the Philippines use urea and complete fertilizer for both rice and corn, and other crops. These are the most popular fertilizer types, and often, farmers are not familiar with other types such as urate of potash or 0-0-60. Data from 1987-2018 show that rice and corn yield have seen minimal increase, with rice increasing to 19 tons (13.3%) in a decade while corn yield increased to 7.7 tons or by 12.18 percent.

Dr. Sanchez then discussed the advantages of using inorganic fertilizers. First, inorganic fertilizers are convenient to use, meaning they can be easily handled and applied as dry granules, water-soluble powders, or as liquid concentrates used for foliar application. They are also suitable for custom fertilizer blending options, to provide the exact amount required by the crop. Moreover, chemical fertilizers can be stored for longer periods, provided that properly sealed containers are used.

Another advantage is the immediate release of nutrients for plant uptake, which is important to quickly mitigate nutrient deficiencies of crops. Inorganic fertilizers can instantaneously release nutrients in the soil solution through hydrolysis. However, this is something that needs careful attention in the management of fertilizers. If the nutrients are released very quickly, the plants should also be ready to take them up, otherwise they will be lost to the soil.

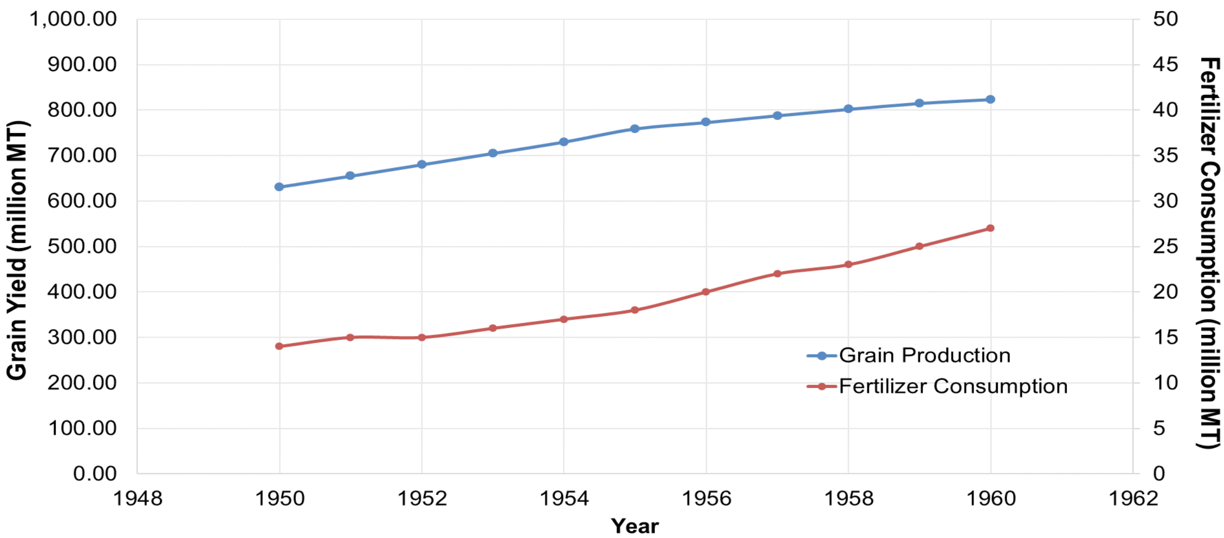


Figure 5. Global fertilizer consumption and grain yield (1950-1960)

Appling the 4Rs of Nutrient Stewardship ensures judicious use of inorganic fertilizers.

With this, Dr. Sanchez emphasized the importance of the synchrony between fertilizer release and demand of the crop to avoid losses in the soil or leaching. Among the primary nutrient elements, nitrogen shows the greatest mobility in the soil and therefore prone to leaching. Potassium is only slightly mobile, while phosphorous is immobile, but less so in sandy soils making them still prone to leaching.

The third advantage of inorganic fertilizers is their accurate formulation. The guaranteed analysis of their fertilizer grade, given as percentage (%) by weight, ensures the exact fertilizer requirements of the crop. For example, urea has a fertilizer grade of 45-0-0, which means it has 45 percent nitrogen. For complete fertilizers, some of the commonly used formulations are 14-14-14 and 16-16-16. Through the standard fertilizer grades, it is easier to compute how much fertilizer or rate is needed based on recommendations, which is one of the Four R's (4Rs) of Nutrient Stewardship. Dr. Sanchez asserts that If used judiciously based on the 4Rs, there should be no problem with applying inorganic fertilizers.

The fourth and most controversial advantage of inorganic fertilizers is its cost effectiveness. They are said to be capable of increasing crop yields at a relatively cheaper price, due to their higher nutrient content. Thus, smaller amounts could sufficiently provide for nutrient crop needs. To illustrate, urea is priced at about PHP 1,000.00 per 50/kg sack. This is already 45 or 46 percent nitrogen, compared to chicken manure, which is only 3-5 percent nitrogen. Dr. Sanchez also showed the prevailing fertilizer prices in 2018 of the most used fertilizer sources according to PSA surveys.

Looking at the relationship of price and consumption of inorganic fertilizers, data from 2002 to 2016 show that for both rice and corn, higher prices have minimal effect in lowering fertilizer use.

Table 3. Prevailing fertilizer prices

Fertilizer	Price (PhP) per 50kg sack (2018)
Urea	1,031.05
Ammonium sulfate	600.00
Ammonium phosphate	936.18
Complete (14-14-14)	1,111.51

This could mean that farmers continue to use inorganic fertilizers regardless of the price. Most recent data from the PSA on the cost and return analysis for rice show that farmers usually spend about PHP 4,000.00 for fertilizers, with a net profit-cost ration of PHP 0.50. Dr. Sanchez noted that this may be lower now because of the lower farmgate price of rice. Similarly with corn, average cost of fertilizers is PHP 3,200.00 for 1 ha, with a PHP 0.59 profit-cost ratio.

Dr. Sanchez then discussed the environmental issues associated with inorganic farming, which she noted to be a controversial topic. Because of the high mobility of inorganic fertilizers, they are highly prone to nutrient losses due to runoff and leaching. This often occurs during uncoordinated fertilizer application or when application does not match the demand. It has been accounted that as high as 45.7 percent for nitrogen and 35.9 percent for phosphorous could be leached under normal field conditions. These could lead to excessive enrichment of surface waters with plant nutrients, primarily nitrogen and phosphorous, resulting in eutrophication and deterioration of water quality.

Fertilizer application also contributes 13 percent of the global greenhouse gas emission, 74 percent of which are from nitrous oxide (N_2O) fluxes caused by nitrogen fertilizer use. It should be noted that nitrous oxide has higher global warming potential than carbon dioxide or methane. Since the release of nitrous oxide often stems from denitrification processes, it is largely affected by improper management of fertilizers.

Further, there are safety issues associated with inorganic fertilizer use, particularly in terms of handling, as shown in Table 4.

Anhydrous ammonia is a dangerous gas due to its high concentration of hydrogen, making it highly inflammable and explosive. It can also cause irritation to the eyes and the respiratory system. However, it is not being used in the Philippines. Meanwhile, the use of ammonium nitrate is also restricted in the country. To transport anything that contains nitrate needs written permission from the Philippine National Police (PNP) and the Philippine Drug Enforcement Agency (PDEA) because it is often used in making explosives. Other chemical fertilizers are less dangerous and may only cause minor irritation. For example, urea is a common fertilizer used in the Philippines with minimal safety concerns. It is hydroscopic, meaning it absorbs water from the atmosphere, and may cause irritation upon contact. This can easily be avoided through proper handwashing and the use of proper containers, for instance, plastic in packaging to avoid absorbing water.

Dr. Sanchez stressed that the negative effects of inorganic fertilizer use usually stem from misuse of fertilizers. First is improper or inappropriate use, such as the application of fertilizers to the soil surface when not appropriate or not suited to the soil type or the landscape. Related to this is nutrient imbalance from using fertilizers composed of an incomplete or improperly balanced nutritional profile that is not suited to what the target crop needs for optimal growth and product quality. When the nutritional needs of the crop are not met, it can deplete soil nutrients in the soil.

Moreover, some fertilizers may contain other materials or contaminants. Application, or cumulative application, of these contaminants to the soil via fertilizers might pose unacceptable risk to human, animal, and soil health or the environment. For example, phosphate fertilizers sometimes contain cadmium, this is why many countries monitor cadmium levels in fertilizers.

The final topic in the presentation was the challenges in inorganic farming. The biggest challenge today is feeding the growing population. Dr. Sanchez said that with the global population likely to reach 9.6 billion by 2050, it is highly alarming that the projected growth will mainly come from developing countries like the Philippines. Another dilemma is that despite the increasing yields due to fertilizer addition, global grain yield per ton of fertilizer used is already reaching a plateau. Data has shown that for every ton of fertilizer use, grain production does not change and has leveled off since 1975 (Figure 6). This can be attributed to the excessive mining of soils and the imbalanced application between N-fertilizers and other fertilizers. Because farmers tend to over apply urea, which only supplies nitrogen and disregards other macro and micronutrients, soils today are often depleted of the latter.

Table 4. Handling precautions of common fertilizers

Fertilizer	Handling Precaution
Anhydrous ammonia	Extremely irritating to eyes and respiratory system Inflammable and explosive Needs specialized equipment for handling
Urea	Hydroscopic and may cause irritation upon contact
Ammonium nitrate	Strong oxidizer and readily absorbs water Can be explosive when mixed with carbonaceous materials
Diammonium phosphate Monoammonium phosphate Triple superphosphate Single superphosphate Potassium sulfate Potassium chloride Potassium nitrate	May cause irritation; avoid excess dust and prolonged contact with the material

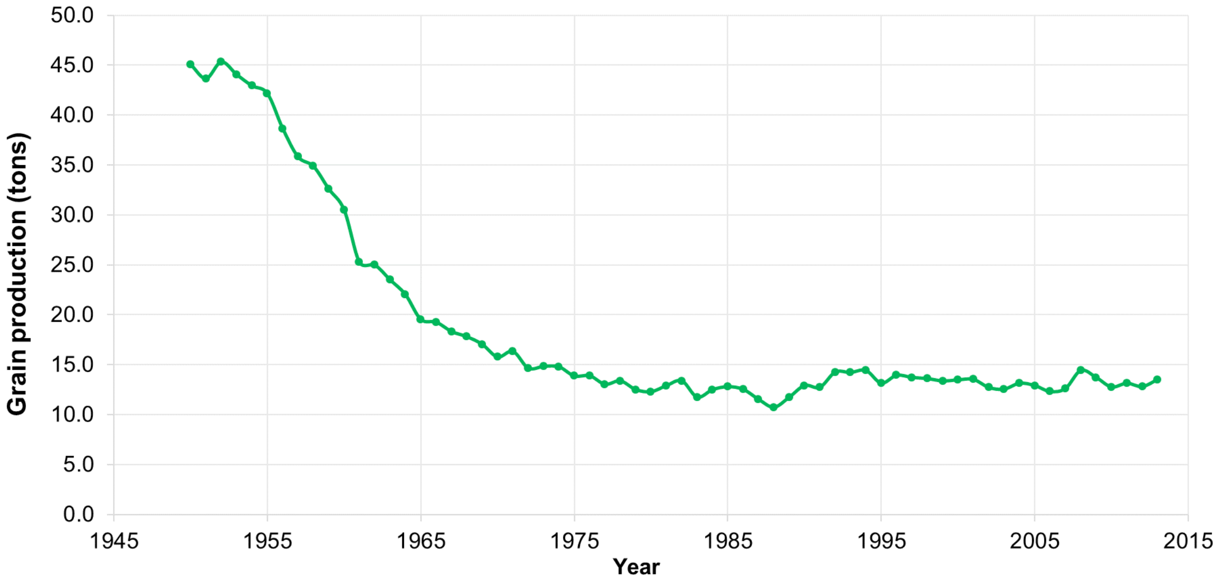


Figure 6. Global grain production per ton of fertilizer used (1950-2013)

To address this challenge, Smart Fertilizer Technologies are now the latest trend. Applications of biotechnology, nanotechnology, and nuclear technology in agriculture have the potential of increasing nutrient use efficiency and yield, while reducing their adverse ecological impact. For instance, with biotechnology, we are already able to use biofertilizers. With nanotechnology, there is a project where PCAARRD is developing nanofertilizers and they are now optimizing production and use in selected agricultural crops including rice, corn, vegetable, coffee, cacao, banana, sugarcane. Meanwhile, nuclear technology uses isotopes to monitor soil nutrient. There are also radiation modified fertilizers being developed.

Along with these new technologies, there are also diagnostic and decision support tools that are available to help optimize fertilizer use, particularly in distinguishing the appropriate amount and the correct timing of fertilizer use. These tools can help in achieving the 4Rs of Nutrient Stewardship. Examples include:

- Soil Test Kit (UPLB and BSWM)
- Minus One Element Technique (MOET) (PhilRice)
- Leaf Color Chart (LCC) (PhilRice, IRRI)
- Rice Crop Manager (RCM) (IRRI)
- Crop Optimized Recommendation for Nutrients (CORN) (Philippine Nuclear Research Institute)
- Nutrient Expert for Corn and Cassava (International Plant Nutrition Institute)

Just recently, the UN-FAO has released the International Code of Conduct for Sustainable Use and Management of Fertilizers. Called the Fertilizer Code, it is the result of an exhaustive consultation process, which was initiated in December 2017 until February 2019. It was finally endorsed by the 41st session of the FAO Conference in June 2019. The code is not only for chemical and mineral fertilizers, but also includes organic fertilizers such as livestock manures and composts and sources of recycled nutrients such as wastewater, sewage sludge, digestates, and other processed wastes.

Dr. Sanchez capped her presentation by saying that these are now the directions toward meeting the demand for more food to feed the growing population. She concluded, as Dr. Maghirang stated, that more funds are needed for R&D. This is why she said her team is thankful to DOST and PCAARRD for supporting the development of smart fertilizer technologies.

SCIENTIFIC BASES OF INTEGRATED ORGANIC AND INORGANIC FARMING IN THE PHILIPPINES

Dr. Eufemio T. Rasco

In providing the evidence for CAMP's stand, Dr. Rasco presented the scientific bases of integrated organic and inorganic farming in the Philippines. He began his presentation by presenting the key messages, so that the audience would not forget them.

First, contrary to popular perceptions, organic and inorganic farming basically adhere to the same science and ideology. There is no doubt that both camps believe in photosynthesis, respiration, DNA, and chromosomes; and whether they admit it or not, both of them modify nature to serve their own ends. Agriculture, by definition, involves the destruction of forests to grow crops and livestock.

Second, organics choose to study bigger and bigger parts of the universe by examining interactions of organism and ecosystems. Inorganics look at smaller and smaller parts of the universe, looking at interactions at the level of genes and molecules. One is holistic, the other is reductionist.

Third, the needs and preferences of humanity are sufficiently diverse to accommodate both farming practice. The world is big enough for both of them. Fourth, organic and inorganic farming are complementary in many ways. This industrial farming model initiated by inorganic farmers and adapted by conventional farmers will provide the need for high-volume, low-value products while the small farm-based models fostered by organic farmers will provide the need for low-volume, high-value, high-diversity products. Moreover, technology such as Bt eggplant developed by reductionist science can be useful to organic farmers as well. At the same time, biodiversity conserved by organics are needed as a source of raw materials of reductionist science such as molecular biology. Lastly, the challenge to society is how to nurture and promote the complementarity of both practices.

Dr. Rasco then defined the terms organic, inorganic, and conventional farming, which he used throughout his presentation. Organic refers to the almost exclusive use of naturally occurring biological resources and related technology for agriculture, with preference for renewable energy. Organic rejects synthetic chemicals such as fertilizers and pesticides, antibiotics, and GMOs. But some organic practices allow the use of non-synthetic inorganic chemicals. On the other hand, inorganic refers to the exclusive use of physical and chemical resources, whether naturally occurring or synthetic, including renewable and non-renewable energy and GMOs. Lastly, conventional can be seen as a combination of organic and inorganic. It does not discriminate between organic and inorganic farming practice, instead it integrates both practices. Economics, not biology, physics, or chemistry, is the main guide for decision-making in conventional farming.

Dr. Rasco presented a poster case of inorganic farming being done in container vans in Brooklyn, New York. It does not use soil and sunlight, is climate-controlled, and may not even need farmers in the traditional sense. It

The future of food: Why farming is moving indoors

By Russell Hotten
BBC News, New York

23 August 2019

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Tobias Peggs says the fledgling industry is still developing the right business models

This container van farm in New York is a poster case of modern inorganic farming.

relies on the use of artificial intelligence and robotics, among others. Meanwhile, an organic farming poster case in India, called Zero Budget Natural Farming (ZBNF) is currently being debated. It uses no commercial or external inputs.

Dr. Rasco discussed how organic and inorganic farming can be complementary. Organic farming in the Philippines today gets a boost from hobby farms, like those started by Mr. Villegas. These farms start as a backyard hobby while some evolved to agritourism farms. In fact, some sources claim that the Philippines is the leading country in agritourism in the Southeast Asian region. Most if not all of these farms aim to be organic. “Personally,” he said, “I hope that this trend will continue because it is a way of attracting young, idealistic people into farming. It matters less that the major income comes from entrance fees rather than the crops produced.”

On the issue of relatively low yields in organic farms, Dr. Rasco believes that this can be compensated by the higher prices that organic produce commands. Based on data from the US, organic yield is lower than conventional yield in both grain and vegetable crops, except sweet potatoes, which has about 50 percent increase in organic yields. What this means is that on the average, there are some crops that will perform better under organic than conventional farms. Dr. Rasco stated that he used US data because they are the biggest producer of organic products and may have a much better database than other countries. In the future, there can be islands of organic farms supplying food to local farmers’ markets, leading the way towards connecting agriculture with nutrition and care for the environment.

Dr. Rasco also admitted the sad truth that care for the environment and nutrition and health of consumers seem to be an afterthought of modern agriculture, caused by the industrial orientation and profit motive of mainstream farming. Based on the evolving bottom lines of farming, there is a need to hasten the evolution of farming into a practice that is committed to a higher purpose than mere profit. The old objective is still profit or income for farmers and other players in the value chain at the expense of nutrition and health of consumers, and the environment. This has been seen in the dominance of a few crops like rice, corn, and soybeans, which are best suited to industrial farming because they are relatively non-perishable and can be processed into many products. This industrial farming has taken its toll on human health. For example, the diabetes epidemic in the Philippines has been linked to rice consumption. It has also negatively affected the environment. For instance, 70 percent of diverted water is used for farming and pollution of Manila Bay has been linked to industrial-style farming in Central Luzon. For these reasons, it is quite alarming that industrialization of farming seems to be the path being taken by modern agriculture.

Dr. Rasco continued that there is also the emerging bottom line of concern for the environment, which is probably an offshoot of the environmental movement in the 1960s. Concern for the environment is the reason why goals such as nitrogen use, efficient resource use, and reduction of GHG emission is being pursued in industrial farming. This is also where organic farming started, particularly with concern for soil health in the late 19^{th} century. According to Dr. Rasco, today, we have a fairly new set of bottom lines: people or the nutrition and health of consumers and climate proofing or food security amidst climate change. Industrial farming aims to achieve better nutrition by improving the nutritional content of major crops like the biofortification of rice or the Golden Rice project. Organic farming also aims to achieve the same goal through agricultural diversification. If rice does not contain enough vitamin A, why not eat kangkong with rice instead of spending money on Golden Rice.

The presenter went on to say that industrial farming aims to contribute to food security amidst climate change by developing technologies such as alternate wetting and drying rice culture to reduce GHG emission. The organic movement response, on the other hand, is still crop diversification. If rice is devastated by typhoon or drought, sweet potato can come to the rescue. The recent water crisis around Mt. Banahaw shows images of rice farmers shifting to sweet potato production because they do not have water to plant rice.

Today, it would be ideal if organic farms gradually shift focus on fruits, vegetables, roots, and tubers that are locally adapted and part of traditional food systems, instead of high value crops. This will supply local markets, initially the health conscious middle-class that can afford the higher cost of organic produce. But as production costs drop, they can shift to locally adapted species such as kangkong, malunggay, kamote, saluyot, and alugbati.

Dr. Rasco cited an article from the *British Journal of Nutrition* on a global survey comparing the status of current evidence contrasting organic and inorganic farming technology. The results summarized in Table 5 show that the advantage of organic is in terms of lower pesticide residue, lower heavy metals, and higher antioxidants.

Dr. Rasco also envisioned that these islands of organic farms will also provide ecological services for the surrounding conventional farms. He said that this principle has been demonstrated in the highly successful ecological engineering project of IRRI and PhilRice, where plant species that reduced insect pest population are grown around rice

Table 5. Status of current evidence on contrasting farming technology

Criterion	Organic	Conventional
Yield	Low	High
Nutritional quality	Similar	Similar
Pesticide residue	Lower	Higher
Heavy metals	Lower	Higher
Antioxidants	Higher	Lower

fields. Meanwhile, in making use of the most advanced technologies for industrial scale production, conventional agriculture can supply grains such as rice, corn, and legumes, and other food stuff that are required in huge quantities and low cost for stable state, export, and industrial processing. In the cities where space is limited, urban agriculture based on controlled or soil-less environments can grow highly perishable high value crops such as salad crops for the upscale market.

From these examples, Dr. Rasco concluded that there is room for organic, inorganic, and conventional farming to co-exist for a long, long time. The diverse needs and preferences of consumers guarantee this. Ultimately, it is the consumers who will decide which farming practice will prevail, not the lawmakers such as those who passed the Organic Farming Act or chose to restrict biotechnology.

He then tackled the question: is organic farming basically unscientific? He said that there are many claims that organic farming is not evidence-based but this is only half true, as there are many versions of organic farming and we need to be sure which they are referring to. Some are more scientific or evidence-based than others, and some will prosper more than others. It is not convincing that the zero-budget natural farming in India can become mainstream anytime soon. Not because it is organic, but because its main claims are not supported by scientific evidence. Neither can monoculture organic farms operating in industrial scales can compete with conventional farms in producing grains and staples that are required in large quantities. The logistics of producing, transporting, and applying huge quantities of organic fertilizer, as shown in the slide of Dr. Maghirang, can be a major constraint and will work against the principle of self-reliance advocated by organic farmers. This uses a lot of fossil energy as well. The resulting higher cost cannot supply the need of the mass market for affordability and quantity; and large monoculture counters the diversification mantra of organic farming.

The speaker reiterated that scientists working on organic and inorganic farming adhere to the same scientific truth. The difference is they choose to push different branches of science. One is holistic, looking at bigger and bigger things: organisms, landscapes, and ecosystems. The other is reductionist, looking at smaller and smaller things, molecules and atoms, discovering and manipulating cell functions. Both believe in the science of photosynthesis, respiration, plant nutrition, and soil microbiology. Both also believe that farming has the net effect of removing nutrients from the soil that needs to be replenished. They differ in the manner that the lost nutrients are restored. Both also believe that some kind of protection is needed against pests, but differ in the manner by which protection is provided.

Both also believe that the key to providing the food needs of the growing population in the light of declining resources and climate change is a more efficient photosynthesis; but they differ in the manner by which this can be achieved, Dr. Rasco said. He expained that the inorganic farming sector will try to invest in C4 rice to cope with climate change, while organics will likely switch to corn, which is already C4, during the dry season; and plant rice during the wet season. Or they may switch to cassava and banana, which are better adapted to weather extremes. These differences in adaptation are the reason why banana and root and tuber crops evolved in the tropics and grains evolved in temperate countries. The crucial question is whether or not consumers are prepared to make similar switches in their diet. Will consumers prefer to eat banana, cassava, and kamote instead of rice?

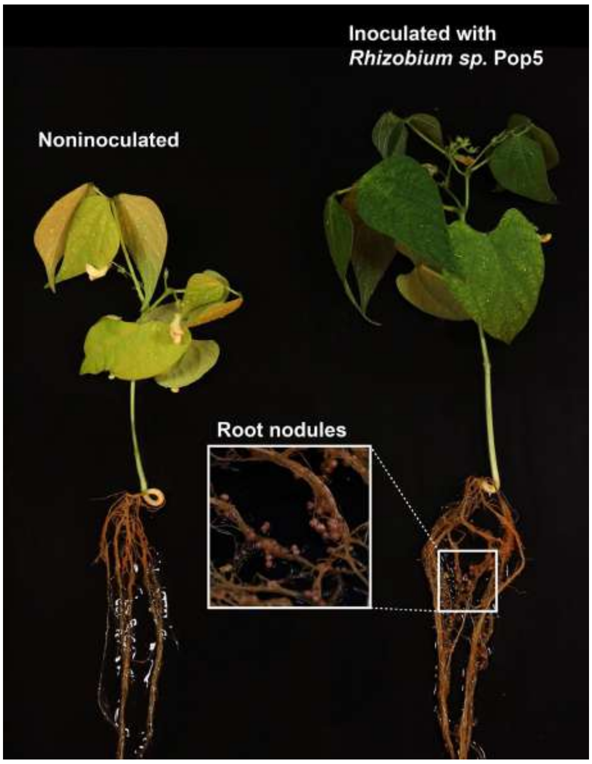
For consumer health and nutrition, science is on the side of organics. But consumers are not rational, they gamble with their health, defying science.

The most important distinction between organic and inorganic is not in the science but in the technology. Organics put emphasis on recycling and the need to nurture soil health relying mainly on biology. Inorganics put emphasis on manufactured fertilizers that have a higher nutrient density and are more suited for global trade. Inorganics work on unhealthy soil by treatment rather than prevention with practices like crop rotation and diversity. For crop protection, organics prefer to utilize natural biological mechanisms such as plant resistance and natural enemies of pests such as in ecological engineering; inorganics rely on chemical pesticides. The distinction is not so simple, as both sectors utilize crop resistance for pest management, but organics do not accept the use of GMO for this purpose.

Dr. Rasco also noted the similarity between the evolving science of plant health and current trends in human health. The organics sector emphasizes on staying healthy with proper diet, exercising, and living a healthy lifestyle to strengthen body defenses against pathogens and prevent metabolic disorders leading to chronic diseases. In contrast, inorganics depend on drugs, surgery, radiations, and vaccines, which is the mainstream medical practice. But in the end, even the healthiest lifestyle can result in infectious disease, as it is not only dependent on the host but also on the pathogen. Thus, mainstream medicine has a role in the treatment of infectious diseases. In the same manner, organic farming practices have a role to play in conventional mainstream farming. Organic farming has a role not necessarily in producing more nutritious or healthier food, as the nutritional advantage of organics is not supported by data, but the diversity of the diet. This is an assurance that the whole range of food functions can be supplied, including the strengthening of body defenses and rehabilitation for disease. This shows that it is best to utilize all tools available.

Dr. Rasco then addressed the purported conflict in ideology, which he questioned. Both organic and inorganic sectors believe that humankind has a role to play in working with nature to serve his needs, he asserted. The difference is in the degree and level of biological organization where intervention is practiced. For instance, GMOs that conventional farmers use are actually based on natural biological practices that scientists have hijacked to achieve direct modifications of plant GMOs at the molecular level. On the other hand, biological fertilizers preferred by organics are naturally occurring microorganisms. To illustrate, Dr. Rasco presented a photo that shows plant protection benefits from biofertilizers. *Rhizobium* sp. Pop5 not only fixes atmospheric N but also has the potential to protect the plant by producing phazocilin, a new class of antibiotics.

Lastly, Dr. Lasco posed a final question: how can we ensure that both organic and inorganic farming thrive without destroying each other? His answer is that we must first compensate organics for providing the ecological services for conventional farms. This is already being done through the higher prices of organic products. Second is adopting evidence-based policy of promoting integration rather than competition. For example, why should organic farming



The bacterium that produces the antibiotic phazolicin forms nodules on bean plant roots, resulting in a more robust plant (right) than on the left. (Photo: Dmitrii Y. Travin)

law discriminate against Bt eggplant just because it is a GMO? Bt eggplant is a useful technology even for organic farmers, as it reduces the use of toxic pesticides. Last is the policy on the value of human labor versus machines. One of the reasons why organic produce is expensive is that it is labor-intensive. The complex decision making and highly diversified and integrated organic farms coupled with the smaller scale operations dictated by the relatively small local markets organic farmers have decided to serve do not justify mechanization. To cope with this, one solution is to use government subsidies to train people rather than purchase machinery or to legislate higher wages in organic farms.

Dr. Rasco stated that this may take a long time, as other things distract the government. But he is inspired with how young people are no longer waiting for the government to act. Young professionals now gamble with the high opportunity cost to engage with the low profit and high-risk occupation of organic farming, of which Mr. Villegas is one example.

To end his presentation, Dr. Rasco repeated the key messages of his presentation:

1. Contrary to popular perceptions, organic and inorganic farming basically adhere to the same science and ideology.
2. Organics look at nature with a wide angle lens; inorganics with a zoom lens.
3. The needs and preferences of humanity are sufficiently diverse to accommodate both farming practices.
4. In many ways, organic and inorganic farming are complementary.
5. The challenge to society is how to nurture and promote complementarity of both practices.

ENJOYING THE BEST OF BOTH WORLDS: MAINSTREAMING ORGANIC PRACTICES IN CONVENTIONAL AGRICULTURE
Dr. Emil Q. Javier

To start his presentation, Dr. Javier stated that its title already suggests the conclusion: that in fact we can get the best of both worlds and make them both work in the Philippine context. His presentation outline included a discussion on the challenges or the three "No's" of organic farming, with the end being conciliatory.

He presented the definition of organic agriculture that the International Federation of Organic Agriculture Movements (IFOAM) is using:

> Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity, and cycles adapted to local conditions, rather

> than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation, and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

Dr. Javier said that there is nothing to disagree with in this definition. Its purpose is noble, including concern for the people and environment, equity, and quality of life. But he also added that this is not a monopoly for people advocating organic farming. All of those in agriculture share these noble purposes. Both organic and conventional agriculture share so many things in common, including science-based sustainable practices. These include land preparation, soil erosion control, and weed management using reduced or no tillage and mulching with crop residues and biodegradable plastics. In fertilization, compost manuring with crop and livestock residues and green manuring with legume cover crops is not the monopoly of organic farming, as they are also practiced in conventional farms, as well as the use of beneficial soil microorganisms like *Rhizobia* and *Mycorrhiza*. In pest management, both use resistant varieties developed through conventional breeding, crop rotation to interrupt pest and disease cycles, mixed cropping, biological pest control, and insect traps. Even if there are differences, the greater part is common to both business models and to infer that organic agriculture has monopoly of these practices is not quite correct.

The original contention and the point of divergence is also in the definition, with the phrase "*rather than use of inputs with adverse effects.*" Dr. Javier explained that the locus of conflict between organic versus conventional agriculture is that organic agriculture has already labeled inorganic inputs as causing adverse effects in its operational definition. In operationalizing this phrase, organic agriculture systems completely ban the use of synthetic chemical fertilizers, pesticides, and GMOs. From this, Dr. Javier concludes that the complete ban of fertilizers is an overreaction and unnecessary. There is a need to replace minerals (N,P,K, Mg, Ca, etc.) extracted by crops from the soil, otherwise agriculture becomes an unsustainable industry like mining. They can be replaced with organic or inorganic materials, or both.

Dr. Javier then showed evidence that chemical fertilizers are not inherently bad or wrong, particularly the long-term experiments conducted in fields in the Rothamsted Experimental Station in the UK since 1843, in the Morrow Plots in Illinois, US since 1876, and more recently, the IRRI Chandler Plots in the Philippines since 1963. These plots have been planted with various fertilized crops like rice, corn, and soybean and all fields are still productive. This shows strong evidence that chemical fertilizers are not necessarily bad. Of course, we must recognize the consequences of acidification, salinization, among others;

but these ill effects are not only due to chemical fertilizers. The same bad consequences can be obtained with organic fertilizers. For example, they are already encountering problems in Holland with dairy manure and in Denmark with hog manure. When you put excessive fertilizers, whether organic or inorganic, there can be adverse consequences.

There are also limitations to organic fertilizers. Dr. Javier gave examples, some of which were also mentioned by the other speakers, including:

- Low nutrient density; need to apply high volume per hectare;
- Not always available in the amounts needed, and could be expensive (chicken manure, vermicompost);
- High logistics and energy costs in assembly, transport, and application;
- Mineralization (nutrient release) is not always in synchrony with the spike of crop demand for nutrients - very true for annual crops, but not as demanding of tree crops; and
- More expensive per unit kilogram of nutrient.

Dr. Javier then showed a graph (Figure 7) from the USDA illustrating the results of meta studies, which shows that the yield penalty for organic agriculture is true. He mentioned the he preferred this data, rather than those from the Rodale Institute, which is a proponent of organic agriculture. The graph shows that yield penalty of organic fertilizer is especially strong on annual crops like rice and corn, while perennials, as well as pasture crops, are less affected.

However, Dr. Javier affirmed that organics supply benefits not provided by chemical fertilizers. These include organic matter, which improve soil structure for aeration and drainage; beneficial soil microorganisms (but also deleterious ones); and essential trace elements. Therefore, the most judicious approach is a balanced mix of organic and chemical fertilizers. Because of this, Dr. Javier expressed that he was very happy when Mr. Villegas advocated for balanced fertilization towards the end of his presentation.

He concluded that the complete ban of synthetic chemicals and pesticides by organic agriculture is idiosyncratic and at times contradictory. A chemical is synthetic if it does not already exist in the natural world, but organic standards also prohibit compounds existing in nature if they are produced by chemical synthesis. Prohibition is not only based on the nature of compound but also in the method of production. However, it is true that botanical pesticides are usually milder and more benign to humans. But then again, they are not as effective and would require more repeated applications; and are therefore more expensive.

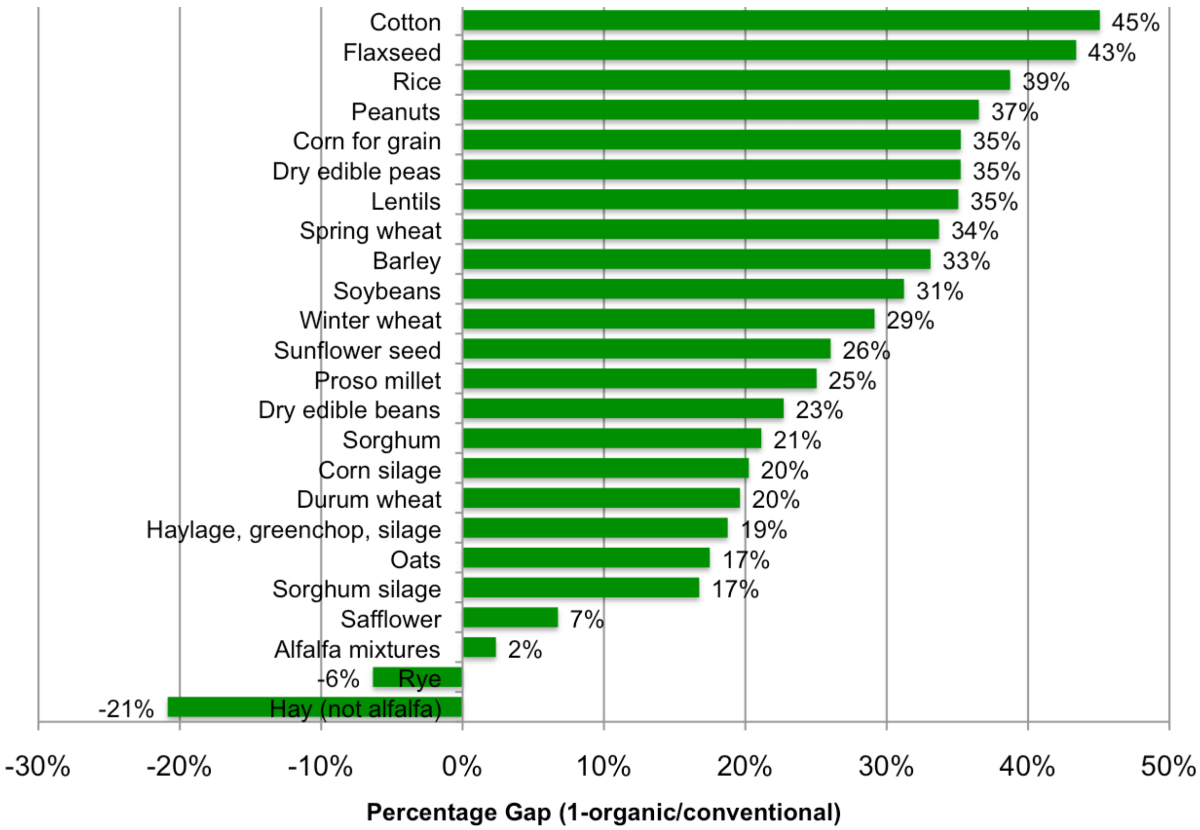


Figure 7. Organic yield gap for US row crops (2014)

Nevertheless, Dr. Javier said that organic pesticides are not always safe or safer than their chemical counterparts. For example, copper sulfate is a popular fungicide in organic agriculture; it is also a heavy metal. According to the LD50 toxicity measure, if you have 300 mg of copper sulfate per kilogram of body weight, half of the population dies. On the other hand, the chemical fungicide Mancozeb, which is banned by organic agriculture, is 15 to 37 times safer. Methyl bromide in organic strawberry production is also toxic to humans and a known carcinogen. Pyrethrins from chrysanthemum flowers are relatively one of the safest insecticides in the market but are very toxic to bees and aquatic life. Same with Rotenone from the derris plant, which is mildly toxic to humans but extremely toxic to insects and aquatic life. It is also associated with Parkinson's disease. These organic pesticides may be benign to humans but are highly toxic to other forms of life. Therefore, organic pesticides are safe most of the time, but not always safer.

Dr. Javier also asserted that there are no scientific bases for banning GMOs. He presented formal declarations from reputable national and global institutions stating that GMOs are safe, including from the World Health Organization, European Commission, The Royal Society (UK), American Association for the Advancement of Science, and the National Science Academies.

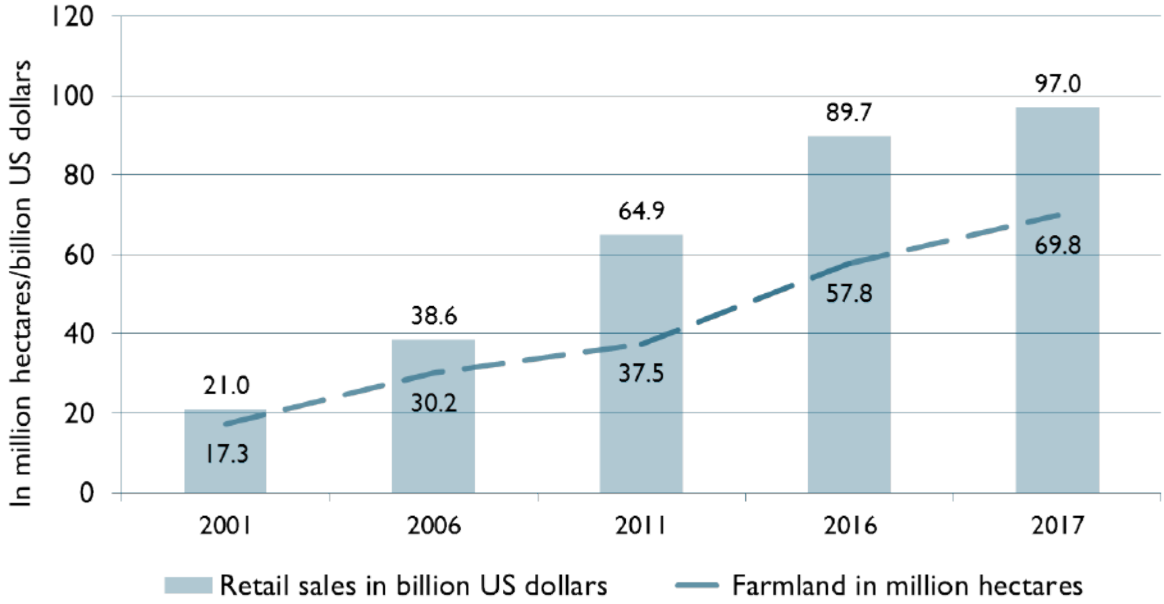


Figure 8. Growth in organic food and drinks sales and farmland (2001-2017) (Source: FiBL-IFOAM-SOEL Surveys 1999-2019)

He expounded on data put together by the International Service for the Acquisition of Agri-biotech Applications (ISAAA). He said that over 70 countries have been adopting GMOs since 1996 and that there are 191.7 million ha of biotech crops around the world. Further, there is no single instance of poisoning or any other alleged negative effects from GMOs. This is proof that GMOs are safe and acceptable, he said.

Dr. Javier then discussed why organic agriculture should be taken seriously. Despite their challenging claims, organic agriculture is a fast-growing business model globally. Almost 70 million ha or 1.4 percent of farmlands are now devoted to organic agriculture (Figure 8). Most of the farms, however, are permanent grasslands mainly in Australia. A smaller fraction are permanent crops and arable land crops.

There is also fast growth in the market with USD 97.8 billion organic foods and beverages in 2017, which is 4.1 percent of total world agriculture produce. The Philippines also has the distinction of being among the countries with the highest number of organic farmers, with India being the top country (Figure 9).

In reality, there are two opposing world views on the future of agriculture. On one end is mainstream conventional agriculture, which provides the bulk of food for humanity. At the other end is an organic future, which purports to redress the downsides of conventional chemical agriculture. It is also a reality that there is still a small but rapidly growing demand for organic produce in the developed countries. We are faced with the relentlessly increasing demand for food by the increasing population, rising incomes, and urbanization; but

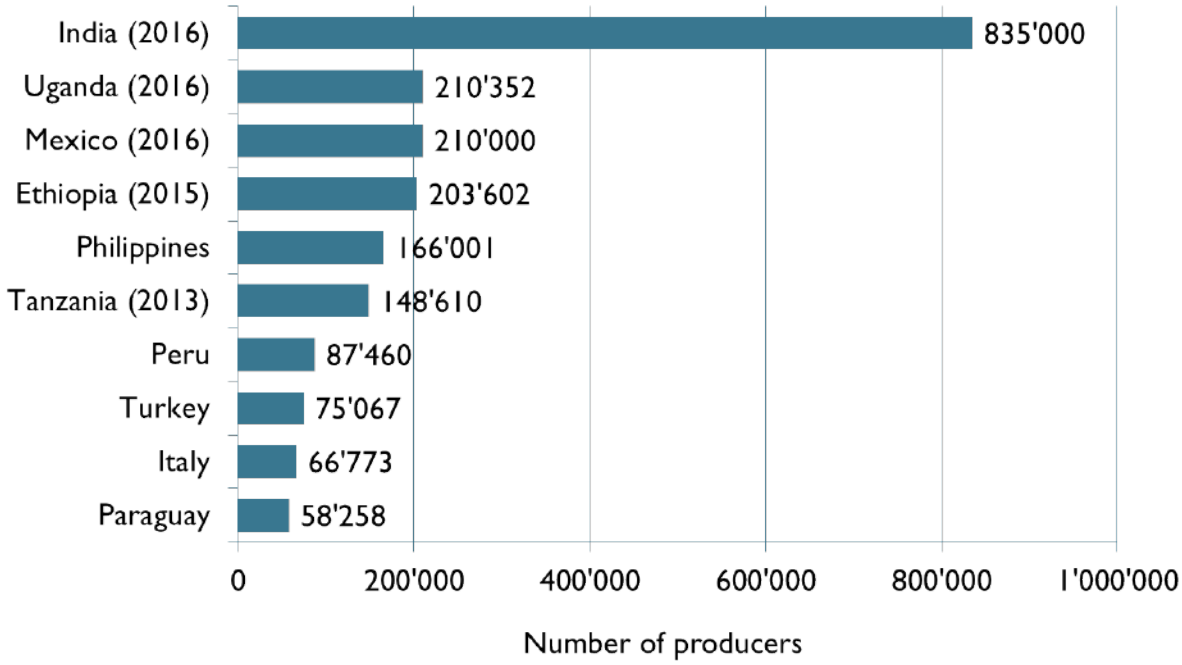


Figure 9. Top 10 countries with the largest numbers of organic producers (2017) (Source: FiBL Survey 2019)

increasingly with less land, water, and biodiversity. There is a need to feed the earth's nine billion people by 2050, Dr. Javier said.

He then discussed continuing advances in biochemistry with pesticides, which are more target-specific and least toxic and persistent or Category IV pesticides. In fact, there are no more Category I, and very few Category II pesticides—because producers know that they can go out of business if they continue to produce these harmful products. More and more, pesticides in the market are now Category IV. At the same time, there are advances in genome editing and synthetic biology, which will further raise productivity ceilings, produce new products, new tools to address old problems, and new industries that, unfortunately, will not pass under the organic label as legislated now. For example, we already have the impossible burger which uses an organism to produce the red protein in meat. These are non-GMO, but even in Europe, they classify genome-edited organisms as GMO.

Locally, in the Philippines, the painful reality is that in 20 years, there will be more and more poor Filipinos. We are also faced with the reality of further worsening per capita availability of arable land and water. It is imperative to dramatically raise productivity per hectare and per kilogram of available water at a cost affordable to the poor. However, it is a fact that organic produce is more expensive. If only organic products will be available in the market, more Filipinos will be more food insecure.

Nevertheless, it should be recognized that there is still a small but rapidly rising demand for organic products by affluent consumers in urban centers and for the export market that Philippine agriculture is yet to tap. Thus, the position in CAMP is that there is a niche for some farmers to become highly efficient organic producers to meet the requirements of the affluent consumers; as well as to grab a market share of the global demand for organic produce.

In his conclusion, Dr. Javier observed that while the forum speakers did not consult amongst themselves, their presentations asserted the same views. The two modes of production need not be mutually exclusive and a lot of sustainable, science-based practices are common to both. With enlightened moderation from both sides, the two domains of agriculture practice can co-exist. As concluded by Pamela Ronald and Raoul Adamchak in their book *Tomorrow's Table: Organic Farming, Genetics and the Future of Food*, "Truly sustainable agriculture (that can also feed a world with nine billion people in it) may only arise from the merger of organic and GM/conventional techniques."

Dr. Javier then recommended the following strategic directions for conventional agriculture in the Philippines. He noted that the known downsides of conventional farming do not yet prevail in the Philippines. Fortunately, Philippine conventional agriculture has yet to reach the excesses attributed to monocropping and petroleum-based farming. In fact, rice fertilization remains low. Ironically, the excesses are with organic fertilizers, particularly the use of chicken manure in vegetables in Baguio. Therefore, in the future, conventional agriculture needs to pay more attention to agroecologically sound practices espoused by organic farming, including integrated nutrient management, integrated pest management, multiple cropping, and increasing investments in drip irrigation. Dr. Javier emphasized the importance of drip irrigation, especially in addressing decreasing water supply for agriculture.

On the side of organic farming, the main issue that needs to be addressed is the challenge of inclusivity. Smallholder organic farmers find it hard to participate, and this limits organic farming to rich farmers or conglomerates. In fact, in the US, big agricultural companies have already taken over organic farms. This too can happen in the Philippines if steps are not taken to ensure that small farmers are able to participate in the profitable organic agriculture business.

Another recommendation is that organic agriculture needs to be less doctrinaire with regards to new benign pesticides and biostimulants, and to stop the complete ban on such products. The world of science continues to move on and inorganic products already exist that are more benign to people and the environment but are still not accepted by mandated organic standards. At the same time, organic farming needs to be open to genome-edited and synthetic biology products which are non-GMOs. Other issues that contribute to the lack of inclusivity of organic farming and the bias against small organic farmers include:

1. Prohibitive costs of third party ratification/certification;
2. Lack of access to profitable markets, both domestic and export; and
3. Insufficient knowledge and lack of relevant technologies in an admittedly knowledge-intensive subsector.

To address these, Dr. Javier recommended the following:

1. Institution of participatory guarantee systems (PGSs) as affordable alternative to third party certification;
2. Consolidation of small organic farmers into cooperatives and their formal inclusion in supply chains as partners and contract growers, similar to the recommendation of Mr. Villegas; and
3. Dedicated R&D for locally adapted organic methods and practices.

To illustrate the great opportunities and challenges of organic farming, Dr. Javier talked about organic coconut production in the Philippines. There is a huge opportunity for coconut water and coconut milk to grab a share of the huge global market for beverages and health drinks. The great advantage is that coconut water and coconut milk are organic, and are counted among traditional food in the Philippines. At the same time, there is extra opportunity to raise coconut farmers' income by intercropping high value crops under coconut trees, like vegetables and coffee. This, however, would require supplemental soil nutrients from organic sources such as chicken manure and legume cover crops. Producing organic coconut milk and coconut water in volumes will give the country a competitive advantage in the global health drinks market.

According to Dr. Javier, this is an example of how the two types of agriculture may marry and how scientists may help in the finding the best of both worlds. Similarly, ideas such as this are an example of how CAMP can help push or demonstrate that we can make the best of both organic and conventional agriculture complementing each other.

OPEN FORUM

The questions raised and the responses from the speakers were as follows:

QUESTION 1:

Dr. Ben Pecson: It is well accepted that yield from organic agriculture is lower and some people are saying that if you are concerned about climate, then you should not buy organic farm products because yield is lower and it also cuts forests for farming. How will you address this issue?

Mr. Villegas: Yield from organic farming in the beginning is really low, but this improves after two to three croppings. This is why balanced fertilization is recommended for organic in-transition farms. That said, the real solution to climate change is to plant trees and food crops to encourage photosynthesis and absorption of CO_2. At the same time, you will have food from crops and from trees.

Dr. Pecson: If you are saying that organic farming can have the same yield as conventional farming after two to three years, the data showed by Dr. Javier disproves that. The data show that over many years, organic farming has not been able to show an increase in yield, except for sweet potato.

Mr. Villegas: From our experience, and this is for lettuce, arugula, tomato, and similar types of crops, the effect of organic farming is additive unlike chemical fertilizers. As Dr. Maghirang mentioned, we must understand the symbiotic relationships and what is going on between the organic concoctions and the crop itself.

Dr. Pecson: While this is your experience, we still have to consider the data which shows wordwide experience over a long span of time.

QUESTION 2:

Participant: Taking coconut aside, which is organic and naturally grown, when you go to farmers they are always after "what's in it for me?" or what they can get from one hectare. Right now, when you talk of organic farming, people usually think about lettuce, cucumber, and french beans. But production of these high value crops is not enough to support a production outfit, processing line, or an export market.

Rather, we should attach organic farming with crops that will give high value and that is needed by the country. A major example is garlic. Most of the garlic we consume is imported from China. This is also the same garlic being imported to the EU, but there are four major differences. First is the price. China garlic sold in the EU is cheaper, even though we are only two to four hours away from China while EU is 14 hours away. The second difference is that when analyzed, our garlic has a lot of pathogens and microbes. This low quality garlic still goes to the market, primarily because of the garlic cartel and other means that allow such products to enter even with a phytosanitary ban.

Now, in a meeting with Agriculture Secretary William D. Dar and the Indian Ambassador, I explicitly asked the Indian government to help us with 14 established varieties of garlic. We can fight the cartel by simply increasing our yield. There is misconception that garlic can only be grown successfully in the north. The average yield of garlic is only two to two-and-a-half tons per hectare. The best garlic harvest in the north is four tons, while yield in India averages 14-15 tons per hectare. Even if we increase yield to only eight tons, this is still better than planting rice. This spells PHP 150,000 to PHP 200,000 in four weeks per hectare. At PHP 200 per kilo farmgate price, this is already PHP 1.2 million per hectare.

Why don't we consider and concentrate on high value vegetables like garlic and help the farmers improve their livelihood? Let us forget about lettuce. In my experience as an organic farmer, we are harvesting large volumes of lettuce. Our market is the Ayala group and Healthy Options, but this is still very small. We cannot penetrate the Hong Kong market because of the very short shelf life of lettuce. If you cannot get the cargo on the plane in two to three hours, the lettuce will be wilted; while garlic will last for six months. Why don't we concentrate on this?

Dr. Maghirang: Our average yield for garlic is about 3.2 tons per hectare. We can get five to eight tons per hectare depending on soil nutrition, since we mostly use inorganic fertilizer. Garlic yield is also highly dependent on location, as it is highly susceptible to disease. Windy areas are safe and have high yields, but farms in other locations have lower yields of about one to two tons. Moreover, the garlic varieties in India may not be suitable to our country.

Participant: On 19 October, the President of India is coming to the Philippines and one of the Memoranda of Agreement (MOA) that will be signed, and I am one of the signatories, is a joint MOA for garlic production. I am looking at IPB to give seeds for testing. Two to three years ago, DA was given a lot of garlic planting materials, but they got lost. Now, with Sec. Dar, we have come

come up with an agreement and we are already working towards the shipment of these planting materials. In fact, we are also looking at farm trials with our research group.

Dr. Tito Contado: May I add other high value crops: turmeric, black pepper, and malunggay (Moringa). I would also like to talk about the efficiency of farming in the world. In 1990, China declared that they are feeding 52 percent of the world population with only seven percent of world's arable land.

QUESTION 3:

Dr. Florencio Mauricio (to Dr. Villegas)**:** Are you using vermicast as a fertilizer?

Mr. Villegas: Yes, we are using vermicast with vermicompost. We also use vermicast to produce vermi-tea, which is one of our organic concoctions. We also have fish amino acid.

Dr. Mauricio: My experience on the practical use of earthworms is, when I introduced earthworms to produce vermicast for our tree farm composed of forest and fruit trees in Agusan del Sur, the trees grew very fast.

Participants raise their questions during the open forum.

CLOSING PROGRAM

To close the program, Dr. Ruben L. Villareal, former UPLB Chancellor, SEARCA Director, plant breeder, and currently CAMP board member, summarized the forum. He congratulated the members of the organizing committee, chaired by Dr. Contado, and its members Dr. Ricardo M. Lantican and Dr. Rogelio V. Cuyno. He also commended the forum secretariat led by Ms. Virma Rea G. Lee and acknowledged SEARCA as forum host and PCAARRD as partner.

Dr. Villareal mentioned two things that to him made this forum stand out. First, he said that this is the only forum he has attended that did not impose time limits on the speakers. Second, everyone stayed from the beginning until the end because of their interest in the topic and the quality of discussions.

In summary, he said that Dr. Maghirang and Dr. Sanchez covered the basics of both organic and inorganic farming, and shared new information and insights on the issues surrounding the two practices. Mr. Villegas provided an excellent example of organic farming. Meanwhile, Dr. Rasco and Dr. Javier provided insights about enjoying the best of both worlds of organic and inorganic farming.

Pointing out the brevity of his summary, Dr. Villareal said that everyone may look forward to the forum proceedings that SEARCA is preparing and PCAARRD will publish.

The program ended with CAMP's presentation of tokens of gratitude to the forum speakers and partners.

Dr. Villareal summarizes the forum presentations during the closing program.

SPEAKER PROFILES

The forum speakers included National Scientist Dr. Emil Q. Javier, who gave a presentation on Mainstreaming Organic Practices in Conventional Agriculture; and Dr. Eufemio T. Rasco, Jr., who talked about the Scientific Bases of Integrated Organic and Inorganic Farming in the Philippines. On the side of organic agriculture, Dr. Rodel G. Maghirang, IPB Director, discussed the Science and Practice of Organic Farming; while Mr. Pablito M. Villegas, an organic farming practitioner and entrepreneur, shared his Experiences and Advocacies of Organic Farming. Dr. Pearl B. Sanchez, director of the Agricultural Systems Institute at UPLB CAFS, presented the Science and Practice of Inorganic Farming

This section presents a short profile of each of the speakers.

DR. EMIL Q. JAVIER

Dr. Emil Q. Javier, conferred as National Scientist by the President of the Republic of the Philippines on 7 January 2020, is a Filipino agronomist with a broad understanding of developing country agriculture. He was the first and only developing country scientist to chair the Technical Advisory Committee of the prestigious Consultative Group for International Agricultural Research (CGIAR), a global consortium led by the World Bank and the Food and Agriculture Organization of the United Nations (UN-FAO) (2000). He was Director General of the Asian Vegetable Research and Development Center (AVRDC) based in Taiwan and has served as Chairman of the Board of the International Rice Research Institute (IRRI). He also served as Chairman and Acting Director of SEARCA. In the Philippines at various periods, he was President of the University of the Philippines (UP) in 1993-1999, Minister of Science and Technology (1981-1986), President of the National Academy of Science and Technology (NAST) (2005-2012), and Chancellor of UPLB (1979-1985). Dr. Javier holds doctoral and master's degrees in plant breeding and agronomy from Cornell University (1969) and University of Illinois at Urbana-Champaign (1964), respectively. He completed his bachelor's degree in agriculture at UPLB (1960).

Dr. Eufemio T. Rasco, Jr.

Dr. Eufemio T. Rasco, Jr. has led institutions and projects involved in a wide range of research and development activities covering plant breeding, variety evaluation, crop physiology, and environmental and agronomic studies. He led and worked in the academe with UPLB and UP Mindanao, the private sector with East West Seed Company, the government with the Philippine Rice Research Institute (PhilRice), and international agricultural research institutions such as the International Potato Center. Among his pioneering and notable work involve tropical vegetable hybrids, potato, sweet potato, and neglected species such as sago palm and nipa palm. Commercial adoption of his East West Seed Company vegetable hybrids was widespread (global), fast, and record-breaking in market domination with more than 30 years in some cases. These have benefitted millions of farmers and hundreds of millions of consumers. He has also published about 100 journal articles and five books as main or co-author. Upon retirement from the academe, he shifted his focus to studying connections between agriculture, nutrition, and environment.

Dr. Rasco is an Academician at the National Academy of Science and Technology (NAST).

Mr. Pablito M. Villegas

Mr. Pablito M. Villegas has gained national and international reknown as a top-notch professional and techno-manager in the field of rural finance, agricultural and rural development, and value chain management. He started as a poor farm boy who obtained a degree in Agriculture from UP in 1969 and master's degree in Agricultural Economics and Agribusiness from the University of Georgia, USA in 1994.

He worked professionally at the UP Department of Agriculture and the Land Bank of the Philippines, as well as in 20 countries globally. In 2003, he came full circle by returning to the farms, as owner-operator of an 8.8 hectare family farmland. He also led the rural cum agricultural cooperative movement as a social entrepreneur and agriculture mentor in the organic agriculture movement. He is part of the Go Negosyo Mentor ME Program, as well as the Philippine Chamber of Agriculture and Food, Inc.

Mr. Villegas has had more than 40 years of experience as an agricultural research planner and implementer; a development banker; and as an international consultant and Chief Technical Advisor for several international institutions such as the UN-FAO, United Nations Development Program (UNDP), World Bank, Asian Development Bank (ADB), European Union, United States Agency for International Development (USAID), and as part of international consulting firms operating in the United Kingdom, Belgium, Netherlands, Japan, New Zealand, Australia, Spain, USA, and the Philippines. Mr. Villegas remains a registered consultant of the above organizations and now a gentleman farmer and social agritourism entrepreneur.

Dr. Pearl B. Sanchez

Dr. Pearl B. Sanchez is a Professor of Soil Science and currently the Director of the Agricultural Systems Institute of the College of Agriculture and Food Science (CAFS) at UPLB. She obtained her PhD in Soil Science at the University of New England in Australia, MS in Soil Science minor in Agricultural Chemistry and BS in Agricultural Chemistry at UPLB. Her research covers soil chemistry, nutrient management, fertilizer formulation, and soil and water quality monitoring. She is involved in various collaborative projects dealing with the inter alia optimization of the production and use of NPK nanofertilizers, soil and nutrient management strategies for improving tropical vegetable production in Southern Philippines, and smarter approaches to reinvigorate agriculture as an industry (SARAI Phase 2). Her work and leadership in research has led to a vast network of national and foreign linkages.

Dr. Rodel D. Maghirang

Dr. Rodel D. Maghirang is vegetable breeder and current director of IPB at UPLB CAFS. He has developed more than 40 varieties of vegetables such as eggplant, garden pea, cowpea, snap beans, sitao, cucumber, roselle, squash, and other vegetables. Due to his outstanding accomplishments in vegetable breeding, Dr. Maghirang was requested in 2003 to serve at the DA as a special assistant to the undersecretary for operations until 2005. He was also at the helm of national programs on vegetables and high value crops such as National Vegetable Research, Development, and Extension Network; Ginintuang Masaganang Ani-High Value Commercial Crops Program; and Organic Vegetable Research, Development, and Extension.

He earned all of his degrees from UPLB, namely, BS Sugar Technology in 1977, and MS and PhD in Plant Breeding in 1985 and 1993, respectively. He has two post-doctorates: one on molecular biology from the University of Queensland, Australia, and another as a visiting scientist at the Asian Vegetable Research and Development Center.

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