VEGETABLE PRODUCTION IN THE PHILIPPINES

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ABSTRACT

Vegetable production in the Philippines during the 1980s has been characterized by a yearly fluctuation in the volume of production, a continuous decline in the area of land utilized for cultivation and a continuous increase in the value of production. The national average yield has been consistently low at about 5 t/ha.

A number of biophysical, socio-cultural and economic factors limit the production of vegetables. These include : a) climatic conditions ; b) soil conditions ; c) availability of land for cultivation ; d) per capita consumption of vegetables ; e) availability and cost of seeds ; f) inadequate credit facilities ; g) poor post-handling and marketing practices ; etc.

Vegetable research in the Philippines is carried out at the national, regional and provincial levels, in the areas of crop improvement, crop protection, crop production and management, crop physiology, seed production/technology, and crop processing and utilization. A number of breakthroughs have already been made particularly in crop improvement but research efforts in the future should focus into the following thrusts : off-season production ; production of processing types ; production of temperate vegetables in the lowland ; seed production ; and integrated pest management.

An example of a production technology which has improved vegetable production is the post-rice growing of wilt susceptible but processable tomato varieties.

Introduction

Vegetables, which are a unique group of plants grown for human consumption are not only rich sources of important vitamins and minerals but are a lot cheaper than fruits, cereals, etc. They are also practically available the whole year round because they are early maturing and can fit in any type of cropping system. There are hundreds of vegetable species grown in the Philippines. Because of their diversity, they can adapt to varying climatic and soil conditions i. e., if not all of them can be grown at the same time of the year in one location, at least one or two kinds of vegetables can be grown. In other words, there is always some vegetable species available at any time of the year.

Vegetable production statistics

The 1980s saw a yearly fluctuation in the volume of vegetables produced (Fig 1). This is particularly true from 1980 to 1985 however, the trend changed when production slowly picked up 1986 and 1987. The volume of production of the different vegetables from 1980 to 1987 is given in Table 1. The production trend for each species is more or less similar to the trend of total volume produced.

The total land area utilized for vegetables continuously declined from 1980 to 1983 so that land availability was only one of the factors responsible for the observed fluctuation in volume of production.In 1980, 0.43 M ha of land was grown to vegetables (Fig. 1). Seven years later, this figure dropped to 0.34 M ha. Table 2 shows the area utilized for growing the different vegetables from 1980 to1987. The trend observed for total area is not

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Fig. 1 Vegetable production statistics (□ =volume, M mt ; + = area, M ha ; ◇ =value, B pesos) in the Philippines, 1980-1987

Table 1 Volume of vegetables produced during the period 1980-1987 (tons)

	1980	1981	1982	1983	1984	1985	1986 p	1987 p
Bitter gourd	387,038	16,875	19,545	16,681	16,887	16,923	17,544	17,085
Bottle gourd	23,496	27,527	28,976	25,842	21,577	20,670	20,206	21,070
Cabbage	66,601	77,634	61,622	62,866	61,211	63,706	74,100	71,562
Chayote	15,488	14,240	19,399	13,191	12,850	12,927	12,718	12,519
Cucumber	5,798	6,080	6,175	5,777	5,632	5,580	4,305	4,305
Eggplant	110,908	107,280	126,986	110,203	105,161	96,674	88,514	84,777
Gabi	109,373	105,387	112,899	100,428	96,339	92,847	103,404	108,830
Garlic	12,761	13,796	26,109	16,605	14,380	17,929	16,768	17,273
Ginger	42,955	42,106	41,824	35,749	30,930	29,390	27,496	28,734
Green leafy vegetables	104,689	111,028	102,207	71,753	78,134	78,747	80,217	67,615
Green onion	12,023	12,842	13,269	11,087	11,847	11,879	12,214	11,455
Irish potatoes	36,893	37,125	40,677	40,699	36,651	42,412	48,520	54,796
Mustard	10,628	10,115	11,344	12,682	16,493	20,654	27,233	29,095
Onion	40,581	37,184	44,174	42,161	52,531	53,165	54,233	61,502
Pechay	43,493	42,022	36,193	26,491	25,796	24,538	24,866	24,092
Pepper	3,698	3,534	3,701	3,070	3,018	3,239	3,606	4,199
Radish	10,916	11,023	11,312	9,235	9,318	8,468	8,924	8,949
Snap beans	10,620	10,886	9,882	9,261	7,618	6,464	6,281	6,254
Sponge gourd	12,263	12,474	12,890	11,000	7,990	8,243	8,386	8,055
Squash	91,573	83,208	102,153	80,720	79,824	79,231	79,118	70,215
Sweet potato	1,047,750	1,010,298	1,037,626	801,504	820,300	777,178	800,614	843,674
Tomatoes	140,200	134,112	127,342	104,827	140,813	130,958	143,888	150,028
Watermelon	213,700	196,908	250,456	75,652	55,838	41,482	43,757	209,000
Other fruit vegetables	25,683	26,894	26,930	23,835	29,788	32,905	35,933	32,915
Other veg. (sitao, etc.)	31,901	39,813	36,322	19,597	24,311	25,826	21,888	21,965
Total	2,611,029	2,190,391	2,310,013	1,730,916	1,765,237	1,702,035	1,764,733	1,969,964

Source : Agribusiness Factbook and Directory, 1987.

Table 2 Area of land grown to vegetables during the period 1980-1987

	1980	1981	1982	1983	1984	1985	1986 p	1987 p
Bitter gourd	4,690	4,650	4,790	4,210	4,340	4,610	4,660	4,640
Bottle gourd	2,960	2,920	2,850	2,720	2,400	2,500	2,520	2,470
Cabbage	7,830	7,170	6,580	6,300	5,830	6,000	6,680	6,350
Chayote	2,140	2,070	2,510	1,860	1,740	1,790	1,790	1,740
Cucumber	1,260	1,320	1,320	1,160	1,000	1,110	1,010	1,010
Eggplant	17,230	16,260	15,710	14,310	14,940	15,470	15,180	16,110
Gabi	33,550	32,050	33,830	30,280	29,710	30,220	30,060	29,890
Garlic	4,720	5,570	9,030	8,850	5,880	6,740	6,860	6,460
Ginger	5,830	5,860	5,780	5,240	5,450	5,270	4,240	4,270
Green leafy vegetables	36,130	38,340	37,030	31,370	30,510	30,680	31,450	29,180
Green onion	3,020	3,020	2,920	2,710	2,740	2,830	2,880	2,620
Irish potatoes	4,140	3,830	3,910	4,200	3,880	3,920	4,320	4,550
Mustard	1,360	1,360	1,450	1,440	1,730	1,950	2,340	2,380
Onion	5,930	5,430	6,440	6,740	7,780	7,000	6,500	6,825
Pechay	4,720	4,600	4,590	3,960	3,710	3,780	3,900	4,010
Pepper	1,530	1,460	1,520	1,330	1,340	1,360	1,450	1,700
Radish	2,080	2,290	2,060	1,720	1,660	1,540	1,630	1,550
Snap beans	3,080	3,060	3,030	2,640	2,390	2,510	2,500	2,570
Sponge gourd	2,360	2,440	2,710	2,390	2,280	2,350	2,490	2,340
Squash	6,910	6,960	7,990	7,190	6,500	6,720	6,750	6,620
Sweet potato	235,830	220,880	209,330	174,690	170,080	164,300	164,770	164,610
Tomatoes	16,340	15,450	15,210	13,900	16,050	16,410	17,490	18,160
Watermelon	14,920	14,270	14,910	7,270	5,420	4,070	4,250	5,262
Other fruit vegetables	5,890	6,740	6,090	6,270	6,400	7,470	7,870	7,430
Other veg. (sitao, etc.)	7,950	7,440	8,080	7,360	7,230	7,680	7,300	7,300
Total	432,400	415,440	409,670	350,110	341,090	338,280	340,890	340,047

Source : Agribusiness Factbook and Directory, 1987.

consistent with the figures reported for some vegetables. Bitter gourd, for instance, did not vary much in area utilized for its cultivation. Tomatoes, on the other hand, were continuously grown in decreasing land area (1980-1983) but starting 1984 production expanded to 0.016 M hactares up to 0.018 M in 1987.

The national average yield for vegetables ranged from 4.94 t/ha in 1983 to 6.04 t/ha in 1980. The rest of the years saw a steady figure of 5 tons/ha This is very low compared with average yields obtained in other countries.

In terms of the value of production, the trend observed was opposite that of land utilization. Except for 1983 when value of production reached a low P2.64 B, the value of vegetables produced continuously rose from P2.83 B in 1980 to P5.68 B in 1986 (Fig. 1). A slight decline of about P10 M was experienced in 1987 which could be partly attributed to the increasing trend in volume of production. The value of production for each of the major vegetables is given in Table 3. The trend observed for each kind of vegetable from 1980 to 1987 was generally similar to the trend for total value.

Figure 2 shows the relative share of the different kinds of vegetables in the total volume of production in 1987. Sweet potato was on top of the list with 42.83% share followed by watermelon with 10.61%. Tomatoes contributed only 7.62% of the total volume, followed by gabi and eggplant. The least grown vegetables were snap beans (0. 32%), cucumber (0.22%) and pepper (0.21%).

In terms of share in land area utilized for each kind of vegetable, sweet potato was still the major contributor (Fig. 3) with almost half (48.41%) of the total land area for vegetables devoted to sweet potato. Watermelon, which was second in the list for volume of production, ranked twelfth (12th) because only 1.55% was utilized for its cultivation. Gabi and green leafy vegetables had more or less equal shares of 8.79 and 8.88%, respectively. At the bottom of the list were pepper (0.5%), radish (0.46%) and cucumber (0.

Table 3 Value of vegetables produced during the period 1980-1987 (P 1,000)

	1980	1981	1982	1983	1984	1985	1986 p	1987 p
Bitter gourd	32,236	37,457	45,081	36,142	48,225	55,965	69,589	70,221
Bottle gourd	28,479	28,973	29,033	26,879	26,729	69,212	72,791	54,388
Cabbage	176,202	149,278	129,102	106,993	192,288	272,674	367,070	342,364
Chayote	12,255	10,533	16,351	12,006	16,538	18,728	19,796	19,474
Cucumber	12,196	15,213	13,539	11,047	12,393	17,940	13,412	16,665
Eggplant	241,858	211,642	306,239	269,315	333,876	491,023	461,440	394,253
Gabi	80,416	126,076	126,473	128,262	158,238	245,392	247,838	352,295
Garlic	160,807	382,570	378,858	206,799	390,965	574,381	563,053	244,820
Ginger	81,477	55,980	78,161	136,044	259,203	211,897	167,768	136,254
Green leafy vegetables	115,830	93,911	99,006	96,538	124,363	175,838	186,593	164,816
Green onion	35,123	41,647	36,876	41,515	64,808	79,745	81,438	74,304
Irish potatoes	81,424	85,542	121,784	91,938	127,963	184,838	263,744	264,347
Mustard	13,581	16,484	17,854	19,794	36,216	55,414	73,985	83,527
Onion	81,594	113,644	99,610	146,181	241,140	232,705	302,249	229,277
Pechay	79,562	60,065	59,783	41,719	59,705	74,017	80,562	81,768
Pepper	22,006	18,402	21,809	13,667	16,273	23,115	28,271	34,734
Radish	23,175	23,844	24,306	21,311	28,852	32,787	36,788	41,395
Snap beans	23,283	26,153	20,440	22,483	21,798	24,979	29,149	31,354
Sponge gourd	23,976	19,990	19,920	17,870	14,098	19,527	21,861	20,611
Squash	110,636	71,777	105,709	86,850	129,654	164,517	161,268	154,587
Sweet potato	694,731	776,536	879,435	696,867	1,058,062	1,328,377	1,479,057	1,557,934
Tomatoes	321,283	329,357	308,432	237,693	461,144	607,523	645,904	566,551
Watermelon	205,890	207,435	244,425	100,086	96,614	102,326	89,074	519,673
Other fruit vegetables	32,912	39,100	40,735	32,013	60,117	107,578	119,400	112,561
Other veg. (sitao, etc.)	137,089	114,624	94,260	44,202	85,778	113,722	96,099	101,309
Total	2,828,021	3,056,233	3,317,221	2,644,214	4,605,040	5,284,220	5,678,109	5,669,482

Source : Agribusiness Factbook and Directory, 1987.

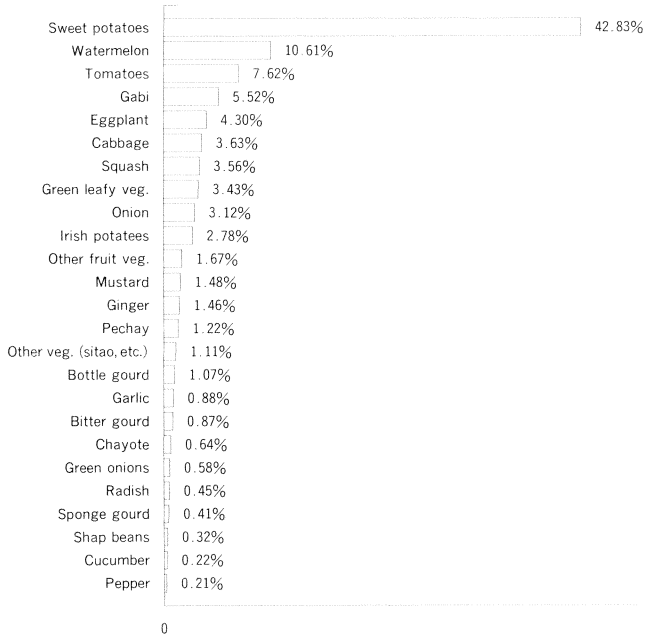

Fig. 2 Percentage share of each vegetable species in total volume of production, 1987

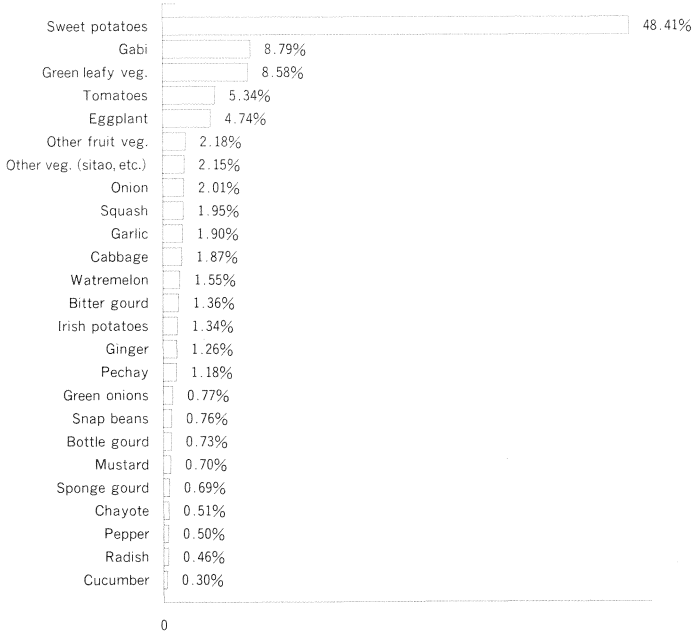

Fig. 3 Percentage share of each vegetable species in total area of production, 1987

30%).

The percentage share in value of production (Fig. 4) shows roughly the same trend, i. e., that sweet potato was still number one (27.48%) while the shares of tomatoes and watermelon were only 9.99 and 9.17%, respectively. Cucumber was still at the bottom with only 0.29% share.

The above figures show the relative importance of the different kinds of vegetables in terms of volume and value of production. Sweet potato, for example, was produced in large volumes but because it is not as highly priced as the other vegetables, its percentage share in value of production was much lower than its share in volume. Tomato, on the other hand, is more expensive so the trend observed was the opposite. There are other vegetables which are more expensive than tomato but their percentage share in the value of production was small because the volume of production was much smaller. Unlike sweet potato which is grown throughout the country, these vegetables are cultivated in specific locations. Pepper, for example, is largely grown in elevated areas such as Baguio because of its specific requirement for low temperature.

The low figures for the national average yield of vegetables indicate that vegetable production has not progressed very much from the traditional practices. The development of production technologies that would increase the productivity of our vegetable farms has always been the major objective of every research endeavor but there are a number of other factors which limit vegetable production and they are outlined below.

Constraints on vegetable production

1 Biophysical factors

The Philippines approaches the equator within latitude of 4° 40'N and extends 1000 miles to 21° 10'N. It is 700 miles wide from 116° 40'W to 126° 34'E. This location is primarily

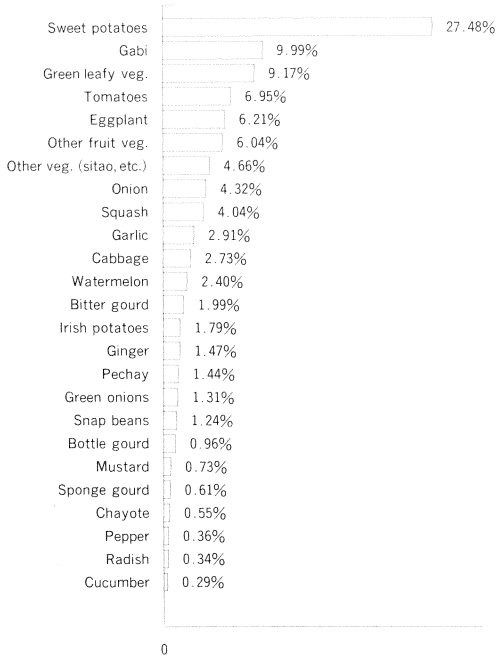

Fig. 4 Percentage share of each vegetable species in total value of production, 1987

responsible for the following constraints on vegetable production.

1) Climatic conditions

Located right in the typhoon belt, the Philippines is frequently visited by typhoons. An average of 19-20 typhoons a year has been recorded and this has tremendously affected the production of vegetables. In 1987 alone, it was estimated that around 13,700 tons of vegetables valued at P77.9 M were destroyed by typhoons (BAS, 1987).

High temperature and high relative humidity are likewise the dominant features in the country's warm climate (Fig. 5). These environmental elements play important roles in the vegetative and reproductive development of vegetable crops. Fruit setting in tomato, for example, is highly reduced by high night temperature.

In addition to high temperature and high relative humidity, the Philippines has a very uneven distribution of rainfall. There are basically only two seasons, the wet and the dry season.

2) Soil conditions

The soils in the Philippines are generally acidic. This was brought about by the continuous process of weathering and rapid rate of organic matter decomposition. Leaching is also a predominant process. As a result, the soil becomes porous and granular and generally exhibits a red or yellow color. Furthermore, the levels of N, P and Ca are very low.

3) Pests and diseases

Insect pests, diseases and weeds always cause problems in growing vegetables. The volume of production damaged by pests and diseases in 1987 was estimated at 973 tons valued at P1.9M (BAS, 1987).

The more important insect pests include : thrips [*Thrips palmi* (Karny) and *Megaloruthrips usitatus* (Bagnall)] which have drastically reduced melon and watermelon production and are now affecting eggplant and other vegetables ; diamond back

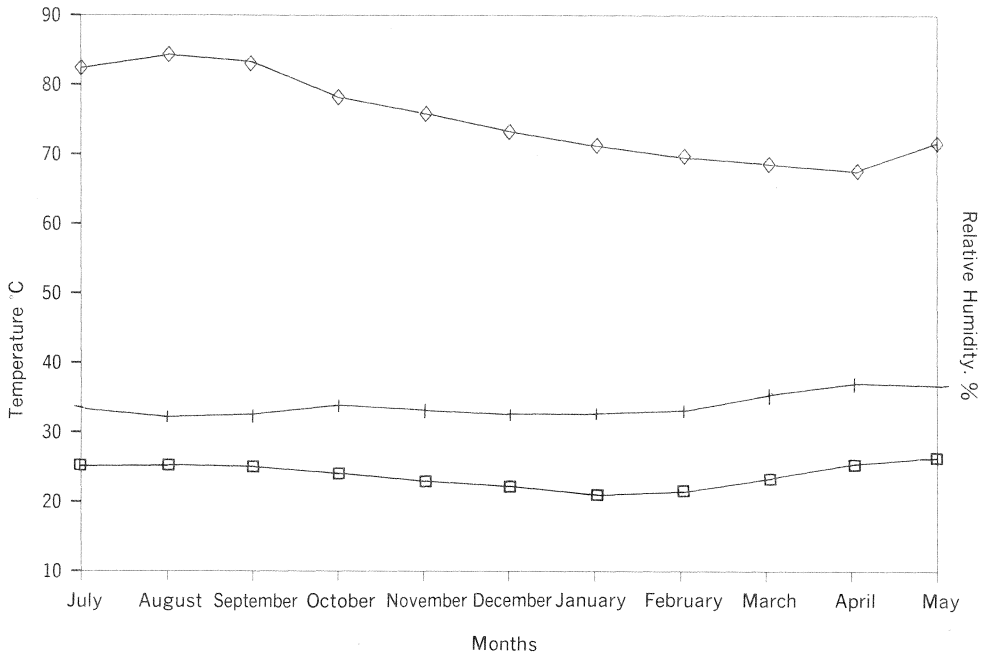

Fig. 5 Mean monthly minimum (□——□) and maximum (+——+) temperatures and relative humidity (◇——◇), 1985

moth [*Plutella xylostella* (Linn.)] is a serious problem for all crucifers ; eggplant shoot/fruit borers [*Leucinodes orbonalis* (Guenee)] ; tomato/pepper fruitworms [(*Helicoverpa armigera* (Hubner)] ; legume pod borers [H. *armigera, Maruca testulalis* (Geyer), *Etiella zinckenella* (Treitschke)] ; amplaya fruitfly [*Dacus cucurbitae* (Coquillett)] ; aphids (*Aphis* spp.) ; and spider mites (*Tetranychus truncatus*). In general, insect pests are more prevalent during the dry than the wet season.

The most important diseases include : bacterial wilt [*Pseudomonas solanacearum* (E. F. Smith)] ; viruses, such as mosaic of cucurbits, legumes and solanaceous crops ; downy mildew of cucumber (*Pseudoperonospora cubensus*) ; gray leaf spot of tomato [*Stemphylium lycopersici* (Enjoji) Yamamoto] ; Phytophthora fruit rot (*Phytophthora parasitica*) and phomopsis of eggplant (*Phomopsis vexans*) ; Cercospora leaf spot and anthracnose of pepper ; purple blotch of garlic and onion [*Alternaria porri* (Ellis) Cif.] ; head rot of cabbage (*Rhizoctonia solani*) ; and early and late blight of potato (*Phytophthora infestans*). In general, diseases are more prevalent and serious during the wet than the dry season,the conditions being much hotter and wetter coupled with more cloudy days.

The problem on pests and diseases is further aggravated by very poor implemention of proper pest control management practices by vegetable growers.

2 Socio-cultural factors

1) Low consumption of vegetables

The Filipinos are basically non-vegetable consumers as clearly shown by the very low per capita consumption of vegetables estimated at 106 g/day (FNRI, 1982) which is much lower than the daily requirement of 300 g per person per day. It is possible, however, that the value 106 g/day has been underestimated because consumption of vegetables from numerous home gardens was probably not included in the computation. In some areas,

consumption may be low because for most people vegetables are not easily affordable. Another possibility is that, consumption is low because eating vegetables or having vegetables in the diet is associated with being poor. Whichever is the true cause of low vegetable consumption, this has surely, influenced the trend in vegetable production.

2) Cropping patterns/systems and land availability

Rice is the staple food of the Filipinos. There are about 3.5M ha of land planted to rice and during the rainy season almost 100% of this total area is cultivated for rice production. In most areas, the land planted to rice is also used to grow vegetables during the dry season. Around 70-80% of the total area devoted to vegetables during the dry season is located in provinces where rice is the main crop grown during the rainy season. This accounts for the low production of vegetables during the wet season.

3) Technology transfer

In general, the Filipino farmers are hesitant to adopt new production and post-production technologies. This is coupled by the inefficiency of extension personnel and facilities to disseminate the latest information on new technologies.

3 **Economic factors**

1) Availability and cost of good quality seeds

In most cases, good quality seeds are not available. Seeds of improved varieties of vegetables are difficult to obtain. Aside from being expensive, the farmers have to travel a long way in order to get them. To date there are only a few reliable sources of these good quality seeds.

2) Inadequate infrastructure

Irrigation facilities cannot adequately irrigate the total area of land devoted to crop production. In addition, farm-to-market roads are very poor.

3) Inadequate credit facilities

Banks are reluctant to extend loans to farmers because they are aware of the high risk involved in crop production. If ever they do extend loans, this is done only for specific crops. As a result farmers turn to usurious lenders. The process becomes a vicious cycle of borrowing to produce then repaying after harvest, only borrow again.

4) Marketing inefficiencies

Marketing of vegetable produce is characterized by a proliferation of marketing channels. Therefore, it takes a very long time before the produce reaches the consumer. And because there is lack of storage facilities, the quality of the vegetables is drastically reduced. This is further aggravated by poor transportation facilities, improper handling along the way and of course the very high perishabitity of the merchandise.

Another inefficiency of the marketing system is the lack of market information. There is poor or inadequate price reporting to farmers. As a result the farmers do not get a fair price for their produce.

Because many of the constraints cited above are beyond our control, they pose as challenges to research anad development institutions such as the Department of Agriculture (DA), State Colleges and Universities (SCU's), and the private sector. These institutions need to set the directions of the research thrusts for vegetables so that the above-mentioned problems can be properly addressed.

Status of vegetable research

The Philippine Council for Agriculture, Forestry and National Resources Research and Development (PCARRD) is the government agency responsible, among other things, for the effective and efficient management of agriculture and resources research. PCARRD has identified and established a network of research centers and stations throughout the country (Valmayor and Tiamzon, 1988). They have specific responsibilities in conducting research at various levels for each commodity group. In each center or station, research on vegetables is done in any of the following areas or disciplines : 1)crop

improvement ; 2) crop protection; 3) crop production and management ;4) crop physiology ; 5) seed production and technology ; 6) crop processing and utilization ; 7) marketing ; and 8) extension. In the University of the Philippines at Los Banos (UPLB) which is the National Research, Center, these various disciplines are taken care of by the different academic units/departments. For example, crop improvement is the main responsibility of the Institute of Plant Breeding (IPB) : crop protection is handled by the National Crop Protection Center (NCPC) ; and crop processing and utilization by the Postharvest Training and Research Center (PHTRC) and the Institute of Food Science and Technology (IFST). Academic departments such as the Departments of Horticulture and Agronomy of the College of Agriculture are involved in the research on aspects of seed production and technology. Crop physiology which used to be a very strong discipline is handled by the Department of Horticulture and IPB.

To carry out research activities in these various disciplines, the university has a staff of highly trained manpower which include 17 with PhD degrees, 12 with MS degrees and 9 with BS degrees. It is sad to note, however, that only a small number of individuals work full time on vegetable research since most of these people are also involved in instruction and extension activities.

With regard to the financial support given to vegetable research in 1988, only US $239,878 was alloted for vegetables in comparison with the US $ 594,052 alloted for fiber crops (Table 4). Vegetables ranked ninth among the 12 commodity groups being funded for research and development.

Of the US $ 239,878,42.80% (US $ 102,622.19) was used for crop improvement, followed by crop protection with its share of US $ 59,104.61 (24.64%) (Table 5). There were a total of 59 and 32 studies which were funded for crop improvement and crop protection, respectively. It is interesting to note that in the field of crop physiology only one research study was conducted with only US $ 1,869 as research support.

There are also a number of constraints on vegetable research in the country just like vegetable production. The most important of these is the lack of financial support. Vegetable research in the Philippines is certainly inadequately funded. Nevertheless, there have been a number of breakthroughs already made, particularly in the field of crop improvement.

Rasco (1988) suggested the following research thrusts for the national vegetable research : a) off-season production of fresh vegetables ; b) production of processing types ; c) production of temperate types of vegetables in the lowlands ; d) seed production ; and e) integrated pest management. There is definitely a lack of tested appropriate technology for each of the four types of vegetable production mentioned. Research efforts should be directed towards developing these technologies.

A good example of a production technology developed by research aimed at increasing production of processing types of vegetables is described below.

Growing bacterial wilt-susceptible tomato variety after rice : an improved vegetable production technology

Growing vegetables after a crop of paddy rice is not a new practice among Filipino farmers. Neither is it a high technology practice. Simply put, it is a way of maximizing the productivity of a piece of land. Among tomato growers in the provinces of Pangasinan and Ilocos Norte in Northern Philippines, however, post-rice technology is more than just a type of a cropping pattern. The post-rice technology has allowed them to grow bacterial wilt susceptible, processing types of tomato. In the past, the production of processing tomatoes had always been unsuccessful because of bacterial wilt . Painstaking research has brought about this uncomplicated and inexpensive technology and today, growers of processing tomatoes are reaping the fruits of research efforts.

The farmers who adopted this particular technology are mostly contract growers of

Table 4 Research fund allocation for agricultural crops in the Philippines, 1988

Crop	Annual budget[1] (M US $)	Percentage	Rank
Coconut	515,795.49	12.88	2
Corn and sorghum	279,146.25	6.97	8
Fiber crops	594,052.00	14.84	1
Fruit crops	389,683.41	9.73	5
Legumes	293,655.91	7.33	7
Ornamental and medicinal plants	125,476.39	3.13	11
Plantation crops	171,198.37	4.28	10
Rice, wheat and other cereal grains	453,979.54	11.34	4
Root crops	493,291.16	12.32	3
Sugar cane	124,671.63	3.11	12
Tobacco	322,736.60	8.06	6
Vegetables	239,878.37	5.99	9
Total	4,003,565.10		

Source : PCARRD, 1988.
[1]1 US $=P21.50

Table 5 Summary of on-going vegetable research by discipline, PY 1988

Discipline	Number of studies	Budget[1] (US $)	Percentage
Crop improvement	59	102,662.19	42.80
Crop protection	32	59,104.61	24.64
Crop production and management	29	32,240.93	13.44
Crop physiology	1	1,869.77	0.78
Seed production and technology	19	30,629.95	12.77
Crop processing and utilization	9	13,370.88	5.57
Total	149	239,878.33	100.00

Source : PCARRD, 1988.
[1]1 US$=P21.50

the processing companies which manufacture, among other things, tomato paste and mango puree. The growing of tomatoes is closely supervised by the company technicians from planting to scheduling of harvesting. All planting materials and production inputs are also provided by the company at cost. The farmer, on the other hand, provides the land, labor and management of all operations in consultation with the technician.

The cultivars grown for processing include varieties from the United States and the Asian Vegetable Research and Development Center (AVRDC) in Taiwan. In Pangasinan, the company supplies the farmers the imported cultivars Peto 95-43, UC-204 and VF 134 -1-2 while in Ilocos Norte, the cultivar grown is Bronco (Ilocandia 4). In 1986, an introduced variety from AVRDC (CL 2784-1-1-4) was officially released by the Bureau of Plant Industry. This cultivar is popularly known as 'Mapula' ('red' in the native language).

Planting of tomatoes is done during the months of September to December when climatic conditions are favorable for optimum production. Aside from low occurrence of typhoons, temperature and relative humidity are both low. Fruit setting is favored and

development and prevalence of diseases are greatly minimized.

The cultural management practices employed were reported by Villareal and Beltran (1986). The farmers apply fertilizers at the total rate of 136.5 kg N, 90 kg P and 180 kg K per hectare using complete fertilizer (14-14-14), urea (46-0-0)and muriate of potash (0-0-60). For basal fertilization they use 45.5 kg N, 90 kg P and 60 kg K. The rest of N and K is side-dressed during the second and fourth weeks after transplanting. Furrow irrigation is practiced and the use of chemicals is only employed whenever necessary.

Villareal (1987) described the experiences of the farmers during the first cropping. There were 509 farmers who participated in the scheme and from the 409 hectares solicited, an average yield of about 20 t/ha was obtained. This yield more than doubled the country's national average of 8.5 t/ha for processing tomatoes. The target yield was 18 tons/ha with breakeven yield of 11 t/ha. The farmers, therefore, experienced substantial increase in their income ; the earnings from tomatoes being greater than that of the main rice crop.

The experience of farmers in the northern province of Pangasinan demonstrates how a technology can be successfully transferred from experimental plots to large scale farm operations.

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Discussion

Imai,H. (Japan) : You mentioned that the average yield of tomato for processing in the Philippines is 8.9 t/ha. In the new farmer trial using the' Mapula' cultivar you indicated that the yield reached 20t/ha. It appears to me that this yield level is still low for high season processing tomato production. Is this trial profitable for the farmers?

Answer : I realize that the level of 20t/ha is still low. However, for those farmers, such a level is sufficient to provide them with extra-income. Also this value is only average and some farmers are able to obtain much higher yields.

Ozawa, K. (Japan) : Please introduce the measures applied to prevent typhoon damage in the Philippines.

Answer : We have tried a number of protective cultivation practices but without success. Vegetables can be grown in protective structures like greenhouses or glasshouses but the farmers in the Philippines cannot afford to build such structures. We tried mosquito or fish nets but they cannot protect the plants when typhoons are really strong.