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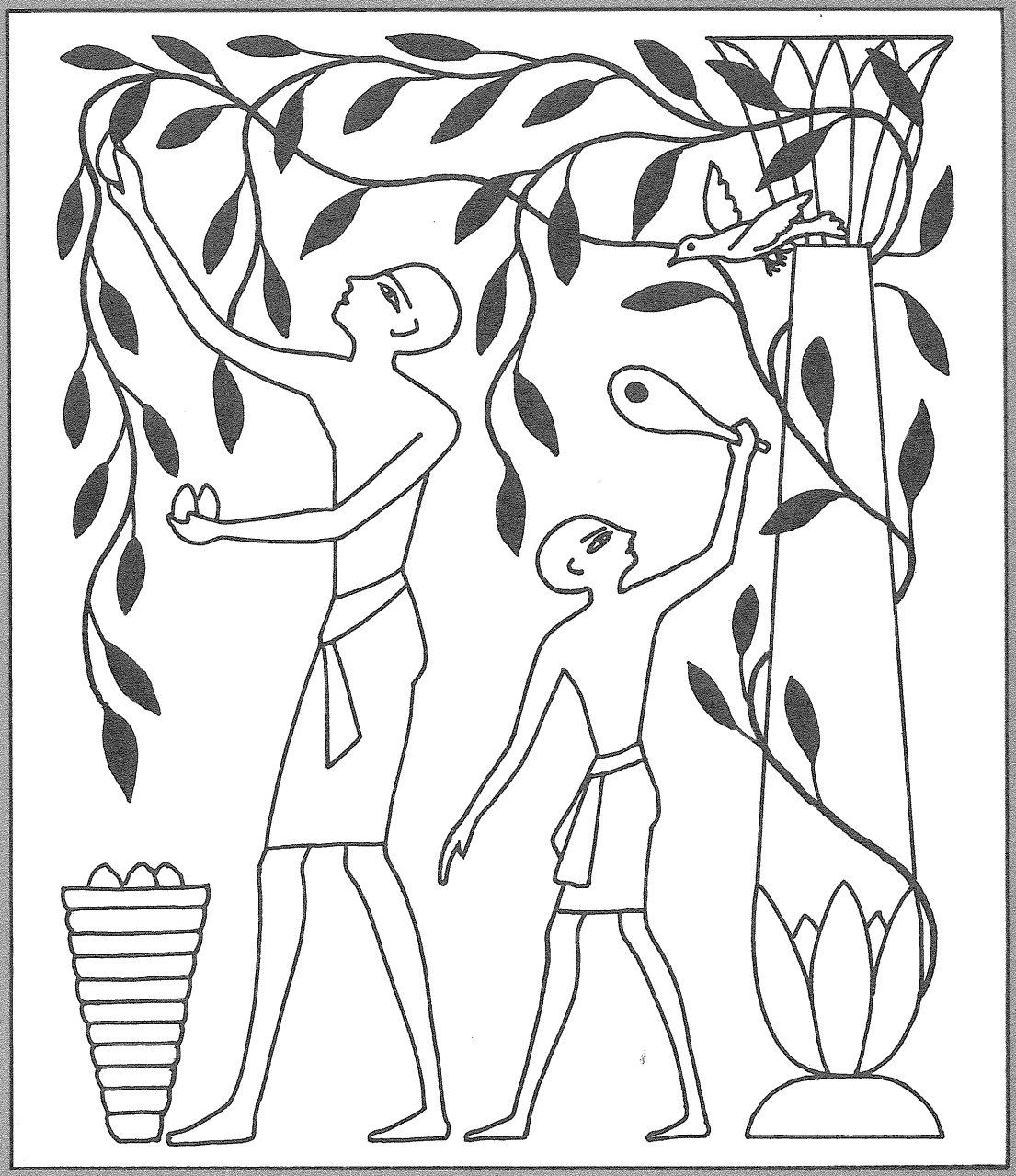


XXth International Horticultural Congress, Sydney 1978

XXth International Horticultural Congress

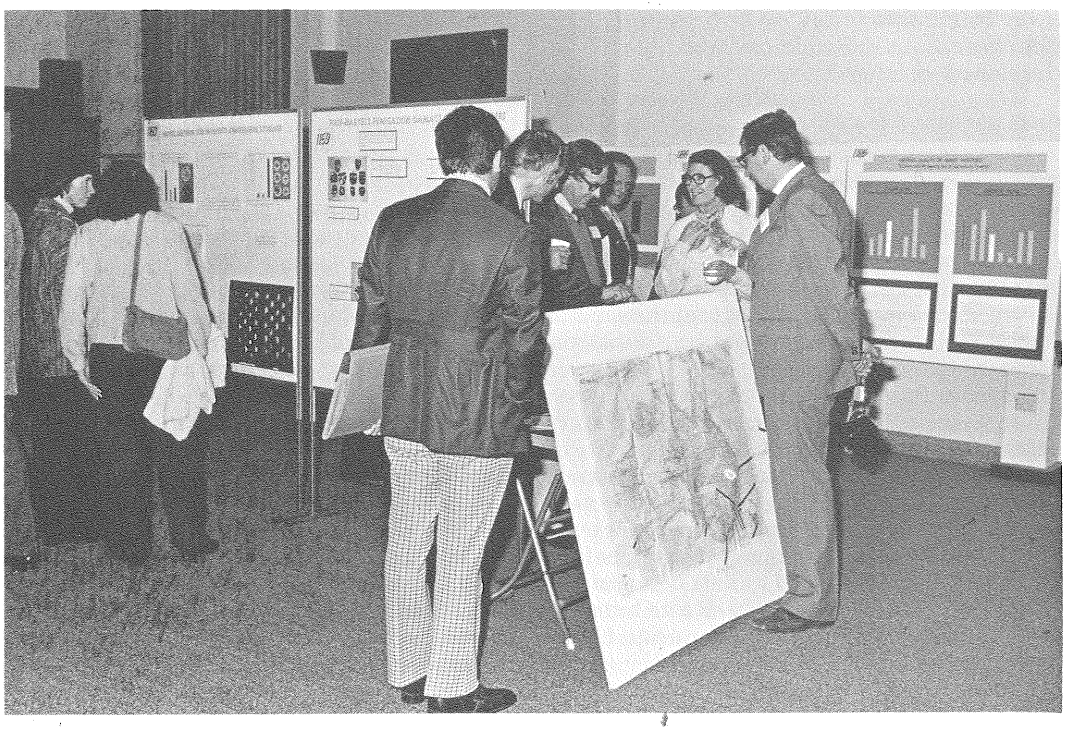
For the first time, Australia was host country to an International Horticultural Congress when the XXth Congress was held in Sydney, 15-23 August 1978, with opening sessions in the Sydney Opera House and the technical sessions at the University of Sydney.

The Division of Food Research, participated actively in the Congress in several directions. Dr W. B. McGlasson was a member of the Organizing Committee and Chairman of the Program Sub-Committee and the Postharvest Horticulture Section Program Committee; Dr B. V. Chandler was a member of the Citrus Section Program Committee.

On Thursday 17 August a display of Postharvest Horticultural Research in Australia and New Zealand was held at the Food Research Laboratory, North Ryde as part of the program of the Postharvest Horticulture Section of the Congress. The display, organized by Mr K. J. Scott, included over 70 poster presentations of research projects and achievements and exhibits of fruit storage systems and equipment.

This issue of *CSIRO Food Research Quarterly* is devoted to five papers which were presented to the Postharvest Horticulture Section of the Congress in a symposium entitled *The Importance of Fresh Fruits and Vegetables to Man — Food or Social?*

The XXIst International Horticultural Congress will be held in Hamburg, Federal Republic of Germany, 29 August to 4 September 1982.



Delegates to the Congress who came to the Division on 17 August saw a poster display of research projects and achievements.

What horticultural products offer to man

By R. J. Millington

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Changes in man's diet

The established record of hominid development begins about 2.6 million years ago in the Omo River Valley in north-western Kenya. *Australopithecus,* from his archaeological remains, was a meat eater and it has been suggested (Harrison *et al.* 1964) that the carnivorous diet of the Eskimos, while exceptional perhaps in the small use of vegetable foods, illustrates the essentials of hunting dietaries including that of Palaeolithic and Mesolithic man. On the other hand Davidson *et al.* (1975) state that *Australopithecus* and *Homo erectus* were '. . . primarily vegetarians but they may have done some hunting for up to a million years. Hunting slowly developed as man moved away from other primates; he became omnivorous . . . skilled in tool making and developed social groups . . .'

From vegetarians to meat-eaters

Barnicot (1969) believes that '. . . it is a reasonable inference that the earlier members of the hominid lineage were vegetarians, though the evidence is scanty.' Detailed observations of lesser primates have shown that besides eating flowers, bulbs, cones, leaves, seeds and fruits, shoots and rhizomes, insects and small mammals are occasionally eaten.

The anthropoid apes, notably the chimpanzee and gorilla, are primarily vegetarian but with bipedalism and the freeing of the hands for manipulation, the occurrence of animal bones suggests that meat was a significant dietary component of the earliest hominids, *Australopithecus*. The difference in the jaws and molars between *A. robustus* and *A. africanius* has been attributed to retention of the primarily vegetarian habit of the former and the development of hunting and meat-eating in the latter.

Popular opinion amongst archaeologists and comparative anatomists is that bipedalism, tool-making and ground dwelling of early man were accompanied by a major change in diet from primarily vegetarian to a meat-eating mixed diet. The rate of change of dietary composition is not well documented but took place over part of, or more than, a million or so years.

Firemaking and cooking

The addition of firemaking to man's technology is first recognized about 300 000 to 350 000 years ago in cold Eurasia at about the time of the Mindel glaciation. In Africa, hearths were not common until 40 000 to 60 000 years ago. With the advent of fire and hence cooking, the availability of plant foodstuffs was enormously enhanced. As Leopold and Ardrey (1972) point out the practice of cooking on the denaturation of widely occurring toxins in plants rendered many new plants into potential foodstuffs (e.g. cassava).

Apart from the role fire played in cooking and the derived benefits from detoxifying plant products, it was fire that promoted the usefulness of cereals and other primarily starch yielding plant materials, as well as pulses. The agricultural revolution of 10 000 years ago could not have occurred without fire and Leopold and Ardrey regard the controlled use of fire as an essential evolutionary step preceding the cultivation and utilization of wheat, barley, rice and maize. These grains, inedible in their raw state, have provided man's major, although scarcely appetizing, food supply.

The agricultural revolution

The agricultural revolution had three main consequences: firstly, it increased the total supply of food for man and secondly it caused his numbers to increase so that it was impossible for most to revert to the low-yielding hunter-gatherer way of subsistence. Thirdly, it resulted in lowering the proportion of animal protein in man's diet. For the last 9000 years or so, until the recent

industrial revolution, agricultural man was, in general, unable to eat anything more than small quantities of meat.

Nutrition

During the two million years or so before the agricultural revolution it is reasonable to assume that nutritional disease was rare, and, equally, that the widespread nutritional diseases of protein deficiency – beri-beri, pellagra, riboflavin deficiency and rickets – stem largely from the dietary change of the neolithic period (Yudkin 1969).

Thus in the space of about 2.5 million years man's diet has changed from the primarily plant diet of his apelike ancestors, to a mixed meat and vegetable diet of the early hominids; back to a predominantly vegetable diet following the domestication of plants and now, in some industrialized countries, a return to a mixed diet comparable with that existing before the domestication of plants some 10 000 years ago.

Man is unable to synthesize ascorbic acid or derive it from his intestinal flora. He shares this disability with a select group of vertebrates including the other primates, the bulbul, fruit-eating bats and the guinea pig. Through his vegetarian ancestry and through his carnivorous hunter-gatherer stages, while there was dependence on non-cereal plant foodstuffs, population pressure on food resources were probably so low that neither domestication of fruits nor the practice of horticulture was necessary. However, as population increased in both numbers and density, and man became tied to his dull diet of cereal and root crops, the pressure increased for assured sources of both palatable and essential nutrients.

History of horticulture

Horticulture as we know it probably developed for these reasons following the domestication and cultivation of farinaceous crops. These grains, roots and rhizomes brought with them rapid population growth, jaded palates and nutritional deficiencies.

Horticulture then is a relatively new human activity stemming from population pressure and the inability of the natural environment to produce the supplements necessary when the proportion of meat eaten declined and the predominance of cereals and other crops led to nutritional deficiencies.

With maize, nicotinic acid became short; with polished rice, thiamine; with root crops some of the B vitamins and, with most cereals, the phytate content can interfere with calcium absorption, which is further conducive to rickets.

How early then are the historical records of horticulture as distinct from the hunter-gatherer's utilization of the plant products of his natural habitat?

Hyams (1971) ascribes the invention of horticulture, almost certainly, to the women of the New Stone Age. At Nineveh, on the Tigris, and throughout Mesopotamia there is abundant archaeological evidence of the cultivation of peas, vetches and lentils to complement cereals, from about 6000 B.C. Of fruits, there is necessarily a less certain archaeological record.

Sennacherib brought back plants from the Hittites, and included in his records were fruit trees, shrubs and spice plants. At Jericho, figs were grown and used in 5000 B.C. The art, skills and benefits of horticulture prior to 3000 B.C. are well illustrated in Egyptian records. The pomegranate, grapes, figs, culinary and medicinal herbs, melons and onions were included in their range of crops. In Greece, by the seventh century B.C. kitchen gardens, orchards and vineyards were attached to country houses. Similarly the Romans developed intensive horticultural activity.

Meanwhile, in the New World, the evidence from the lower Illinois valley, about 8000 B.C., would suggest that the problem of intensive cultivation of horticultural crops was partly obviated by expanding populations siting themselves in areas where the natural abundance of these crops was commensurate with the size and growth rate of the population. Similar evidence comes from more central American locations, where again a combination of climate, soil and plant-life provided a suitable location for the development of large aggregations of people and relatively high population densities (Robson 1978).

In the Old World, less favourable combinations of biological and biophysical characteristics necessitated the development of horticulture as a means of producing food to supplement the diet. In the New World, where populations were smaller, it was practicable to locate or to re-locate in those

areas where natural densities of useful plant species were sufficient to augment dietary requirements arising from the domestication of cereals, tubers and root crops, by near-urban societies.

In more tropical environments intensive vegeculture of predominantly high calorie foodstuffs seems to have originated at about the same time as the domestication of cereals – 5000–10 000 years ago. At this time too came the domestication, and the practice of gardening, of horticultural crops; bananas, pineapples, durians, and so on, both to offset nutritional deficiencies and to lend lustre to an otherwise rather drab diet.

Food preferences

Yudkin (1969) has noted that properties of shape, colour, smell, taste and texture cause particular species, including man, to choose particular foods. For these properties he uses the word 'palatability' and states that during the course of evolution, a developing species continued to choose foods that gave the required nutrients and at the same time had particular attributes of palatability for the species. Clearly, the qualities of meat and the colour, smell, sweetness, acidity and aromatic taste of fruits must have provided an enticing diversion from seeds, leaves and roots. 'When he ate what he liked, he ate what he needed.'

Horticulture and culture

As already mentioned, horticultural products offered man a means of achieving a balanced diet. But they contributed much more than this: by including herbs they added zest to an otherwise monotonous gastronomy, and the medicinal herbs, if not actually promoting better health, at least lent valuable psychological reassurance throughout the aeons before medicine acquired some scientific support.

Floriculture, which has long been a large part of horticulture, but which, unfortunately, cannot be discussed here, has played an important role in developing the aesthetic tastes of man. Courtship without flowers, festivals without fruit and gaiety without the fermented product of the grape are scarcely imaginable in our modern cultures.

The practice of horticulture in all its forms expanded as society steadily evolved. It has fulfilled fundamental needs and satisfied desires. Invented by women, it kept them occupied for millennia while the menfolk disappeared ostensibly to hunt. It is, indeed, tempting to speculate whether the current foment on the distaff side would have arisen had modern society managed to maintain gardening as a common pastime not only for women but for men and children as well.

Conclusion

What I have tried to do is follow the dietary changes of man over the last 2½ million years and to point out the factors leading to the development of horticulture with its resultant horticultural products. While meat was a large component of diet, neither protein nor vitamin deficiencies were serious or widespread problems. However, in the wake of the domestication of cereals and root crops came a reduction in meat intake and concomitant deficiencies that could be met by fruit and vegetables necessarily cultivated because of human population sizes and densities. The agricultural revolution 10 000 years ago is regarded by most as the blessing which led to the development of large and sedentary social groups with leisure to propel our cultural and technological development. It brought with it also the squalor associated with over-population and urbanization. Probably its greatest virtue was in bringing about horticulture itself, an expression of the adaptability of man to cope with the evolution of society.

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What does man want from horticulture? — developed countries

By J. M. Lyons

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In a developed country man 'wants' from horticulture the same as has been his desire over generations — variety in his diet, pleasure from flavour, texture, appearance — the enjoyment of eating. The agricultural pattern that has emerged throughout the world is in part a result of ecological accident — a particular combination of climate and soil — and in part the result of economic and cultural factors in the society that grows the crops. Man's need to obtain an adequate supply of nutrients through his diet is not only a part of his biological evolution but also part of his social evolution. As he developed a stable agriculture, he was able to organize a stable way of life without the necessity of foraging over substantial areas. This freed his energies for new kinds of social and economic activities. As an example, the U.S. today has a horticultural industry that is producing over 60 major commodities on 2 430 000 ha of land and generates millions of dollars of economic power on the farm and related industries. Farming is looked upon as an occupation rather than a way of life.

Rather than ask what man 'wants' from horticulture from the perspective of a developed country, I feel it is more important to ask what the impact of man has been on horticulture in a developed country — to examine the ingredients of its evolution, to look at its characteristics, and to ask about the implications for the future.

Establishment of the horticultural industry in the U.S.

The wide array of horticultural crops grown in the U.S. today reflects the basic principles of food consumption — why people choose to eat particular things as against others. These food habits have evolved since the beginning of man and are a result of familiarity with a food item and its availability.

Familiarity

People will eat what they are familiar with — what they recognize as food. Of all the foods available in a society, individuals select only a small number to eat. For example, in a modern U.S. supermarket there are probably some 8000 food items but the typical diet revolves around only 125 different items.

Culture

Cultural pedagogy has played the major role in determining what we select as fit to eat. Food habits have evolved from an interaction of what was available and of cultural beliefs as to what was fit to eat. Cultural geographers study which cultural behaviours are linked to food habits — religion, historical custom of ethnic groups, status or prestige foods — habits dictated by culture and society over a period of many generations. The nature and diversity of our horticultural crops represent the diversity of origins of the early explorers, settlers and immigrants that make up our history and our population.

Nutrition

Of all the criteria governing selection of foods, nutritional value is actually seldom considered. Nutrition is a relatively new science in the four million-year history of man but he obviously was able to survive without consciously applying it as a science. Despite the lack of positive nutritional selection, fruits and vegetables can and do contribute to our nutrition. A brief review shows that their major nutritive contributions to our diets are vitamins A and C. They provided about half the vitamin A and over 90% of the vitamin C in our diets in 1971, which in fact was about the same proportion as in 1925. In addition to these two major vitamins, they contribute niacin,

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riboflavin, thiamin, potassium, phosphorus, calcium, iron and sodium.

However, the nutritional importance of fruits and vegetables in the normal diet is a function of the nutrient composition of the item and the quantity eaten – not always are the crops highest in nutritive value consumed in large quantities. As an example, the Table shows that a number of fruits and vegetables can significantly contribute to vitamin C nutrition. Peppers, broccoli and Brussels sprouts are rich sources of vitamin C, but potatoes and oranges contribute most to vitamin C nutrition. Shifts in relative contribution amongst these items over time have occurred and about three times as much vitamin C is now contributed by citrus fruits and considerably less by potatoes than in the 1920s – a result of increased availability through technology.

Data on the other nutrients obtained from horticultural crops that contribute to our diets can be generated but the data on vitamin C serve as an adequate example.

However, despite the fact that we currently consume some 211 kg per person per year of fruits and vegetables, selection of a particular fruit is *not* made on the basis of its *nutritional value*! Fruits and vegetables are chosen for flavour, texture, appearance, and variety in the diet – for eating enjoyment. Again, food selection is based on familiarity and cultural beliefs which are determined by what food is available to eat. There are two types of availability:

- constant availability – when a food item is available throughout the year, this can be the result of natural accident of a proper geographic location for that food in the environment, or by having a technology capable of producing and transporting that food from a different geographic region
- partial availability – when a food item is not available throughout the year. This is affected by seasonality (certain foods are only available during specific seasons), and by economics. Limited economies only have available those foods they can afford.

In the early days of our settlement, many horticultural commodities were only partially available both because of seasonality and limited economic resources. Having the good fortune of a wide range of soil types and the proper climate, their partial availability has evolved to virtually constant availability through technological development. Technology is the dominant characteristic of our horticultural industry. This dominance seen in the technology of *transportation* and *storage* (as opposed to production technology) is the subject of the Postharvest Horticulture Section of the Congress.

Vitamin C concentrations and 1970 production of this vitamin by several crops. The top ten crops in each category from among 39 major fruits and vegetables are included (from Stevens 1974).

	Vitamin C concentrations ($mg\,100g^{-1}$)		Vitamin C production (tonnes 1970)	
Peppers	128	(1)	427	(7)
Broccoli	113	(2)	310	(11)
Brussels sprouts	102	(3)	51	(28)
Cauliflower	78	(4)	166	(21)
Strawberries	59	(5)	265	(14)
Spinach	51	(6)	171	(20)
Oranges	50	(7)	7159	(1)
Cabbage	47	(8)	1012	(5)
Grapefruit	38	(9)	1301	(4)
Cantaloupe	33	(10)	402	(8)
Asparagus	33	(10)	77	(27)
Tomatoes	23	(16)	2476	(3)
Potatoes	20	(18)	5879	(2)
Corn	12	(20)	547	(6)
Bananas	10	(26)	327	(10)
Apples	7	(32)	396	(9)

What horticultural foods were available in early America? In the 1500s when the early settlers arrived, they found the Indians enjoying a variety of fruits and vegetables, including plums, persimmons, cherries, crab-apples, wild berries of all sorts, peppers, beans, maize, the husk tomato, pumpkin and squash. As settlements developed, 'Old World' fruits and horticultural techniques were brought to New England and stone-fruits, apples, grapes were amongst the fruits cultivated. Similarly oranges were introduced into Florida in the 1500s by the Spanish, and the Franciscan Fathers brought oranges, lemons, olives, figs and pomegranates to California as they developed their missions. Hence by the 1700s the widest possible array of fruits and vegetables was available in the U.S. The fundamentals of availability and familiarity of horticultural items were thus established very early in our history. The extension of fruit and vegetable growing to the frontier outposts as the settlement of the country proceeded westward is part of the history of the country itself.

Expansion of the horticultural industry

Expansion of the horticultural industry followed the theory outlined by von Thunen, the German economist (1783–1850), which described concentric farming zones or belts surrounding the market, the outer boundary of each zone being determined by the distance at which farmers could no longer make a profit because of increased transportation costs. In the U.S. this pattern existed and changed only as the transportation system expanded westward, first with canals and then by rail. Before about 1850 fresh market fruit and vegetable production as an industry was virtually unknown except along canals and railway lines leading out about 80 km or so from the larger northern cities. Generally, agriculture was still in the dark ages as an industry. There had been no advances except to extend the boundaries of production. No mechanical improvements had been made; the farmer still broadcast his grain, cut it with a sickle, and threshed it with a flail as had been done from the beginning of time. The nature of plant disease was not understood and agricultural chemicals were still in the future. Bordeaux mixture was used commercially in the 1880s and this technological advance marked the development of our modern horticultural industry. From the 1880s to 1900, the development of cold storage and improved transportation facilities coincided with the working out of effective insect and disease control methods.

At the same time a successful canning method evolved which provided a new way of preserving foods without greatly changing their appearance, flavour or nutritional value. The technology of quick-freezing to preserve quality came in the late 1940s and was yet another method of preserving and distributing horticultural commodities.

The census of 1900 was the first attempt to make any detailed report of horticultural commodities in the U.S. Economists focusing on agriculture and food needs tend to be most interested in those commodities that can be easily counted and those that move in channels of national and international trade – cereals, soybeans, coffee, sugar, beef. Fruits and vegetables were difficult to count historically because they moved only short distances and were consumed on the farm. As the horticultural industry grew in economic importance these commodities were counted on a regular basis and by 1919 U.S.D.A. statistical reports (Corbett *et al.* 1925) showed some 40 fruit and vegetable crops shipped to market with a value of $230 000 000. (It is also of interest to note that this same statistical report by the U.S.D.A. states that, 'Although the dollar is used to express the economic status of our horticultural industries and to indicate their magnitude, it is, after all, the more abiding aspects, the deeper things in horticulture, of which the dollar is but an index, that have real significance. Although the material side of horticulture must be recognised, it is its contribution to the happiness and welfare of millions of people which makes its numerous aspects so very much worthwhile'.) Today that same horticultural industry produces over 60 different kinds of major fruits and vegetables with some 2 717 000 ha in commercial production for fresh market and processing, or about 130 m^2 for every person in the U.S.

At the beginning of agricultural development in the U.S., land was abundant and labour cheap. Capital inputs such as farm machinery and fertilizers were modest. Farmers created their own power in the form of physical work of family members and animals raised on the farm. Since that time agricultural productivity has increased at an average rate of almost 1% p.a. As the farm output for this period increased, there was essentially no change in the amount of inputs, but the composition of inputs has changed dramatically. Capital inputs in the form of mechanized power, machinery and chemicals have increased substantially; the area under cultivation has remained constant; and there is 70% less farm labour. There are currently about 4% of the economically active population engaged in agriculture (3% in the United Kingdom, 12% in New Zealand, 91% in Chad). As the horticultural industry developed, commercial fruit and vegetable production gradually displaced other farm enterprises as one farmer after another, finding fruit and vegetable growing more profitable, expanded his production. In some areas the transition was from cereal production, in others from dairying or stock-raising to production of fruits and vegetables. As the transportation system evolved and city populations grew and became special markets absorbing large quantities of particular crops, the 'trucking industry' evolved. Before that evolution, the

'market gardeners' only supplied a seasonal production to meet the requirements of the local markets. The key features in the development of this horticultural industry were:

- available land
- a steady increase in population
- a steady increase in per capita income.

The modern technological horticultural industry

The modern food system in the U.S. can be described as one having an industrial base of supply, a sophisticated transportation and distribution system, a large processing industry, appliances for home storage, and a level of industrialization that permits higher costs for foods. All of this adds up to one overriding concern – the energy subsidy to this food system. And horticultural commodities are particularly heavily subsidized in terms of energy inputs.

Energy inputs into the food system, as with many activities in our society in the past several decades show a striking increase. Estimates of total energy use in the food system in 1940 were approximately 2870×10^{12} kJ as compared with over 8800×10^{12} kJ in 1970 – more than a three-fold increase. As we have become efficient in our ability to increase farm productivity there has been a concomitant substitution of technology for labour and hence greatly increased energy use on the farms. One farmer now feeds 50 people compared with a 1 : 3 ratio in earlier days. This technology that allowed for reductions in farm labour also created new employment in farm related activities to offset the displaced workers, but not without some painful social dislocations in many areas. The decline in farm labour as a function of the energy supplied to the food system has gone through an exponential phase and it is unlikely that further reduction in farm labour will occur even with greatly increased energy inputs. Similarly, farm output as a function of energy input into the food system has reached a plateau. There was an exponential growth phase for productivity in relation to energy input from about 1920 to 1950. Since then, increments in production have been less despite enormous increases in energy inputs.

There is considerable variation in the amount of energy consumed amongst the various food groups, and processed fruits and vegetables are particularly energy intensive. Some 1963 data show an energy ratio (energy input : food energy) of over 15 : 1 for processed fruits and vegetables as compared with 10 : 1 for fresh fruits, 5 : 1 for fresh vegetables, and 4 : 1 for flour and cereals. Categorizing fruits and vegetables on the basis of energy content is not particularly helpful because they are not consumed in our society as a source of energy (or protein for that matter) but rather to provide vitamins, minerals, variety and pleasure in our diets. But the data do emphasize the magnitude of the energy consumed in our modern horticultural industry. Strictly from an energy perspective, when we eat processed tomatoes we are eating natural gas! 1 t tomatoes contains about 770 000 kJ of food energy; 1 t processed tomatoes has consumed over 3.9×10^6 kJ, including 2.9×10^6 kJ of natural gas. In comparison, rice produced in the U.S. requires an input of about 4.8×10^6 kJ per tonne but in return produces over 12.5×10^6 kJ in food energy. Obviously processed tomatoes are not eaten for the energy that might be derived from them. As a food group, fruits and vegetables consumed about 18% of the total amount of energy used for food related activities in 1963. Meat, poultry and fish consumed 27%, the dairy industry 16%, and flour and cereal products 13%. Sugar, alcoholic beverages and other foods consumed the remaining 26%. For an accurate assessment these data would have to be updated but they serve to emphasize the magnitude of and trends in the energy flow of our highly technological food system.

What are the implications and challenges?

As one looks at the world's population and projected increases, the question of survival and expansion of an energy-intensive horticultural industry becomes paramount. The U.S. food system which is briefly described here has developed as it has for a variety of reasons and it is interwoven into a highly industrialized economy. The facts are clear. A horticultural industry that produces a large number of different crops and makes them available virtually all year round consumes ever increasing amounts of energy. Estimates show that nearly 40% of the energy used in the food system goes into processing, transportation and storage. If data were available just for horticultural commodities, the percentage would be even higher.

There are no answers here. Is it possible to

reduce the energy required for the transportation and storage of horticultural commodities? This is the question and challenge for postharvest horticulture in the future. As energy in the food system becomes limited — at least in an economical sense if not in actual amounts — horticultural commodities that are consumed for pleasure rather than for nutrition will be most vulnerable to dislocation. The possibilities of a return to the market garden approach, partial availability, and less choice, must be considered.

In planning and preparing for the future, we must look at the present food system, as well as the history of how it developed, and clearly recognize where we are. We cannot turn back the clock and do it differently but we need to examine our goals closely in order to preserve for future generations the same pleasures that we have enjoyed from eating fruits and vegetables.

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Integrated marketing — an Australian experience

By A. G. English

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Origin

In the years immediately following World War I, the Queensland fruit industry was in a parlous state. Growers urged the Government of the day to set up a State-wide organization to direct the orderly marketing of their fruit.

The result of this pressure was the introduction of The Fruit Marketing Organization Act which gave statutory power to Queensland fruit growers to attempt the orderly marketing of their products through an organization constituted under it, known as 'The Committee of Direction of Fruit Marketing'. It was decided that this ponderous name should be abbreviated to CDFM. However, the wholesale trade of the day, in derision, called it 'the COD'. This name has remained to become a household word throughout the fruit and vegetable industry of Australia.

The original Act did not cover vegetables, hence its name. It was only after a Royal Commission in 1944 that the Act was amended to include vegetables.

The COD constitution

The Constitution of the COD is achieved through Local Associations, Sectional Group Committees for bananas, pineapples, citrus fruits, deciduous fruits, other fruits and vegetables, and the Executive Committee. The unit in the COD is the individual grower, around whom the entire structure revolves, and from whom the constitution progresses. The COD is owned by the fruit and vegetable growers of Queensland. It is co-operative in principle and in its mode of operation.

It is not, however, a co-operative business in the legal sense, in that it is not registered under The Primary Producers' Co-operative Associations' Act, nor The Co-operative Societies' Act, and no actual shares are issued to growers.

A Queensland grower of fruit or vegetables, or both, becomes in effect a 'shareholder' immediately he supports any of the COD activities, or uses any of the COD transport systems or becomes a member of a Local Association registered with the COD.

Transport

Satisfactory marketing of highly perishable products, such as fruit and vegetables, depends on fast and efficient transport through all stages of the marketing chain. One of the first tasks undertaken by the COD was the organization of bulk transport from production areas to the main markets, not only in Queensland but also interstate. In the 1920s rail was the only means available. With the advent of road transport, following World War II, the COD continued its bulk rail service but gave support and assistance to private road transport operators.

For the efficient working of the bulk rail system, the COD provides a service at both the consigning and the receiving ends. 'Loaders' are appointed at the various railway stations in the production districts to check in loads and to attend to all details of consigning, particularly the efficient stacking of loads in the wagons.

At the receiving end, the COD has its own staff or representatives present to check the goods and ensure delivery to the various wholesalers' premises as quickly as possible. The service is provided for all growers, irrespective of whether they consign to COD's wholesale floors or to those of private agents and merchants.

The railway service has improved immeasurably since the COD was formed. At that time, interstate consignments had to be trans-shipped at Wallangarra because Queensland's rail gauge was 3 feet 6 inches and New South Wales had the standard gauge of 4 feet 8½ inches. Later, the standard gauge was brought through to Brisbane via Kyogle in New South Wales, but trans-shipping still had to be done in Brisbane. However, transit times to southern markets

were reduced drastically. Today, interstate fruit trains travel at passenger train speeds and leave Brisbane daily for southern markets.

The COD's close liaison with railway departments has resulted in a close working relationship and in the most advantageous freight rate for growers. The COD, after providing a guarantee of a minimum tonnage, pays the railways at bulk rates for haulage. After adding a margin to cover its costs, the freight charged to growers is deducted from their account sales by their wholesalers and paid over to the COD. Any surplus at the end of the year is credited to the respective Sectional Group Committees so that the full ultimate benefit of the rail service goes to growers, either directly or indirectly. The COD's freight charges under this arrangement are much lower than if growers consigned individually to market.

For many years, the COD regarded with hostility the competition of interstate road transport. It was later accepted however by grower-leaders that every grower should have the right to choose his own means of transport. Steps were taken to achieve this objective, steps that introduced to the Queensland fresh fruit and vegetable transport industry an atmosphere of harmony such as had never previously existed.

It was in transport that the COD early established its reputation for service, a service that was all too frequently taken for granted by growers. The basis was staff dedication to serve growers.

In 1963, the COD built a fumigation chamber on railway land at Clapham in Brisbane, which allowed Queensland growers to send oranges to Melbourne without fear of condemnation for fruit fly. As fumigation techniques were developed for other fruit and vegetables, more rooms were built.

Air transport has been used over many years, mainly for the interstate trade in beans and strawberries. Fast road and rail have attracted the beans but some strawberries are still sent south by air. The COD organizes and supervises this service.

The COD was involved in experiments with refrigerated rail transport as early as 1925 when fresh fruit was packed in dry ice for transportation from Brisbane to Mt Isa. As a result of COD requests to the Queensland Railway Department in 1946, two ice wagons used for meat transport were converted for fruit and vegetables. During the early 1950s another 120 ice wagons were introduced. They were primarily for meat transport but were also available for fruit and vegetables. From 1959 to 1977 mechanical refrigeration units were installed in 33 of these wagons.

As the industry converts to 'on farm' pre-cooling, so the Railway Department is updating its refrigeration capacity. During 1977, 10 refrigerated containers, each of 8-pallet capacity, were purchased. By March 1978, 30 mechanically refrigerated wagons, each of 20-pallet capacity, had also been added. Owing to the large volume of interstate traffic, an arrangement also exists whereby the COD can use refrigerated wagons and containers operated by the N.S.W. Public Transport Commission. This Commission is currently considering constructing additional mechanical refrigerated containers suitable for travel between loading centres in Queensland and southern capitals.

The increased use of refrigeration has sorely taxed the capacity of the railways, and some districts have turned to refrigerated road transport.

Wholesale and retail marketing

The COD operates nine wholesale branches from Cairns in North Queensland to Melbourne, and five specialist retail outlets which provide a service to consumers in country towns.

Despite general resistance by the wholesale trade to the introduction by chain stores of a new concept in marketing, the COD recognized very early that this new dimension had to be accepted and that chain stores had to be adequately serviced with fruit and vegetables in whatever form they required. One of these forms is known generally as 'pre-packing'. The objective is to provide an article that the customer can pick up conveniently and put in the trolley, just like any grocery item. Unfortunately, there was a time-lag before the COD and other parties undertook this work for the large buyers. This forced them to do their own, mostly in each store, and the result left a lot to be desired. Chains and supermarket operators are retailers, expert in that field, but they are not specialists in fresh fruit and vegetables. They generally recognize this and look to the fruit and vegetable industry to provide the specialist service. The COD

believed that, if pre-packing was to compete with loose sales, the cost must be competitive. This, in turn, meant that the labour cost component had to be reduced to a minimum. To achieve this, the COD sent senior staff to Europe, the United Kingdom and the United States to find the most suitable machinery. This is now installed in Brisbane, Rockhampton, Townsville and Cairns and has proved that high quality 'prepacks' can be produced at competitive prices.

Banana ripening and marketing

From the inception of the COD in 1924 and for many years afterwards, bananas were ripened in wooden structures without insulation or air conditioning apparatus, and ripening was entirely dependent on outside atmospheric conditions. This was most unsatisfactory and, often, to avoid undue loss, bananas were taken from the rooms before the ripening process had properly commenced. The COD believed that a more scientific process should be introduced, but it encountered opposition from the wholesale trade on the grounds of cost and that reported new techniques had not been proven.

In 1927, the COD sent its manager to America to obtain information on the methods of handling bananas in that country. He found that the United Fruit Company of the U.S.A. had developed a highly successful technique, but it was specifically for the ripening of the Gros Michel variety. The Queensland variety, the Cavendish, was produced under vastly different conditions. The COD enlisted the aid of the then CSIR which, in turn, obtained the co-operation of the Universities in Brisbane and Melbourne and of the railway departments in the three Eastern States. The work commenced in February 1929 and continued until 1932. The most important finding was that, to ripen bananas in a satisfactory way and one approximating natural plant ripening, effective control of temperature and humidity was essential. The ripening technique developed in 1930 is still basically the one used today. In spite of this, there was a reluctance on the part of banana ripeners to change their methods and it was left to the COD to give this lead.

This COD initiative in banana ripening was followed up in later years in packaging and handling techniques. Again, senior COD staff visited America and saw at first-hand how fibreboard was being used to pack bananas in hands and clusters, whilst Australia was still using heavy wooden cases and packaging single bananas in them. The COD initiative revolutionized banana packaging and handling in Australia but it is significant that in New South Wales the singles pack in wooden cases still retains a place in the market.

Refrigeration

One of the most significant recent developments in Australian horticulture has been the belated realization of the importance of correct handling of fresh fruits and vegetables after harvesting. This has been a neglected area because of the number of groups involved — growers, transporters, wholesalers and retailers — their often divergent views and lack of understanding of product deterioration. The rapid development in pre-cooling, refrigerated transport and subsequent handling over the past five years has been most encouraging.

One of the major reasons for the shift to road transport from rail has been the ability of road transporters to install a much greater proportion of refrigerated capacity in a few years. The oft-promoted concept of maintaining a 'cold chain' from grower to consumer is now approaching reality. This is a notable achievement in a country with widely scattered production areas, small farm holdings and huge transport distances.

The COD is now attempting to develop a comprehensive program in its own trading operations for pre-cooling, refrigerated transport and storage where necessary. This is in addition to the cold storage facilities, both conventional and controlled atmosphere, that the COD has operated for many years, principally in the Granite Belt district.

Factory activities

Factory control of various fruits by direction was one of the first jobs tackled by the COD. It was quickly recognized that the first step towards stabilized marketing lay in the effective utilization of supplies surplus to fresh fruit market requirements. Excess supplies on the market led to an accumulation of lines which in turn, rapidly depressed prices. The object was to divert these surplus fruits direct to canneries, to avoid market carryovers and to ensure that canners received the freshest possible fruit. This factory policy was highly successful and

for many years, control was exercised over the following fruits sold for processing: pineapples, tomatoes, strawberries, deciduous fruits, papaws, figs, passion fruit and citrus fruits. The crop was handled on a bulk basis, the COD paying the growers and invoicing the canners. Thus, all canners paid the same prices and all growers received the same prices.

The value of these factory operations to the fruit industry generally is best illustrated by the pineapple section. The control exercised turned the chaotic conditions of the pre-COD days into stability which, in turn, caused the pineapple industry to expand so greatly that it became the predominant section of the Queensland fruit industry, with conditions stabilized from the point of planting to the point of selling the processed article.

Pineapple canning

From 1924 until 1937, the COD had statutory control of all major fruits for canning, but had no interest in canning. Acting on behalf of fruit growers, the COD negotiated with canners on an industry basis.

During this period, the pineapple industry, so heavily dependent upon cannery outlets, lacked stability and the industry was in a precarious state. It was standard practice in heavy crops for quotas to be applied to cannery deliveries. Canneries did not provide a service to growers; they operated as they saw fit, irrespective of the interests of growers. Despite these disadvantages, the lot of the pineapple grower improved, production increased and export markets were developed. It was firmly established during the period that statutory control of canning and jam fruits had great advantages over the old system where canners dealt directly with grower associations or individual growers. In this respect, the COD legislation gave Queensland growers a big advantage over those in other States of Australia.

From 1938 to 1946, the COD had a half interest, but no management rights, in the largest pineapple cannery in Queensland. It was an attempt to weld proprietary enterprise, with its finance, knowledge and canning equipment, to a statutory body of growers with full legal control of fresh fruit made available by growers for canning in Queensland. The cannery processed pineapples only. After nine years, the tie-up was terminated and the COD, on behalf of the Pineapple Sectional Group Committee, established its own Cannery at Northgate in 1947. The new Golden Circle Cannery, whilst owned by the COD, functioned under a separate Board known as the Cannery Board of Management and was subject to policy decisions of the Pineapple Sectional Group Committee.

The cannery was almost an instant success. Whilst it was established by the Pineapple Sectional Group Committee of the COD and was primarily a pineapple cannery, the Board soon realized the value of becoming a multi-purpose cannery. Other tropical fruits and, later, vegetables were processed, allowing the cannery to operate all year round, a decided advantage over the canneries handling principally deciduous fruits.

It was further realized that the cannery should be as independent as possible of outside supplies of canning requisites, such as cans and cartons. A can plant was installed and later a fibreboard converter. In more recent years, the cannery has installed its own blow-moulding plant for plastic cordial containers.

Following the early success of the cannery, moves were made to have it excised from the COD organization. Many growers felt the need for subscribers to the cannery's capital to have some equity in the cannery. In 1964 *The Fruit Marketing Organization Acts* were amended to allow the cannery to become a separate entity from the COD. However, there is some integration at Board level and harmonious relations have continued ever since.

The cannery's success is reflected by the fact that, today, it is the only pineapple cannery in Australia. The cannery, together with a Rationalization Plan, which discourages pineapple production beyond Australia's requirement, provides growers with the knowledge that they are getting the maximum out of the market place for the fruit they choose to have processed.

Container exchange

At the COD Container Exchange, returnable wooden containers are hired out to growers who wish to use them for consigning cabbages, cauliflowers, pineapples and watermelons to markets in Queensland.

Most pineapple growers now use the wooden crate that can hold 12–30 pineapples, depending on size. Cabbages are now mostly marketed in bulk bins that have

an average capacity of 400 kg. Cauliflowers and some smaller varieties of cabbage are received at the Brisbane Market mainly in the vegetable crate. The bulk bin is also used extensively for watermelons. A bin of melons weighs 700–800 kg.

The introduction of these wooden containers was greeted with objections from some sections of the trade. It was thought that the cost of additional paper work would offset the savings made by using a less expensive package. The objections were soon put to rest. As the contents were handled less, damage was significantly reduced, resulting in the product being offered for sale in better condition.

Bulk handling of consignments in crates and bins reduced the time that growers or carriers had to spend unloading and handling at the market. The dimensions of the containers are shown in the Table.

The bins are constructed of timber, on a pallet base, reinforced by angle iron and steel strapping. The pallet is the same size as the base of the bin, which is considerably larger than the standard pallet in use in Australia.

Outside measurements (mm) of containers

	Length	Width	Depth
Vegetable bins	1486	1067	787
Vegetable crates	762	413	381
Pineapple crates	667	362	311

Plastic returnable containers

The COD first introduced the concept of plastic returnable containers for fresh fruit and vegetables in 1971, following an overseas trip by its General Manager. The COD, in conjunction with Departments of Agriculture in the Eastern States of Australia, liaised with the plastics industry to develop a container system that could be adapted to plastic returnables.

It was felt initially that 18, 36 and 72-litre volumes would adequately cater for the demands of industry. It was later decided that the 72-litre container would be too large and a 60-litre container was proposed in its place. It was a source of disappointment that, after all the work that went into this development, the containers were used by large retail chains and other operators but not in the main terminal markets.

Planting materials

From its inception, the COD has been involved in upgrading the quality of planting materials used by Queensland growers, and this activity continues in association with the Department of Primary Industries. Approved seed of French beans and tomatoes, virus-free strawberry runners and citrus budwood and seed, and apple and pear trees, are examples of the planting materials provided for growers.

Research and extension

The COD has always recognized the necessity for a strong research effort directed towards the industry's problems. The joint development with CSIR of a satisfactory commercial technique for ripening bananas (referred to earlier) was one of the earliest projects.

The principal research resource available to the Queensland horticultural industry is the Queensland Department of Primary Industries. A close working relationship exists between this body and the COD. This is formalized by the existence of six Advisory Committees set up by the Minister for Primary Industries. Each Committee has departmental and grower representation, with the following terms of reference:

- to provide liaison between industry and the Queensland Department of Primary Industries
- to nominate, in both research and extension areas, technological problems of production and marketing and to recommend that appropriate research and/or extension work be instituted
- to review Department research and extension programs.

Since its inception, COD has contributed a total of $464 771 to research organizations.

The COD has two overall policies in its funding:

- support where necessary for research programs of potential or immediate value to industry
- financial contribution or other action to ensure that adequate facilities for research are available.

As examples of activities in the second category, the COD has purchased and operates a pineapple industry farm that is widely used for research purposes, has purchased land and contributed to annual operating costs of the Department of Primary Industries' Horticultural Research Station in Bowen, and has contributed largely in the

purchase of facilities and equipment at the Redlands and Maroochy Horticultural Research Stations and the Sandy Trout Food Preservation Research Laboratory.

For many years, the COD was concerned that extension services provided by governments in Australia confined their activities to production problems. Whilst these problems were important, there was little point in showing growers how to grow bigger and better crops while so much needed to be done in marketing extension and education. As a result of the COD's concern, the Queensland Department of Primary Industries set up a Marketing Extension Service in 1975, the first of its kind in Australia.

The COD has been active in the development of horticultural education in Queensland. From the inception of the Faculty of Agriculture at the University of Queensland, the COD has accepted the invitation to be represented on the Board. When in 1965, the Queensland Government set up the Agricultural Education Advisory Council, the COD was represented.

The COD has always pressed strongly for specific horticultural education; it was actively involved in the development of the degree and diploma level courses in horticulture now conducted by the Queensland Agricultural College. It also has had membership of the Council of the Queensland Agricultural College from the time it became a College of Advanced Education, firstly by its General Manager and later by grower delegates.

This chain starts with the producer and ends with the consumer. The number of links in between may vary according to many factors. The COD can best serve growers and the community by:

- keeping abreast of marketing trends in Australia but especially overseas, so that it can continue to be a leader in any necessary change or new developments
- following a program of modernizing developing and expanding its active involvement with marketing at all points in the distribution chain
- continuing to advocate full use of refrigeration throughout the whole distribution chain, and setting an example in the COD itself
- continuing to recognize the need for specialized and technical services within the organization. At the same time, care must be exercised to ensure that they complement, and closely liaise with, the various Government agencies
- maintaining pressure, and setting an example for improvement in packaging, handling, storage and transport of our highly perishable crops. In-service training will be stepped up to keep the COD the leader in this field
- pursuing the concept of a total industry organization in Australia similar to the United Fresh Fruit and Vegetable Association of the United States of America. The industry in all its aspects is a huge one and all phases of it should be brought together and made to realize how much they all have to gain by working towards common goals instead of pursuing narrow selfish ones
- improving the quality and standard of advertising and sales promotion by the employment of one or more qualified nutritionists or dietitians. The community, especially young people, are nutrition conscious. Our industry has products renowned for their health-giving properties. We need to speak with authority about them to ensure maximum credibility.

Reasons for success

The Fruit Marketing Organization Act was a brilliant piece of legislation for dealing with highly perishable commodities. A feature of legislation setting up other commodity marketing boards is that ownership of the product passes to the board. This does not apply to the COD. Although the Act gives the COD certain powers to compulsorily control marketing in Queensland of Queensland-grown fruits and vegetables, it cannot be too strongly emphasized that the success of the organization has been achieved on a voluntary basis. Growers' interests are paramount at all times and even when the compulsory powers of 'direction' are used, it is at the request and with the consent of the growers concerned. No other state in Australia has such legislation, nor, as far as it is known, does any other country.

In every other State, there is overriding legislation that provides that, before any marketing board or authority can be formed, there must be a poll of the relevant growers. But, in fact, the COD came into being

without growers being given the opportunity to vote on it. It was permitted, first, to prove its worth. However, there was provision for a ballot of growers every three years, if such a ballot was requested by 500 growers. Only one such poll was held, when 87% of votes were in favour of continuance.

The COD and the Queensland fruit and vegetable industry have been fortunate in the quality of their grower leaders, and their chief executive officers. Any grower involved in COD Committees and all the allied work serves at the expense of his own farming operations. That so many dedicated men have been prepared to do this over the COD's entire existence is a source of wonder. They receive scant recognition from their fellow growers for their time, effort and loss of income, but quickly attract criticism if they do anything to displease even a few growers. The COD has always tried to maintain good lines of communication with its growers, associations and committees. This is not easy in a State as large as Queensland, which has an area of 1 728 000 km^2.

From the outset, COD set out to provide an honest, straightforward selling service which has expanded to cover every facet of marketing. Its total sales for the year ended 30 June 1977 were $55 109 778.

Future projections and plans

The COD cannot, and would not, become involved in producing crops on its own account. It therefore must continue to confine its efforts and resources to the marketing chain.

Developing international markets

By P. M. Turner

Marketing Manager, New Zealand Apple and Pear Marketing Board

New Zealand Apple and Pear Marketing Board

A brief outline of the functions of the New Zealand Apple and Pear Marketing Board may assist in providing a better understanding of the way the Board operates.

Established in 1949, basically as a growers' co-operative and at the request of the pip fruit growers of New Zealand, the Board operates as the sole marketing authority for both the export and the local domestic markets. A basic function is to provide the grower with a guaranteed price for his product and then to try to recoup that price, plus costs, from the market place. The Board's success in this depends on the vagaries of international trade in horticultural products. In its 30 years of trading the Board has been able to achieve profits in only 19 of those years. Nevertheless, in spite of the vicissitudes of trading, the grower has continued to receive a guaranteed income. In fact, the primary function of the Board is to act as a buffer between the producer and the market place.

The size of our operation can be gauged from the fact that the volume of apples and pears handled by the Board now approximates 150 000 tonnes per year, of which 84 000 tonnes are presently exported to a total of 40 countries throughout the world. Total turnover in 1977 was $70 million, with exports representing nearly 80% of that total.

Problems in international marketing

Clearly, international marketing of horticultural products is no sinecure as there are various influences that restrict development of international markets. These do not necessarily apply on a global basis, but are of sufficient importance to be treated as separate issues.

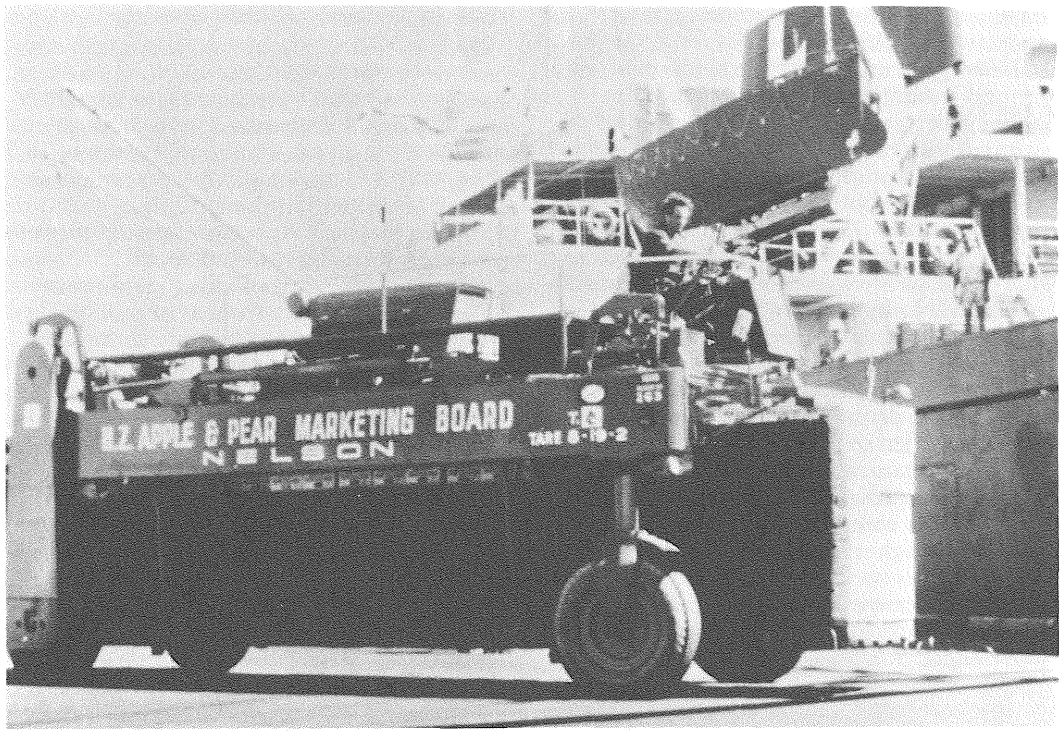

Fig. 1 A straddle carrier loads fruit direct to the ship at the Port of Nelson.

The economic influence

When difficult economic conditions arise in the importing country a common practice is to deny access for a specific commodity. Apart from staple foodstuffs, there is a tendency, under these conditions, for products previously allowed entry to be suddenly classified as either luxury or non-essential; four countries readily come to mind where this has occurred in recent years. These have been markets in which much time, effort and expense had been invested over periods of up to 10 years.

The protectionist influence

This basically refers to making access difficult or, in some cases, totally restricting access, as a protectionist policy for locally grown horticultural products, not necessarily of the same type.

With development of advanced technology for the storage of seasonal crops permitting year-round marketing, this protectionist influence will tend to become more important with its added factors of quotas, tariffs or restricted marketing opportunities. In some cases it could be argued that this protectionist influence operates as a form of subsidy for an inefficient local industry or, alternatively, as protection for the expanded development of that local industry, inefficient or otherwise.

This influence may result in a particular commodity being undersupplied from the local source, resulting in inflated prices being paid by the consumer in that country. The political influence of consumers, nevertheless, may not carry the same weight as the agricultural or horticultural lobby.

The cost/pricing influence

Owing to New Zealand's geographical location, distant from centres of world population, this influence probably has a greater impact on us than it may have on some other countries.

Virtually all horticultural products require sophisticated modes of transport to ensure that they arrive at overseas markets in optimum condition, and transport costs naturally have an increasing influence as the distance from the market increases. The relativity of freighting structures to FOB values thus becomes a most important

element. Economies of freight are almost imperative to achieve a level of return to the producer that ensures that production of that commodity continues to be economically viable. Nevertheless, economies cannot be instituted that might impair the quality of the commodity in the market place, since this could very quickly result in the total loss of that market.

The relativity of packaging costs to the value of the product, both in its raw state and in the market place, is almost of equal importance to that of freight or transportation. The escalating level of these variable costs and their erosion of the net market return probably remain the major financial burden to all producer and marketing organizations.

At the same time, as competition increases within specific commodity groups so does the demand for higher quality within the market place which, in itself, is not conducive to economies in terms of either freight or packaging costs – if anything it has the reverse effect.

The varietal influence

The changing demand for different commodities and for varieties, and even sizes within that commodity, is a serious problem. Taking apples for an example, as economic conditions within any country improve, so does the demand for larger fruit. These changes can occur relatively quickly. In the U.K. we have seen the preference change from a 64-mm apple to a 70-mm apple within the last five years. A very important element in any marketing organization is the ability to provide the producer not only with adequate advice on developing trends, but to influence him to act in accordance with those trends and effect the necessary changes to his cultural practices. It is probably safe to say that historically, the only major influence on which the producer will act is money.

Some solutions to marketing problems

Having looked at the negative influences on international market development, discussion is warranted of more positive aspects within the total chain of marketing from producer to consumer.

There is no doubt that a producer organization operating a single desk export operation does have major advantages in minimizing the negative influences already mentioned.

Meeting the demands of a changing market

Overseas marketing methods can and do change and the single desk function is able to change to meet the demands of the market place. Change has occurred in recent years with the demise of the 'auction' system of selling which for so long had been the prime method of sale within the U.K. and European markets. As volume availability of specific products increased from all competitive sources, marketing conditions changed quite quickly from a 'normal' sellers' market to a 'normal' buyers' market and the value of the auction system under these conditions is undermined. A single desk export operation allowed a total change from that mode into private treaty selling virtually over-night, which would have been almost impossible under a multi-marketing operation. To expand this concept a little further, it is worth noting that in terms of its European trade, which still accounts for over 60% of the Board's apple exports from New Zealand, the Board acts as both consignor and consignee so that we ship to ourselves and it is then the responsibility of the Board's European office to place cargoes into those markets that are currently the most economically viable. This again ensures that the best net return is obtained to the ultimate benefit of the producer.

Shipping

For many years export apples from New Zealand were carried to the main marketing area of the U.K. and Europe under contract to the British Conference Lines, along with

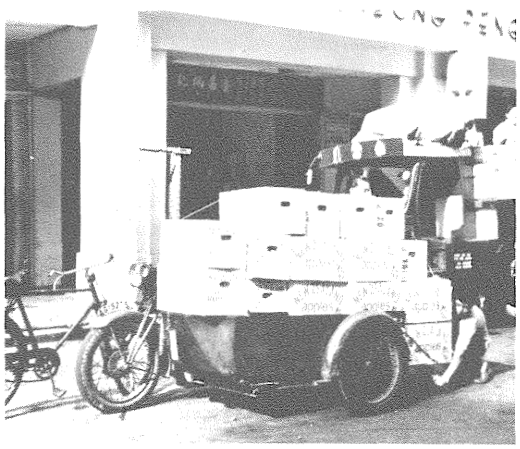

Fig. 2 A simplified method of delivery in Singapore.

the other major primary produce exports from New Zealand, namely meat and dairy products. Rates of freight were negotiated jointly and any percentage increase in rates was applied to each commodity group. Under this system, there was no real incentive for any one commodity group to improve the efficiency of its operation, because such economies were lost within the joint arithmetic exercise. This applied to apples as they were a minority commodity of the three main commodities mentioned.

As a result of these factors and in an effort specifically aimed at reducing the cost/pricing influence, the Board, as the sole shipper of the commodity, was able to move outside the Conference and obtain highly competitive rates of freight under chartered arrangements. This move was first introduced in 1971 and in 1978 some 30 vessels have left New Zealand between March and July carrying one cargo only — apples or pears on behalf of the Board. Freight savings accrued during this period exceed $15 million. This concept or mode of chartered shipping has now been extended well beyond the European theatre of trade and has now reached the stage where 90% of all exports are carried under this system.

The term 'chartered shipping' does, of course, cover a whole range of variable systems within its broad framework and, provided the shipper maintains control of his product at both loading and discharging, opportunity exists for further economies to be effected through the shipper himself accepting a greater percentage of the risk and delay factors. Under a conference-type arrangement these factors are inevitably covered within the quoted freight rate, whether or not they are actually incurred.

Economies of scale

The single desk authority can also achieve further economies within other sectors of the cost/pricing influence which, in summary, might be described as economies of scale. Centralization of facilities is possible, encompassing cold-storage, fork-lift trucks and other plant and equipment. Negotiating

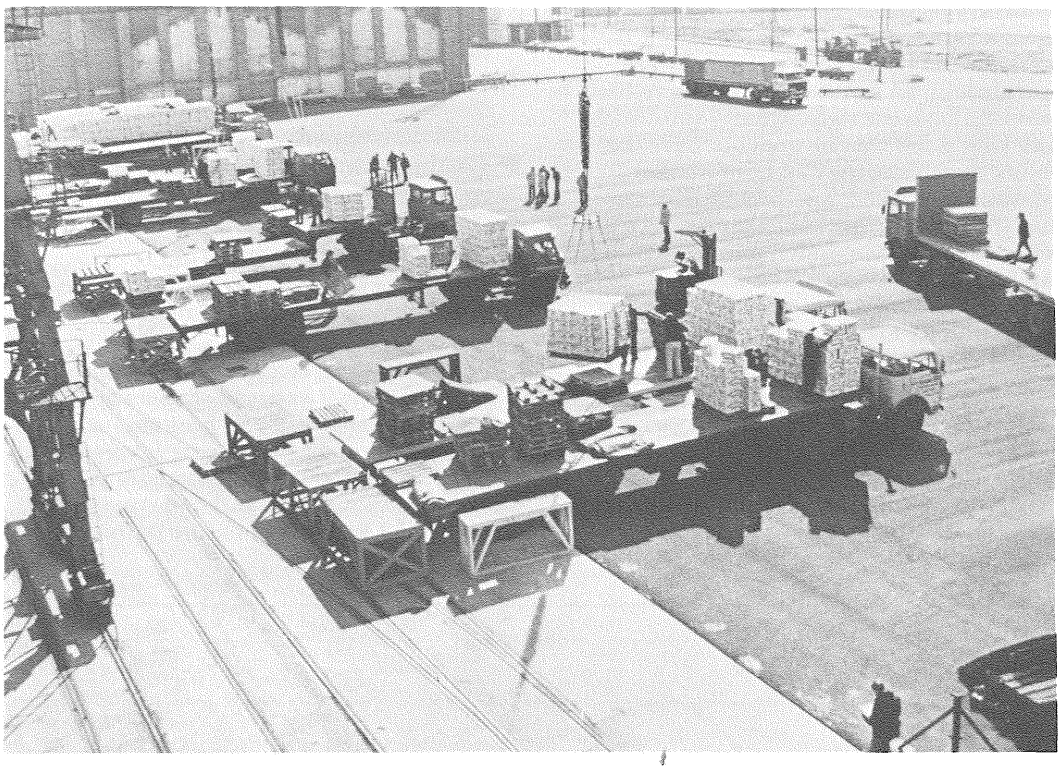

Fig. 3 The Port of London, where fruit is handled by sophisticated methods on pallets direct to waiting road transport.

power in terms of packaging costs, transport costs and stevedoring rates is achieved. Overheads are reduced through the ability to effectively handle seasonal crops with less manpower than in a fragmented operation.

All these factors increase in importance as the cost/pricing influence increases and they can become vital to the continued economic viability of the particular industry.

Agents

An important, and yet at times overlooked, element within the development of marketing in any overseas country is to ensure that the right agent or agents are appointed. Agents can effectively maintain the product for the exporters in the best possible condition, while at the same time achieving the degree of market penetration demanded by the product. Because of the competitive elements existing in most horticultural products, it becomes very important to ensure that the agent has sufficient loyalty to his principal. Generally this will be achieved only when the involvement with the product is sufficient in monetary terms to, in essence, 'buy' the agent's loyalty. We have found that it is preferable in developing new markets to operate with an agent on an exclusive basis — provided he is the right agent — until such time as it is felt that he does not have the ability to achieve the degree of market expansion required, and provided, of course, that the exporter has sufficient product to ensure that the demanded market expansion can be sustained on a long-term basis. In short, there is little value in spreading few apples among many barrels.

Conclusions

Development of international markets will inevitably become more difficult in the future, if only because of the restricting influences outlined earlier.

At the same time, growers or producers will necessarily be striving to increase productivity, if only to nullify the effects of these influences which, in turn, will result in supply and demand becoming increasingly out of balance.

Under free marketing conditions, these two elements — supply and demand — will always dictate price, and the key factor to achieving the top dollar — that 10c or $1.00 above your competitor — is the *quality* of the product presented in the market place.

Sophisticated and expensive advertising and promotional techniques may provide some short-term gain but will never sustain a place in the market for an inferior quality article. The loyalty of wholesalers, retailers and consumers cannot be bought for an article that they cannot sell or that is unsatisfactory to eat. It will be maintained through the quality of the article presented for sale, i.e. one which is seen to represent value for money spent.

To summarize, development of international markets will be aided by

- examining the restricting influences outlined
- studying the market — competitive elements, pricing, packaging, delivery timing, product acceptability
- studying the potential agency structure — choosing the wrong agent could cause immediate failure
- avoiding competition with yourselves — in unity there is strength to combat the influences cited
- take *no* shortcuts on *quality*
- promoting the product, but being wary of glib techniques used by some advertising agencies.

Following these elements is no guarantee of success, but it will improve chances of success in an increasingly difficult business.

However, success in any year is very often dependent upon others' misfortunes in similar product groups and one must always allow for the vagaries of nature both at home and abroad.

What does man want from horticulture? — developing countries

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World population is growing at an annual rate of about 1.9%. If this rate of increase continues, the world's population will be doubled by the year 2017 to 8×10^9. Population growth continues to be much more rapid in the less developed countries (2.3% p.a.) than in the developed countries (0.9% p.a.). Although growth of world food production since the 1960s has been greater than that of population, due to the introduction of high yielding crop varieties and other technologies aimed at increasing food production, per capita food production in the developing countries is now declining (Table 1).

As a result of rapid population growth and food insufficiency developing countries are confronted with the major problems of malnutrition and hunger. These problems are exacerbated by sharp fluctuations in world food supplies and prices. Further, the unavailability of arable land that can be put to productive use is seriously limiting food production efforts in these parts of the world. In order to alleviate malnutrition and hunger, food production in the developing countries must be doubled before the turn of the century through an intensification of the yield per unit area. Recent technological developments in crop production facilitate optimum use of available land. In developing countries, horticulture will play a significant role in the struggle against malnutrition by providing vitamins, minerals and proteins from fruits and vegetables, and against hunger by supplementing the supply of grain staples with other carbohydrate-rich foods like potatoes, sweet potatoes, yams, cassava, and some varieties of banana. These crops are readily adapted to a wide range of environmental conditions particularly those of the humid tropics of Asia, Africa and South America. A wide variety of fruits and vegetables that can fit into almost any kind of intensive cropping system can be cultivated. An added advantage of these horticultural crops over crops like rice, corn and wheat, in addition to the fact that they are easier to grow over a wider range of environmental conditions, is their ability to produce more energy carbohydrates and other nutrients per unit area planted (Table 2). Sweet potato, for example, has a cropping season of only 4–5 months, and can provide the energy requirements of twice as many people per hectare per day as can rice. In comparison to rice it can also support 50 times as many people for their calcium requirement, 12 times as many people for their iron, and 8 to 11 times as many people for their thiamin and riboflavin requirements. Sweet potato leaves and roots contain significant amounts of vitamins A and C and can support 992 and 1370 persons

Table 1. Average annual rates of growth of food production (% p.a.) in relation to population, 1961 to 1970 and 1970 to 1976[A]

Region	Population		Food production			
			Total		Per capita	
	1961–70	1970–76	1961–70	1970–76	1961–70	1970–76
Developed Countries	1.0	0.9	2.8	2.5	1.8	1.6
Developing Countries	2.3	2.3	3.4	2.8	1.1	0.4
World	1.9	1.9	3.1	2.7	1.2	0.7

[A]Figures from the Food and Agricultural Organization (FAO) (personal communication).

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per hectare per day respectively for their daily requirements of these vitamins (see Table 2). The values shown in Table 2 were calculated taking into consideration the growing period of each crop and the yield levels attainable for that particular crop in the Philippines. The nutritive value that is theoretically produced daily is then divided by the minimum daily requirement recommended for a particular nutrient to give an idea of the number of persons that can be supported by that crop per hectare per day for a given nutrient.

Leguminous vegetables are also excellent sources of less expensive and readily available proteins that can be processed into 'vege-meat' formulations. These crops can provide the people of developing countries with meat substitute, and in areas where dairying is not economically viable, with milk and other dairy product substitutes. The protein of cowpea, for example, was found to have amino acid patterns similar to those of whole egg and comparable to, if not better than, those of cow's milk which is inadequate in methionine and cystine.

Both cowpeas and soybeans produce approximately three times the quantity of protein per hectare per day as does rice and about five times that of corn, while the edible parts of sweet potatoes and taro, on the average, supply from one and a half times to twice as much protein as does rice (Table 3). The carbohydrate yield levels of these crops far exceed those of rice and corn. As a result of these attributes, horticultural crops like the sweet potato, cassava, potato and yams are supplementing or even gradually replacing traditional grain crops in many developing countries.

Although not as rich and concentrated as animal protein, vegetable protein contains the complete range of essential amino acids for human beings. Table 4 shows the average amino acid yields of horticultural crops as compared with rice and corn.

Owing to low incomes in the developing countries, the people need to derive the bulk of their proteins, vitamins and minerals from inexpensive fruits and vegetables. Mango, banana and pineapple can produce yields of up to 18, 30 and 80 t ha^{-1}, respectively, and can be grown all year round. Papaya, a favourite breakfast fruit rich in vitamins A and C, is easy to grow, comes into production within a year of planting and remains productive for up to three years. Some varieties produce very large fruit weighing up to 6 kg each.

As a country changes from subsistence to commercial farming, horticultural crops assume greater significance in the improvement and maintenance of the quality of life. Fruits and vegetables can also provide

Table 2. Number of persons different nutrients present in a hectare of crop can support per day[A]

Crop	Calories	Calcium	Iron	Vitamin A	Thiamin	Riboflavin	Vitamin C
Rice	61	2	33	0	18	9	0
Corn	27	1	9	25	42	24	480
Sweet potato	138	138	405	991	140	106	1370
roots	122	85	105	324	100	40	1050
leaves	15	53	300	667	40	66	320
Taro	55	86	178	770	120	61	660
corms	45	28	71	0	107	24	180
leaves	6	40	65	747	10	33	433
petiole	3	16	40	23	1	3	46
Cabbage	41	178	194	50	92	74	3441
Mung bean	29	17	78	4	60	20	27
Cowpea							
pod	42	159	150	347	158	168	1008
drybean	63	18	193	0	129	61	0
Soybean							
dry	33	41	168	0	40	16	<1
green	36	87	194	6	1257	614	251
Tomato	16	26	116	257	58	38	845
Mango	1	0	501	18	1	1	279
Banana	2	110	2	1	0	2	237

[A]Villareal (1971).

Table 3. Protein yield of selected vegetables and number of persons a hectare of crop can support per day[A]

Crop	Edible yield per ha (tonnes)	Days to maturity	Protein in edible portion (%)[B]	Protein yield ($kg\,ha^{-1}$ per day)	No. of persons a hectare of crop can support per day[C]
Rice	4.0	120	7.4	2.5	49
Corn	3.2	110	4.9	1.4	28
Sweet potato					
roots	18	100	1.1	2.0	40
leaves	6	45	2.8	3.7	75
Taro					
corms	12.9	120	2.5	2.7	54
leaves	2.2	120	4.4	0.8	16
petiole	4.2	120	0.2	1	1
Cabbage	20	60	1.7	5.7	113
Mungbean	1	60	20.0	3.3	66
Cowpea					
pod	10.1	60	3.7	6.2	124
drybean	2.5	70	20.4	7.3	146
Soybean					
dry	2	120	40.0	6.7	133
green	3.6	65	14.4	8.0	153
Tomato	14	80	1.0	1.8	35
Mango	13	365	0.5	Trace	<1
Banana	20	365	1.0	Trace	1

[A]Villareal (1971).

[B]Food and Nutrition Research Center (1974).

[C]Based on average recommended daily allowance of 50 g protein.

Table 4. Amino acid yield (g) per hectare per day of selected crops[A]

Amino acid	Recommended daily allowance[B] (grams per day)	Rice	Corn	Sweet potato root	Taro corm	Mung bean	Cowpea	Soybean
Leucine	4.8	41	35	26	46	53	150	84
Isoleucine	4.2	36	19	25	31	43	129	99
Lysine	4.2	29	18	34	54	122	121	174
Methionine	2.2	48	16	27	32	33	125	67
Cystine	2.0	10	6	1	5	5	15	18
Phenylalanine	2.8	37	29	40	80	69	185	114
Tyrosine	2.8	13	8	0.4	18	27	71	64
Threonine	2.8	35	34	29	43	46	129	96
Tryptophan	1.4	—	—	—	—	—	—	—
Valine	4.2	39	20	29	39	47	130	91

[A]Villareal (1971).

[B]National Academy of Science, personal communication.

additional income for small farmers to help them to overcome the problems of hunger and malnutrition. Horticultural crops, because they are intensively cultivated, will play an important role in generating employment for the rural populations of developing countries. The cultivation of a hectare of vegetable crops, for example, requires 8–12 persons, while a hectare of field crop would require only 4–8 persons. Processing tomatoes in Taiwan requires 2180 labour hours per hectare and fresh market tomatoes require 8020 labour hours per hectare, while rice requires only 761 labour hours (Villareal, personal communication).

In the future, developing countries will be

relying on the many varieties of fruit and vegetable crops to enable them to develop different combinations of cropping systems aimed at intensifying production through optimum use of the limited area available. Horticultural crops, in general, vary in maturity and growth habit which make them ideal for multiple, relay, or intercropping systems. In the Philippines, farmers are already growing coconuts, papayas and/or bananas, pineapples and sweet potatoes simultaneously on the same piece of land. This results in quadrupling of the yield potential of the land and hence in quadrupling the income of the small farmers. Crops are interplanted to take full advantage of differences in their growth phases and to maximize utilization of space and light.

Protein deficiency is more acute among the developing nations than the developed ones as the diet generally consists of carbohydrate foods like cereals, which are not particularly rich in growth-enhancing nutrients. The corn-vegetable, rice-vegetable and rice-corn-fruit/vegetable cropping systems are recommended, not only to boost fruit and vegetable production but to encourage the planting of staple crops as well.

The expansion of horticulture in the developing countries will clearly be of great value in the continuing struggle against hunger, malnutrition, and the related problem of poverty, and solution of these problems will, in turn, improve the standard of living of the peoples in these countries.

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