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Filipino Plant Scientists' Answer to STAND 2000*

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Introduction

Participants at a planning conference held in 1988 at the UPLB College of Agriculture characterized Philippine agriculture at the end of this century in the following statement (Villareal 1988): "The trend will be toward smaller, more diversified, and intensively cultivated farms, and Philippine society will rely less on the agricultural sector than on industry and the service sectors for its gross national product.... Unless better policies protect farmers, agriculture will continue its present practice of exporting a lot of raw materials instead of finished products."

Two years later, on Jan. 27, 1990, a similar group participating in another workshop added the following features (Rasco *et al.* 1990). . . "Sustainability of production capacity, and a commercial rather than a subsistence orientation. It is also expected that these farms will be producing sufficient quantities of the basic commodities such as staple foods for the farmers' use, and will be producing a substantial surplus of all products where they have a comparative advantage. Exportable surplus will be shipped in completely processed form to achieve the value added advantage."

Thus, it is generally hoped that small-scale farmers of the future will have more compact farms which will also be more productive, since they will be more diversified and more intensively cultivated than those of today. Farm products will be processed domestically to achieve the value added advantage. This will be accompanied by a change in orientation from subsistence farming to commercial or market-oriented agriculture.

With the aforementioned scenario of Philippine agriculture, what should be the goal, objectives and strategy of Filipino plant scientists?

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The Goal

Improved economic and social status of present and future generations of Filipino farmers and consumers, particularly those with low incomes.

The Objective

To generate and disseminate plant-related knowledge and technology of short- and long-term environmental, social, and economic benefits and to help enhance a national research system for various plant species.

The Strategy

To increase production efficiency and sustainability in all growing environments through appropriate science and technology.

SIGNIFICANT ACHIEVEMENTS

Crop Varieties

Rice. In 1992, two rainfed lowland rice varieties (PSB Rc-12 and PSB Rc-14) were released in collaboration with the Philippine Rice Research Institute. These varieties are adapted to rainfed droughtprone areas. PSB Rc 14 is very popular in areas where rice tungro virus is not serious even under irrigated lowland conditions. Further, PSB Rc 14 has good eating quality. Other rice varieties like UPL Ri 5 and UPL Ri-7, both high-yielding upland varieties, have been released through the Philippine Seed Board and are now commercially grown by farmers in the country.

Corn. One significant breakthrough has been the successful containment of the downy mildew disease which has caused losses of about P1 billion annually. Development of downy mildew-resistant varieties through genetic means and a breakthrough in chemical seed treatment with metalaxyl have resulted in savings for the corn industry of about P100 million annually.

High-yielding open-pollinated varieties (OPV's) like IPB Var 1 (Ginintuan), IPB Var 2 (Tanco White), IPB Var 4, IPB Var 5, and IPB Var 7 have been grown by farmers on thousands of hectares. In 1993 (GPEP), at least 15,000 hectares were planted to IPB OPV's. In some farms, actual yields of 4 to 5 t/ha under appropriate farm management were obtained. One advantage of the use of OPV's is that farmers can save seeds from their previous crop and maintain the desired level of productivity.

A very recent significant breakthrough is the development of high-yielding and pest-resistant hybrids. In 1992, IPB released IPB 913, its first yellow corn hybrid, which gave an average yield of 6.6 t/ha across 18 locations over 2 seasons of trials by the Philippine Seed Board (PSB). IPB 913 is also resistant to downy mildew and moderately tolerant to corn borer and stalk rot. Three more hybrids were released in 1993, namely, IPB 919, IPB 921, and IPB 929. IPB 929 was the first IPB hybrid that broke the 7-ton barrier giving an average grain yield of 7.01 t/ha.

Recognizing the superior performance of the four aforementioned hybrids, DA has included them in the GPEP with an initial order of 25,000 bags (good for 15,000 hectares) of certified seeds in 1993. This year, DA procured an additional 35,000 bags for the GPEP. A total of 50,000 hectares is expected to be planted to IPB hybrids for 1994. The release of superior hybrids has also spurred the development of local seed growers who act as the backbone of the seed production and distribution system. These activities have generated jobs in the countryside as hybrid seed production is a labor intensive endeavor.

Horticultural crops. Several horticultural crop varieties, developed by the Institute of Plant Breeding and Department of Horticulture, were released to the public by the Philippine Seed Board. Among these crops are:

Crop	*Variety Name*	*Trait*
Tomato	Marikit	bacterial wilt resistant
	Marilag	bacterial wilt resistant
	Mayumi	bacterial wilt resistant
Eggplant	Tilandoy	bacterial wilt resistant
	Tagumpay	bacterial wilt resistant
Sweet pepper	Sinagtala	bacterial wilt resistant
Hot peppre	Matikas	resistant to virus and bacterial wilt
Pickling cucumber	Pilmaria	resistant to downy mildew
Slicing cucumber	UPLB-Cu-2	downy mildew resistant
Chinese cabbage	Esperanza	head forming under warm temperature
Pole sitao	Sandigan and Maagap	high yielding pole sitao varieties with good pod characteristics
Bush sitao	Sumilang	high yielding, light green pods and good resistance to fusarium wilt.
Cowpea	Mabunyi	high yielding, long podded and good resistance to fusarium wilt
Abaca	Pacol x CBS H2	resistant to mosaic
Cacao	EET376/UF667	
	ICS 44/LEET376	
Medicinal plants	Lagundi	
	Tsaang gubat	
	Sambong	
	Niyog-niyogan	
	Yerba Buena	

One non-breeding activity which has started to revolutionize the tomato processing industry in the Philippines is the introduction of a growing wilt-susceptible tomato variety following a paddy rice. This practice has allowed wilt-susceptible but processable varieties from California and the AVRDC to be raised in the paddy lowland of Pangasinan and Ilocos Norte. In the past, bacterial wilt precluded the successful production of processing tomatoes.

Orchid hybrids. Kagawara Yuthayong Beauty (a trigeneric cross of the orchid *Renanthera, Vanda* and *Ascocenda*), has been successfully propagated by tissue culture of buds. By the usual process of propagating plants, it would take 10 to 20 years to produce 50,000 plants from the original clone. By tissue culture it would take only about six years to produce the same number including the years it would take to make a selection from which the tissue would be taken.

Mussaenda hybrids. The development of multi-colored mussaendas by the late Dr. Dioscoro L. Umali has been another outstanding Philippine contribution to the world's ornamental horticulture. The cultivated mussaendas, named after the First Ladies of the Philippines and given the Spanish address Doña, have become part of the Philippine and Asian landscapes. The mussaendas have gained great popularity among ornamental growers and gardeners in Hawaii, Puerto Rico, the rest of Central America and in some parts of Europe. To date there are 11 fully-characterized cultivars of mussaenda.

Mungbean and peanut. New varieties of mungbean (Pag-asa series) and peanut (UPL Pn2 and UPL Pn4) of improved plant structure, high yields and high resistance to diseases have been grown commercially in the countryside. The mungbean varieties have spread in production areas in Southeast Asia.

Wheat. Wheat varieties developed to adapt to our tropical environment are Trigo 1, Trigo 2, and Trigo 3. Pilot production in Ilocos Norte conducted at the Mariano Marcos State University and the Philippine Tobacco Research and Training Center has shown yields up to 2.7 t/ha, averaged from 7 ha. At a yield of 1.5 t/ha, wheat growing in the Philippines can be economically competitive.

Improved germplasms developed in UPLB continue to prove their worth not only in the Philippines but also in other parts of the world. For example, seeds of Trigo 1 which showed good adaptation in Sri Lanka were multiplied and used in the national wheat production program. Pagasa 1 of mungbean showed consistent good performance in other Asian countries and was officially released in Taiwan and South Korea. The corn variety Philippine DMR Composite 2 was officially released in Indonesia under the name "Bromo" and in Nepal as "Sarlahi Seto." The UPL-SY2 or "Tiwala" of soybean was reported by the University of Cantho in Vietnam to have performed well in the Mekong Delta. In addition, several of the improved germplasms of tomato have been used in Taiwan's AVRDC's tomato breeding program. To date, many of AVRDC's newly-derived tomato lines are commercially grown in several developing countries and are being used in tomato breeding programs in 40 other countries where poor fruit set due to heat and susceptibility to bacterial wilt are serious problems.

Production Technologies and Methods

Mango flower inducer. The discovery of a flower-inducing technique in mangoes through foliar spray with potassium nitrate has been adopted all over the country and has resulted in P476 million added value to the mango industry. (The industry worth P2.633 billion in 1984 increased to P4.79 billion in 1991).

Embryo culture of makapuno. The successful culture of makapuno embryos by the late Dr. Emerita V. de Guzman led to the production of trees which yield 100% makapuno. A study on the genetics of makapuno provided the basis for Umali's theory that 100% bearing makapuno trees could be produced through embryo culture. The benefits that can be derived from the technology is shown in Table 1. Substantial income can be realized starting on the 10th year which would be tremendously increasing up to the 20th year.

Table 1. Estimated cost and benefit in establishing a 1-ha makapuno plantation

Year	Expenses[a]	Sales/Year[b]	
		100% Makapuno	80% Makapuno
1-5	P83,360.90	P 28,600	P 23,372
10	6,621	54,752	44,744
15	12,956	232,932	189,702
20	17,798	297,086	242,114

[a] Expenses include those for management following recommended practices but exclude cost of the 1-ha land.

[b] Makapuno nut costs P10 a piece; one seedling costs P500. Yield is very conservatively estimated at 20 nuts/tree/year during the first 5 years to 100 nuts/tree/year starting on the 10th year.

Tissue culture of various crops.

Technology/Commodity **Agencies involved/Funding source**	**Highlights**
1. Micropropagation	
a) white potato	
IPB-HADP/DA	Being adapted at limited scale to produce 6,000 microtubers per season as breeder seeds for further propagation to produce certified seeds (Rasco *et al.*, 1992); now being used commercially.
IPB-McDonald's	Tissue culture stem cutting techniques for rapid propagation of planting material have been developed/optimized: each plantlet can be used to produce 60,000 plantlets in 6 months in the highlands and 12,000 in the lowlands (3-5).
IPB-SAPPRAD	Tissue culture (shoot culture and *in vitro* tuberization) techniques optimized and applied to support the breeding program for lowland potato development and disseminate breeder's materials to other agencies in the Philippines and other Southeast Asian countries.
b) bamboo IPB-IDRC	In vitro propagation using embryogenic calli in *Dendrocalamus strictus* and field establishment (6). Callus establishment and occasional plantlet regeneration in *D. latiflorus* cv Machliku (7), used as reforestation material.

IPB-DOST	Optimization of embryo-derived callus system for *Schizostachyum lumampao* and *D. latiflorus*. Callus establishment and occasional plantlet regenerating in *Bambusa blumeana*.
c) banana IPB-IDRC	By shoot proliferation technique (9-11), 200,000 plantlets can be obtained from one sucker of Saba; technique developed for several varieties; used commercially.
d) garlic and shallot IPB-AVRDC-ADB-PCARRD	Multiple shoot production technique from mature bulb of shallot has been developed and is being tested (13); techniques of multiple shoot formation from garlic cloves and subsequent bulblet formation have been developed for garlic for basic seed production.
h) rattan IPB-DOST-DA	Shoot proliferation from seed; technique used on three species *Calamus manilensis*, Palasan or *C. merilli* and Limuran or *C. ornatus* (18-19). Seedlings from tissue culture are available by order.

Mycorrhiza. MYCOGROE, a mycorrhizal tablet, is a biological fertilizer which is effective for growing pines and Eucalyptus in nurseries and in the field. It replaces 50%-80% of the chemical fertilizer requirement of tree species. MYCOGROE is marketed and exported by the Los Banos Biotechnology Corporation and registered with the Fertilizer and Pesticide Authority.

Biological control of the root-knot nematodes and other species. A biological control method using a fungus (*paecilomyces lilacinus*) against the root knot nematode and other species was discovered and proven effective and adaptable by the farmers. This method, which is adapted to farmers' field conditions, could greatly reduce their expenses and increase their income. A private company, Asiatic Technologies, Inc., has been given by UPLB the right to produce and market the technology under the trade name BIOCON.

Biological control of lepidopterous pests. Five species of Trichogramma parasites were successfully mass-produced to control a number of lepidopterous pests. Two of the species were discovered to be abundant in Negros Occidental. Field tests showed that 98%, 90% and 83% control of cotton bollworm, corn earworn, and legume leaffolder, respectively, were obtained when 50,000 of the *Trichogramma* parasites were released per hectare. The cost of producing 50,000 parasites was less than 5% of the cost of one insecticide application per hectare.

Furthermore, a bacterium, *Bacillus thuringiensis,* was also recovered locally and is being mass-produced against lepidopterous crop pests. In addition, a nuclear polyhedral virus has been developed against *Spodoptera litura,* the common cutworm. Both can kill up to 90% of lepidopterous pests.

Technology for unfavorable environment. Research on appropriate technologies for stress environments has also achieved signficant breakthroughs. With the country's approximately one million hectares of acidic soils having a pH value of less than 5.5, the impact on yield depression can be enormous. To correct this problem would require application of 2 to 7 tons of agricultural lime per hectare which is an expensive process. UPLB scientists have identified certain varieties of mungbean, peanut, corn, and sweet potato from the germplasm collection which can tolerate high acidity (low pH) and attendant toxicity due to aluminum. These have been utilized in the breeding program for the development of acceptable varieties for acid soils.

Products and Processes

Food processing and product utilization technologies have been developed which can be adopted by large- and small-scale industries.

Quality fruit wines. Various fruits like tamarind (*Tamarindus indica* L.), guayabano (*Annona muricata* L.), mango (*Mangifera indica* L.), passion fruit (*Passiflora edulis* Sims), atis (*Annona squamosa* L.), pomelo (*Citrus paradisi* Macf.), ladu (*Citrus paratagerina* Hort. ex Tan.), orange (*Citrus sinensis* (L.) Osbeck), pineapple (*Ananas comosus* (L.) Merr.), cherry (*Prunus avium* L.), bignay (*Antidesma bunius* (L.) Spreng.), and different varieties of banana have been found to be suited for wine production. Except for atis, fruits are profitable raw materials.

Niyogurt. UPLB has developed this low-fat yogurt made from coconut milk, skimmilk powder or non-fat dried milk (NFDM), sugar, pineapple tidbits, and culture starters S. *thermophilus* and *Lactobacillus bulgricus.* One cup niyogurt provides 4% protein, 1% total ash, 2% fat, and 24% total solids. Since it has only 2% fat, the product is excellent for those conscious of their fat intake.

Niyogurt has a very high consumer acceptability. This demonstrates the suitability of fresh coconut milk as a less expensive fat carrier to substitute for butterfat in the manufacture of fermented filled milk products.

Postharvest handling techniques for fruits and vegetables. In fruits and vegetables, postharvest losses amount to as much as 30% for fruits and almost 50% for vegetables. The Postharvest Horticulture Training and Research Center (PHTRC) undertakes postharvest research on quality improvement of fruits and vegetables for local and foreign markets. The Center has so far achieved the following objectives:

a. enhanced the export quality of mango to Japan and other countries through research in postharvest disease control, development of appropriate maturity using titratable acidity and specific gravity standards, and development of efficient quality control measures before export shipment;
b. demonstrated the feasibility of non-refrigerated inter-island shipment of banana from Davao to Manila, and long distance export to the Middle East and Europe (involving more than 2 weeks of transport) using ethylene scrubbers (adsorbent) with carriers fabricated from clay and rice hull, in conjunction with vacuum packing;
c. developed or improved village-level postharvest technology; and
d. promoted the cutflower trade.

RESEARCH AND DEVELOPMENT PRIORITY AREAS

Corn

Despite the abovementioned achievements in research, growth of Philippine agriculture has remained low compared to our Asian neighbors. Let us take corn as an example. Our country is capable of producing all the corn that we need and even produce more to cater to the export market. However, it is sad to note that the Philippines has one of the lowest production per unit area in the world and has been a net importer for the past several years. It is, therefore, imperative to identify research and development areas that will alleviate our production problems and promote corn as an export winner.

I. Priority Research Areas

1. Development of high-yielding pest-resistant and stress-tolerant varieties of crops

   a. *Hybrid Corn Research.* It is perceived that the best and fastest way for our country to dramatically increase corn production is through the use of hybrid cultivars. The advantages of using hybrids have already been proven in other countries that use them. Countries with very high yield levels (6-7 t/ha) have almost all their corn area planted to hybrids.

   Our average yield is very low at 1.5 t/ha. Nevertheless, hybrids in the Philippines are currently planted to about 7% of the total area, accounting for more than 20% of the total production.

   Devoting just 30% of our corn area to hybrids by the year 2000 may result in the following: a) assuming an average yield of 4 t/ha/season, our country will realize a total production of 8.4 million metric tons a year, not to mention the production of the non-hybrid areas, which is more than enough to supply the total demand (estimated demand by 2000 is 7.7 M mt); b) cost of production will be greatly reduced, thus enabling us to be competitive in the export market; and c) substantial area can be shifted to other high value crops that are more suited to the area. This is basically the concept behind the Key Production Area approach of the Department of Agriculture.

   Table 2 shows the total area, average yield, and % hybrid utilization of selected Asian countries.

Table 2. Estimated corn area, average yield, and hybrid utilization in selected Asian Countries (1992)

Country	Total Area Planted (million ha)	Average Yield (+/ha)	Percent Hybrid Area	% Hybrid Area Needed for Self-Sufficiency by year 2003
China	21	4.5	73	100
India	6	1.6	20	32
Thailand	1.4	2.6	25	100
Indonesia	3.6	2.2	2	32
Philippines	3.4	1.3	7	35

Source: De Leon & Paroda, RAPA 1993
Ansaldo 1993

b. *Development of Special Types of Cultivars.* Sweet corn and baby corn are potential export winners. Since production of these corn types are highly labor intensive, our fairly cheap labor supply will be a real advantage in the long run.

Thailand is now the leading exporter of baby corn with a total export value of $33 million in 1992 (APAARI 1994). However, their increasing labor cost would make them uncompetitive.

The Philippines should be ready to exploit this opportunity and promote baby corn as a high value crop. There is, however, a need to develop varieties that can produce exportable (high quality) young cobs. The same requirement can be said of sweet corn, the eating quality and uniformity of which are the prime considerations for the export market.

c. *Application of Biotechnology.* Recent advances in crop improvement indicate that biotechnology provides the competitive markets which can greatly facilitate the mapping and transfer of desirable genes into adopted cultivars. The transfer of *bt* gene in corn for example will have a very dramatic impact on our production considering that corn borer is now the number one pest in the Philippines. Another exciting use of biotechnology is in the breeding for resistance to diseases and for tolerance to abiotic stresses such as drought, acid and saline soils. DNA fingerprinting of cultivars will also aid the researchers in varietal identification and quality control aspects in seed production.

Developing countries, including the Philippines, are faced with increasing populations for which food production must be doubled in the next 25 years. Because of constraints in prices of agrichemicals and energy sources, in general, environmental considerations (dwindling good agricultural lands, ecological concerns) and production plateaus, applications of biotechnology are sought to further improve crop production through primarily the development of crop varieties with novel characteristics. Thus, a strong plant breeding program is required for successful applications of biotechnology to crop production.

Applications of biotechnology tools cover the range of plant breeding activities, from genebanking through the breeding proper, to testing and distribution. The techniques that can be used range from microprogagation, disease elimination, generation of variability by somaclonal variation, in vitro selection, genetic engineering, gene mapping, moleclar diagnostics disease indexing/monitoring, etc.

2. Development of cost-effective production and post-production technologies

High cost of production in the Philippines has been attributed to a number of factors such as high cost of inputs and post production losses. Research activities that are geared toward the reduction or substitution of inorganic fertilizer by indigenous organic sources and promotion of integrated pest management technology would be very rewarding. Postharvest handling should be geared toward minimizing damage due to stored grain pests such as weevils and *Aspergelius flavus*. Processing technologies for green corn and baby corn should be further studied.

3. Improvement of Cropping Systems

One of the potential sources of increased corn production is the planting of corn after rice. For example, vast areas in Central Luzon lay idle during a good part of the dry planting season because of moisture constraints. Corn-after-rice cropping system has been demonstrated to work in these areas given proper technologies. However, concerns such as land preparation and water management need to be further studied.

II. The Priority Development Concerns include:

1. Technology Transfer and Marketing Strategies

Transfering and marketing of new technologies always pose a serious challenge to researchers and extension workers. In our experience, the participation of the private sector is the key to the immediate adoption of new corn technologies. For example, new varieties are immediately tested in major corn areas by the seed growers themselves who conduct strip or demonstration tests in their respective areas. The best variety would then be determined and produced by the seed grower based on the response of the farmers in the locality. In this system, the seed grower has a very strong financial motivation to conduct the strip tests and to produce/distribute the seeds in his area. Public-private partnership is very crucial in technology transfer and should be enhanced, not criticized.

2. Infrastructure System

Substantial losses in corn production could be attributed to inadequate postharvest facilities such as driers and storage and bulk handling facilities. Distribution and marketing of grains are further affected by terrible road conditions and lack of transport facilities. A report by a DA-USAID (1991) study indicated that the cost of marketing and distributing corn in the Philippines is 70% higher than in Thailand. It is also cheaper to ship corn from Thailand to Manila than from Mindanao to Manila. That is why there is an urgent need to invest in infrastructure and market development if we want to be competitive in relation to other countries.

3. Grades and Standards

As far as seeds are concerned, there are existing quality control mechanisms already put up by the DA and research agencies. However, strict monitoring is still needed to check unscrupulous seed growers. For commercial grains trading, however, uniform quality control is still lacking and many farmers and grains traders have little regard for quality traits such as moisture, presence of impurities, incidence of pests, etc. If we want to export corn grains, our farmers and traders should be taught how to achieve and maintain quality.

4. Linkages

At the national level, there is an urgent need for a collaboration among corn research centers. In view of the limited government resources, it is imperative to focus on the strength of a particular research institution. For example, upstream or basic studies e.g. biotechnology, could be primarily given to UPLB while midstream and downstream research (extension) could be assigned to regional centers which are more in a position to transfer new technologies in the rural areas. As we see it, there is really no serious coordination among government research institutions as far as varietal development is concerned. That is why there are clamors to create one research institution for corn just like PHILRICE.

Linkages with private institutions and peoples organizations are also vigorously proposed. Private entities have the financial capabilities but they may lack the technical manpower to do specific research. Mutual cooperation is, therefore, needed to achieve common goals. Finally, linkages with international research centers should be established and strenghthened. Building of national capabilities such as manpower training and sharing of germplasm and other resources should be given priority.

Mango

Today, there are only two countries producing Carabao mangoes in commercial quantities; the Philippines and Mexico. Many exporting countries were initially exposed to the taste of India and Florida-type mangoes, as cultivars of these types last longer and are less susceptible to handling injury. However, there is growing interest in the milder-tasting Indo-Chinese types to which the Carabao mango belongs. A good example of the superior flavor of the Carabao or 'Manila Super' mango is the fact that this cultivar constitutes about 99% of the current mango importation of Japan, which in the seventies, used to import only Mexican mangoes of the Florida type.

The market for Carabao mango is growing. The mainland Chinese market is rapidly expanding, with the upscale markets paying better prices than Hong Kong consumers. Importers in Hong Kong indicated that well over 50% of the exports to the colony is re-exported to China. Korea is another potential market. The competitive advantage of the Philippines in mango export is its proximity to these big markets, including Japan.

Other nearby countries like Indonesia and Thailand have shown keen interest in growing the 'Carabao' mango, as there are suitable areas for producing this cultivar in commercial quantities.

The current situation in the banana industry, where Indonesia, Malaysia, and other countries have taken over significant shares of the banana market of the Philippines, might also develop in the case of mango.

The only strategy by which the Philippines can retain its position in the world market for mangoes is by producing adequate and reliable volumes of good quality mangoes at competitive prices. This means that greater effort will have to be put into both expanded production and good postharvest handling techniques. Supportive policies will have to be put into place, although recent developments in world trade (eg., GATT and AFTA) point to the application of appropriate technologies as a key instrument in the strategy.

The expansion of the export market for Philippine mango will require the development of appropriate technologies to extend shelf-life. Fortunately, unlike other cultivars, postharvest diseases in the 'Carabao' mango can be fashioned. This means that no pesticide needs to be used after harvest to control rots. Further extension of shelf-life requires the application of appropriate controlled atmosphere technology which awaits development for the mango.

The prospects are bright for the 'Carabao' mango, with a total world trade of 15 million MT (1989), which is growing. With many countries expressing interest in Carabao mangoes (for example, over 80 countries have been attending the International Mango Symposia), we have to move with a sense of urgency. Furtunately, many Filipinos are heeding the call for expanded production. Support services in terms of cultural management, marketing and postharvest handling will have to be extended to this sector.

OTHER CONCERNS

The move toward greater regional and multilateral trade cooperation will undoubtedly impact on the development of the agricultural sector. With the freer flows of goods and commodities there will be keener competition among producing nations.

But our decision-makers have deemed it that the benefits of freer trade among countries outweigh its cost. Thus, at the regional level, we have joined the ASEAN Free Trade Area (AFTA) agreement. More than 15 commodities, including some agricultural products will be liberalized (meaning accelerated tariff reduction) in order to foster greater trade among ASEAN nations.

Because of a similar agreement in the North American continent, the signing of the North American Free Trade Area among the US, Canada and Mexico, it is expected that some of our agricultural products will lose out to our competitors, particularly, Mexico.

The advent of Gatt (The General Agreement on Tariff and Trade) puts a check on the formation of the restrictive regional trading blocs. As a signatory to it, we are dirtbound to shift from quantitative restrictions to tariffs or duties and in turn, to gradually lower these duties within a 10-year time-frame.

Although the initial higher tariffs that we will impose to imported agricultural goods will protect our local produce, these will, however, be lowered. It is, therefore, imperative that we introduce changes in our production pattern that will increase our productivity in order to have a chance of surviving the ensuing cutthroat competition. The key to this is basically science and technology and their successful application.

The efforts of the University are indeed geared toward this. However, it must be stressed that with or without GATT, the University will continue to produce appropriate S & T that will increase and improve the yield of our farmers because this is what the country needs.

CONCLUSION

Philippine agriculture at the end of this century will be generally characterized by small-scale, more compact, more diversified and more intensively-cultivated farms. Farm products will be processed domestically to achieve the value added advantage. There will be a change in orientation from subsistence farming to commercial or market-oriented agriculture.

With the aforementioned scenario of Philippine agriculture, Filipino plant scientists, thus, will play a key role in identifying, generating and disseminating appropriate science and technology and development concerns that will alleviate our production problems and promote exportable products in processed form to achieve the value added advantage.

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