



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Food - Marketing



CENTRE FOR  
EUROPEAN AGRICULTURAL STUDIES

EUROPE  
AS A  
FOOD EXPORTER

GIANNINI FOUNDATION OF  
AGRICULTURAL ECONOMICS  
LIBRARY

SEP 19 1979

WYE COLLEGE  
(University of London)  
ASHFORD, KENT  
1978



## **CENTRE FOR EUROPEAN AGRICULTURAL STUDIES**

In September 1973, Wye College established a Centre for European Agricultural Studies. Its purpose is to offer:

*To agriculture and industry*

Research and investigation programmes

Opportunities for bringing together European farmers, business executives, politicians, administrators, scientists and academics to engage in post-experience courses, study groups, seminars and conferences

*To developing countries*

Recognition of the special problems of countries whose agricultural economies are linked with Europe

*To other countries*

A monitoring base where developments in European agriculture can be interpreted and transmitted back to official agencies

*To other European universities and research organisations*

Opportunities to develop the exchange of personnel and information, and to collaborate in the development of linked research projects and teaching programmes

*To all participants in its work*

The advantages of a strong university establishment, providing an impartial forum for the exchange of information and ideas

Ian G. Reid  
*Director*

CENTRE FOR EUROPEAN AGRICULTURAL STUDIES

EUROPE AS A FOOD EXPORTER:  
DEVELOPMENTS IN THE EUROPEAN AGRI-FOOD INDUSTRY

Report of a Seminar  
held on 26th-28th April 1977

under the sponsorship of

H.J. Heinz II Charitable & Family Trust

Betteshanger Farms Ltd.

Saphir Sons & Co. Ltd.

WYE COLLEGE, ASHFORD, KENT, ENGLAND

Seminar Paper No. 6  
1977

Price: £2.00

Acknowledgement is made to Gill Dacombe of CEAS  
for her work in the preparation of these papers  
for publication.

## CONTENTS

		Page
INTRODUCTION	Ian G. Reid, Director, CEAS.	... 1
OPENING REMARKS	C.G.W. James, Betteshanger Farms Ltd., Deal, Kent.	... 6
FOOD IN THE FUTURE	Dr. J. Green, General Manager, Research and Development, H.J. Heinz & Co.Ltd., UK.	... 8
WHERE DOES EUROPE'S COMPARATIVE ADVANTAGE LIE?		
IN THE FOOD PROCESSING INDUSTRY?	Dr. Aidan Power, Food Economics Unit, MAFF, London.	... 13
IN AGRICULTURE?	Professor Jan de Veer, Deputy Director, Landbouw-economisch Instituut, Netherlands.	... 21
NEW AGRI-FOOD SYSTEMS:		
NEW TECHNOLOGIES IN FOOD PROCESSING	Professor E.J. Rolfe, Principal, National College of Food Technology, UK.	... 27
NEW TECHNOLOGIES IN CROP PRODUCTION	Professor J.P. Hudson, lately Director, Long Ashton Research Station, UK.	... 40
DEVELOPING COUNTRIES OF THE MIDDLE EAST AND POTENTIAL EUROPEAN FOOD EXPORTS - A VIEWPOINT	Professor Gian Paolo Casadio, Professor of International Economic Organisation, University of Bologna, Italy.	... 46
RESEARCH AND DEVELOPMENT PRIORITIES FOR EUROPE'S AGRI-FOOD INDUSTRY	Dr. A.G. Kitchell, Scientific Liaison Officer (Food), Chief Scientist's Group, MAFF, London.	... 55
LIST OF PARTICIPANTS		... 60
RESUME EN FRANCAIS		... 60
ZUSAMMENFASSUNG AUF DEUTSCH		... 62

EUROPE AS A FOOD EXPORTER;  
DEVELOPMENTS IN THE EUROPEAN AGRI-FOOD INDUSTRY

INTRODUCTION

IAN G. REID

European agriculture is currently faced with two dilemmas. First, the existence of surpluses of certain of its products must represent a waste of resources. Second, its technical potential has not yet been exploited to the full.

These two phenomena could be used to alleviate the overall world food situation and the plight of certain less developed countries. Experts are of the opinion, however, that direct food aid except in drastic famine situations is counter-productive, and that the most effective contribution from Europe would be active participation in the operation of strategic buffer foodstocks in order to regularise the world food market.

These two phenomena also point to the need for a redeployment of resources which the EEC can ill afford to waste, bearing in mind that the terms of trade are likely to move against Western Europe in the longer term. It has few natural resources. Even oil and natural gas are finite and are likely to become more expensive as more difficult reserves are tapped. World demand for raw materials will increase with greater overall industrialisation needed to meet population growth and its higher material aspirations.

Given that our terms of trade are likely to deteriorate, it is important to identify opportunities for development in the agri-food industry of the EEC which may help to counter such a movement.

Traditionally, agriculture and the food industry have developed independently, and it is now important to see how these two sectors can co-operate to meet this challenge. They will need to explore the possibilities of joint research and development in the fields of production, processing and marketing.

Amongst Europe's major resources are:

- i) Its climate and soil
- ii) A labour force relatively skilled in technology and organisation.

These resources are, and should be developed by the agri-food industry for purposes of import-saving, export-earning and the more efficient provision of food to consumers generally.

If Europe is to exploit the resources listed above, we must identify the products in whose production Europe has a comparative economic advantage.

We must also identify the products for which there are likely to be markets.

In making these analyses we must not restrict ourselves to conventional agricultural and food products but must consider agriculture and the food industry as a unified production complex. It may be that, in some cases, agriculture will not be providing a food but only a substance for the food industry.

The basic objective of such analyses is to suggest how new low-cost acceptable foodstuffs can be produced in Europe and marketed both within and outside Europe.

### Agriculture

The soils and climate of Western Europe may be seen to give its agriculture a comparative advantage in four classes of crop product:

- i) Grasses and leafy forage crops (Northern/Western),
- ii) Tubers: Potatoes and Sugar Beet.
- iii) Fruit and Vegetables.
- iv) Wine.

It could be argued that parts of Western Europe have a long-term advantage in cereal growing.

Western European agriculture, however, suffers certain disadvantages, both institutional and technical, which make it a high-cost producer. These include:

- i) The small size of the average farm business which leads to poor



utilisation of resources and poor command over the skills and capital needed to exploit higher technology with its adherent high costs and high inputs of energy.

- ii) Europe has little unused land into which its agriculture can expand and so gain the economies of scale. It is also forced into the slow and expensive process of restructuring its agriculture by taking people off the land. High density of population creates strong competition in land use and hence high land prices, and has forced European agriculture to farm marginal areas.
- iii) The atomistic nature of the structure of European agriculture is also a cause of expensive and inefficient marketing.
- iv) The comparative advantage in growing grass and leafy forage crops tends to be dissipated in their conversion into human food through the ruminant, a process notoriously inefficient in technical, but not always in economic terms.

#### Food industry

The conventional view is that the food-processing industry in Europe is not likely to see major changes in its basic raw materials. If, however, those supplies become scarcer and more costly, the food-processing industry will have to deal with less uniform raw material, thus forcing the development of processes for using these materials more efficiently through restructuring and reforming them. To produce greater uniformity in biological material is nearly always an expensive operation. The food industry may also have to obtain a greater proportion of its raw materials from Europe's own agriculture. It seems likely that these raw materials, and possible new ones, will be used to produce imitations, in both flavour and texture, of existing food products; and will be used as "extenders".

Such developments raise the question not only as to whether European agriculture can be an advantageous source of the required raw materials, but also as to whether the European food-processing industry has advantages in skill and scale of operation, compared with competing food processing industries.

#### Markets

Both before and since the establishment of the EEC, certain countries

of Europe have had a considerable export business in agricultural and food products. The orientation of this trade has been almost exclusively within one dietary culture.

If, however, Europe is to become a food exporter, its food processing industry may have to devise imitations of the foods of other dietary cultures, particularly those of the richer developing countries in the Middle East, Asia, Indonesia, Africa and South America. Japan has also become a major food market. And in so far as the agri-food business in Communist bloc countries fails to develop in line with the increased effective demand of their peoples, they may also become a market for certain food products.

The development of the agri-food industry will require large investment in production and processing. Such an investment will require a managed market if risks are to be brought down to a level bearable or attractive to investors.

There will be the need to have security of supply of the basic foods and raw materials. This will necessitate the operation of strategic buffer feedstocks for the purpose of securing manufacturing supplies. Such a requirement dovetails well with the desirability of helping to solve the problems of hunger and malnutrition caused by natural disaster and the greater variability of output from the agriculture of the Lesser Developed Countries.

#### Research and development

If the European agri-food industry is to maintain or increase its competitiveness, where should it direct its efforts in scientific research and institutional reform in agricultural production, food processing and marketing?

It was against this background that the Centre for European Agricultural Studies organised this Seminar under the generous sponsorship of the H.J. Heinz II Charitable and Family Trust, Betteshanger Farms Ltd., and Saphir Sons & Co. Ltd. The aim was to bring together policy-makers from among European farmers, business executives, administrators, scientists and academics and to focus authoritative discussion upon the likely developments in the agri-food business of the EEC over the next

fifteen to twenty years.

The Centre for European Agricultural Studies is grateful to the sponsors and the participants for their respective contributions.

At the conclusion of the seminar the participants asked that the following statement should be drawn to the attention of the EEC Commissioners for Agriculture and for Industry, the Ministers of Agriculture of the Member States and of the leaders of the organisations directly concerned with the agri-food industry of the EEC.

"We are agreed:-

- 1) that real opportunities exist for the development of substantial exports of both fresh and processed food products from the EEC agri-food industry;
- 2) that real opportunities exist for further substantial exports of the technology of the agri-food industry, including education and training programmes as an integral component;
- 3) that better integration and co-ordination of food-growers, processors, distributors and consumers must be fostered through improvements in the existing organisations and procedures at both Community and national levels;
- 4) that these improved organisations and procedures must be used more effectively in the export effort;
- 5) that food exports as well as food import-saving must be given due emphasis in research and development programmes at both Community and national levels."

OPENING REMARKS

C.G.W. JAMES

The purpose of this seminar is to bring together members of the Agricultural Industry and the Food Industry, in order to look forward together.

Agriculture is an age-old activity. It is a very special kind of industry involving the mobilisation of the forces of nature to provide man with food.

Until about 100 years ago such processing of the raw products of nature as was necessary was mostly done on the farm or in the villages where it was grown. Since that time, and at an accelerating rate in recent years, a great industry has grown up concerned with the processing, packing and distribution of food. This change has happened at a time when imported raw materials were cheap. Parts of the food industry are built around these imports and so, for this and other reasons, the Agricultural Industry has often seen the Food Industry as a threat. This has led to a posture of confrontation.

The sponsors of this seminar believe that this posture of confrontation is damaging and unconstructive.

The sponsors have each in their several ways been involved in successful experience of co-operation between Agriculture and the Food Industry.

The H.J. Heinz Organisation have a distinguished record of support for and co-operation with the growers who provide tomatoes and other raw materials for their products.

Saphir Sons & Co. Ltd. have been pioneers in market orientated growing based on programmed co-operation between selected growers and the best of the supermarkets. This programme has enabled many of the High Street outlets to provide a continuity of high quality fresh produce which would not otherwise have been possible.

We at Betteshanger Farms Ltd. have been privileged to be involved in that programme and we have proved that co-operation, give and take and sometimes the sacrifice of short-term advantage can lead to a very much more profitable long-term business and to a better service to the consumer.

We hope that in this seminar we shall together be able to identify new lines of development and of research for the future of our two industries working together.

I think we should look at the problem under three headings:-

- 1) How can the European farmer learn to produce the "feedstocks" which the food industry wants, and to deliver these in the forms, at the time and at the price it wants them?
- 2) How can the European food industry develop towards utilising the feedstocks that can be most economically grown under the conditions of soil and climate which prevail in Europe?
- 3) How can the two Industries working together develop and exploit new export markets?

The success of the seminar will depend entirely upon your contributions of ideas and experience to it. I hope you will be prepared to contribute generously and boldly. I hope we shall be prepared to explore new ideas.

The outcome/product of this seminar will depend on what ideas emerge from it. We hope it will lead to an on-going dialogue between our two great Industries. What form that dialogue should take will be for you to decide in due course, when we see where our discussions have led us.



FOOD IN THE FUTURE

DR. J. GREEN

The food the world eats now is basically the same as that it ate 40 years ago. The developed world eats more than it used to and much of the underdeveloped world eats less. A great proportion of the food eaten in the developed world is now prepared by the food processor and less by the housewife.

It is anticipated that the food eaten 40 years hence will still be similar though we may hope that the developed world will be eating less and the underdeveloped world more per head. The ingredients are likely to have been procured differently and processed and packaged differently. We have to consider the differences.

It is not generally recognised that Agriculture and the Food Industry must perform an integrated operation. Governments identify their need to feed the people as a need to ensure an adequate supply of produce at the farm gate. The price of food is bound to increase in the next few years since, apart from fresh fruits the products of agriculture are not foods ready for consumption. They have to be processed in some way and the inevitable increase in the cost of energy, tin plate and processors' returns will raise the price of food. The food processing industry is the vital link in the chain that converts agricultural produce into food for man, a conversion involving a great deal of knowledge, investment and work. The food industry has to be encouraged to prosper and Government must learn to think of agriculture and the food industry as a single entity, and even to extend this to include the retail and packaging industry. Nor must it be forgotten that this process makes great demands on energy, one of the crucial factors in the development of Europe's potential as a Food Exporter.

We live in a complex society, in which we have been moving away from the land and into urban environments. And because a large proportion of our population lives in such areas, food has to be preserved. The preservation processes aim to prevent a delay in chemical or bacterial spoilage - hence we have dehydration, canning, refrigeration and pickling. These processes

are becoming more expensive because of the increasing costs of energy and packaging materials. But unless they are practised, much more agricultural produce will be wasted. Fortunately one of Europe's strong points is the technical competence of the Food Processing Industry. It now has to be encouraged to utilise better the products of agriculture, add value to them and export a processed product.

Our society likes animal protein; at present there is much criticism of the fact that we are feeding three times more vegetable protein to an animal to produce animal protein for man to eat rather than the original vegetable protein. Perhaps we should be limiting the cereal protein fed to the animal to what does not convert to fat so that good protein energy is not wasted in producing fat. We can also learn to rear good animal protein intensively by using waste products, marginal land and single cell proteins grown from petroleum residues. This would release cereals to feed the Third World who have not acquired nor as yet can afford our taste for animal protein. Thus we shall not be converted to eating vegetable protein but shall continue to eat meat, much of which we shall have produced ourselves from materials which are now wasted.

Energy is an important element in an intensive production system, and sources must be developed to provide it cheaply so that we may be able to farm more intensively than in the past. The development of chicken farming gives an example of the success of intensive farming. In the future, intensive production of animal protein will yield waste for recycling and conversion to feedstuffs but will use a high energy input. There may also be the opportunity for much more glasshouse farming using solar gains and giving a controlled environment which will allow production of many crops currently only possible in tropical or sub-tropical areas. This presupposes intensive use of energy and a concomitant investment in Europe in the development of energy from radio-active sources, wave energy and solar gain.

In recent years there has been much development work on farms by processors. Within this development new varieties and the effects of processing have had to be carefully co-ordinated. Contract growing has become important, particularly in the United States, with close co-operation between growers and processors. There has also been co-operation between growers, food scientists and packaging experts for improved production of various crops such as mushrooms. New processes have been introduced for sterilising

and packing processed foods thus improving food conservation and reducing wastage.

There is an export potential in these new methods of preservation and processing. Such developments depend upon a better integration of the parts of the chain and upon the Third World being educated to use the food we produce.

Looking to the next fifteen or twenty years, it would seem that the European agri-food business will be operating under the influence and outcome of the following developments:

- 1) Availability of energy derived from sources other than fossil fuels.
- 2) A cleaner environment generally giving cleaner water resources with intensified fish farming.
- 3) Availability of manufactured protein suitable for animal feed.
- 4) Intensive environmentally controlled agricultural product processes, giving use to centralised production of animal protein especially through pigs and poultry, and of vegetable protein through beans and mushrooms with centralised collection and utilisation of waste.
- 5) Greater production of industrial crops such as cotton with by-products of vegetable oils.
- 6) Greater tree fruit production.
- 7) Larger agricultural labour force to deal with the intensified operations.
- 8) New cheap packaging materials and external facilities for freezing.

The agri-food business will have to deal with changes in dietary patterns in which there is likely to be much more centralised and institutionalised eating and where the diet will comprise more fruit, fish, animal protein derived from single cell proteins and recycled waste, artificial sweetener and vegetable oils. The diet will contain less saturated fats, particularly those derived from dairy products.

As regards exports from the European agri-food business, these are likely to comprise agricultural and food technology, cereals, protein concentrates, aseptically packaged foods of high value, dehydrated foods and plastic materials, and breeding livestock.

Discussion

Following up Dr. Green's comment on an increased agricultural labour force it was felt that this would only be feasible if production could also be increased. This would raise the problem of finding new markets, probably overseas, for production which could not be absorbed on the European market, and since many of the "hungry" people of the world are hungry because they cannot afford food there would be little hope of exporting, particularly processed foods, to developing countries until they become richer, or until adequate food aid programmes were devised.

We must accept that there are certain countries to whom we are not going to sell foods. Some of the developing countries have fuel or other mineral resources to sell in order to pay for food imports but some of them have not. One of the main aims of many of these countries seems to be to avoid importing food. If Europe is to make a serious effort to export food we must discover what people want to buy from us.

It was pointed out that participants seemed to be considering the very near future and that in the longer term there will be many more mouths to feed and some of Europe's food will have to be exported to feed them, even at a low return. It is useless to produce food if the world population cannot afford it. Perhaps we shall have to produce more units at a lower profitability per unit than we now have to maintain the total return.

It was generally agreed that there must be close integration between producers and processors and indeed right through to retailers. The Agricultural Research Council did not until recently share this view and did not want involvement in this type of co-operation. Examples were given of integration which does occur already in other parts of the world. In some instances where long-term investment is required for the establishment of a crop, the processor takes some share of the risk involved by offering loans at low interest and contracting to buy the whole crop from a fixed predetermined acreage. This obviously gives the farmer a greater sense of security. In Europe some of the main problems have been that farmers do not regard themselves as part of the food industry and that food processors have been unwilling to enter long-term contracts with producers thus sharing the risks of major investments required for moving into new production fields in our sophisticated capital intensive style of farming.

However, attempts at co-operation are certainly increasing and progress has been made over the last 15-20 years in various sectors of the industry. Hope was expressed that farmers might bring added value back to the farm in the next few years by processing products themselves, particularly frozen products which are becoming increasingly important, thus allowing the major food processors to concentrate on the development of new ideas.

It was suggested that the proposed intensification of agriculture would mean an enormous increase in supplies requiring markets and might give rise to spare land. On the other hand it was felt that the population explosion might force us to intensify the agricultural use of land since those would be needed for other purposes.

Further comment was made on the need to export technology in order to encourage developing countries to produce their own food: they have the land and the people available; they require the technology. It was also suggested that there is already ample opportunity, land and techniques to produce all the food the world needs; the problem is how to get it to the mouths of the people who need it.

Comment was made that few countries in Europe are net exporters of food at the moment but since people the world over tend to want what they cannot grow themselves there are certain items of food for which there is an export potential for Europe.



WHERE DOES EUROPE'S COMPARATIVE ADVANTAGE LIE?  
IN THE FOOD PROCESSING INDUSTRY?

DR. AIDAN POWER

Because of the lack of adequate statistics on the food and drink processing industry in the EEC, economists face a difficult task in analysing its current and future competitive positions in international trade. This deficiency does have some advantage, however, in that the subject has to be approached in a somewhat speculative spirit.

In considering the problem we must look at Europe as a whole and not at the individual industries of its 9 member states. In attempting an assessment of Europe's competitive strengths and weaknesses, however, I have introduced the concept of "trading advantage", in which I include the more general economic advantages as well as institutional advantage (with its historical, cultural and political aspects) in addition to the more familiar notion of comparative or natural advantage. In the long term it may well be economic advantages which govern trade; but in the shorter term the "institutional" factors have considerable significance.

The current position

A review of the EEC's trading profile for processed food and drink products will help to determine where the Community's trading advantages lie and to provide indications of areas of relative competitive strength for the future. From OECD trade figures - fortunately these data have a common base - we can attempt to identify those commodity groups which are important in the Community's trade and to determine in which areas, for which products and from which countries the EEC experiences its main competition. The principal conclusion to be drawn from an analysis of the OECD trade data for 1974 (the latest available at this time) is that the exports of processed foods and drinks from the Community and its main competitors were generally fairly evenly distributed over the major product groups. There was little specialisation by major commodity group between countries, or even between broad geographical areas (such as the EEC), but it has to be borne in mind that the trade descriptions mask considerable differences at individual product level. The main exception was alcoholic

drink which accounted for the highest proportion of EEC export trade of processed food and drink products (almost 21%).

Further analysis of the OECD figures showed that the main processed food categories exported from the EEC were meat (fresh, chilled and frozen), milk products, cereal products, vegetable products, canned meats, cheese and curd and sugar. Each of these commodity groups accounted for 4% or more of the total value of the Community's export trade in processed food and drink products in 1974. Product groups accounting for from 2% - 4% each of the total were butter, evaporated and condensed milk, sugar confectionery, cocoa, processed fish and preserved vegetables.

The 1974 evidence indicates that the EEC was the main supplier to European developing countries (see Appendix). The Community dominated the export trade in alcoholic drinks to virtually all areas; it seems also to have had no serious rivals in the export of refined sugar, sugar confectionery, cocoa and condensed milk. The EEC dominated the export trade to other European countries in meat, cereal preparations and vegetable products and was also the major trader with developing countries in milk products, flour, cereal preparations and canned meats.

However, the trading picture is extremely complex. For instance, again referring to 1974, the EEC exported meat to the US and to Japan where its main competition came from Australia and Canada, although the US itself was also a major exporter of meat to Japan. But, whereas Community trade with the US consisted mostly of beef, its meat exports to Japan were mainly poultrymeat. Australia was the principal supplier of beef to the US, and the US itself was the main supplier of poultrymeat to Japan. Turning to milk products, we find that the EEC was a heavy exporter of dried milk to Mexico and Cuba in competition with Canada, and to South Vietnam, Malaysia, Singapore and Indonesia in competition with Australia. It was the most important supplier of butter to other European countries and developing countries, again in competition with Australia. The Community encountered little competition on the African import market for flour, but was in competition with the US in Saudi Arabia. These examples emphasise the complexity of the trade; clearly when considering trading advantage one must take into account not only what is being exported but also to where the products are going.

### The elements of trading advantage

A key question, then, is the identification of the main determining influences of trading advantage. The pattern of trade outlined above helps to give some indication of where the Community's strengths and weaknesses lie, but a single year's figures must be interpreted with caution since they might be unusual in certain respects. Moreover, trading advantage reflects the net balance of various short and long-term influences all of which may be operating simultaneously but, perhaps, in conflicting directions.

One key element may be natural advantage in producing raw materials for processing. The EEC has considerable climatic and soil advantages for alcohol production and this is reflected, as we have seen, in its predominance as an exporter of wines and other alcoholic drinks. But whether or not the EEC has marked natural advantages in the production of other basic products is not so clear. Price structures within the EEC may have the effect of increasing production of certain commodities where there is no real natural advantage. On the other hand, for example, fruit and vegetable production might well increase if imposed price structures did not encourage production of other commodities at their expense; and this could be a possible development area for the processing industry. Indeed, among the broad product categories being considered it is difficult to distinguish those for which the EEC has significant advantage other than in the production of alcohol, wine, fruit and some cereals.

Another influence of importance is geographical location. For example, we have seen that the EEC dominates trade with other European countries and with Africa, whereas the US dominates trade with developing countries in Central and South America.

"Developed advantages" i.e. those which do not arise from natural conditions such as climate and soil and which have to be worked for, include efficiency in the production of raw materials and processed products, and in the marketing and distribution of the goods produced. By developing the efficiency of its processing industry the EEC could improve its export performance even if it lacks, in general, marked natural advantages of the kind already discussed. Efficient marketing and distribution systems would also go a long way towards making up for any "natural" deficiencies. Little

information is available on the comparative efficiencies of the food manufacturing industries of the major processing countries or of their marketing and distributive systems. There is a need for a comparative assessment of the food processing and distributive industries of the EEC as a whole and its major competitors, as their organisations, structures and relative efficiencies vary so much from one member state to another.

"Externalities" must also be considered. These contribute to trading advantage in varying degrees in the EEC and competing countries. Examples of externalities might be the general level of economic management, the availability of skilled labour, or the existence of efficient complementary industries such as packaging or food machinery industries. A good deal of work could be done to measure and compare the influence of externalities in the various EEC member states and in rival exporting countries.

There are also possible institutional advantages, such as the legal and tariff arrangements with which exporting countries have to comply and over which their industries have no direct control. Three categories of institutional influence might be considered: the protective, the aggressive and the supportive. Basically the EEC is a protective organisation if its one really active industrial policy - the Common Agricultural Policy - is anything to go by. However it also operates aggressive policies designed to increase exports as such, by export subsidies and refunds. Supportive policies also play their part in the form of Government or official participation in promoting exports, in holding trade fairs, in providing export market information and research and development funds.

Another aspect which must be considered is the EEC's aim of setting up a single integrated market of equivalent size to the USA which should theoretically offer all the advantages of a large domestic market. In reality, it is not so simple or straightforward to achieve this with 9 different countries having different historical and cultural backgrounds and varying consumer tastes. In any case, the US itself can hardly be considered as a single, completely integrated market, although it has the advantage of a common set of tastes and attitudes to food.

Institutional advantages of a rather different and perhaps more fundamental kind are the historical and cultural influences. That these contribute to trading advantage may be illustrated by the example of the

EEC's dominance of the trade with Africa which is partly a function of location but also a result of the long historical, political and trading connections between the two continents.

### Summary and conclusions

To summarise, I have a number of reservations about the usefulness of comparative advantage, at least as generally understood, as an analytical tool for assessing the EEC's likely future success as an exporter of manufactured foods and drinks. This is particularly true of the short to medium-term when locational, historical, political and cultural factors can be expected to exert considerable influence.

I suggest that - with the exception of alcoholic drinks, fruit and some cereal production - the European Community has little natural comparative advantage on which to rely in developing its export trade in processed foods and drinks. It has, however, certain trading advantages arising from locational, cultural and historical factors. It also has the advantage of already possessing an economically developed and experienced industry well equipped with skilled management and labour, and benefiting from "externalities" such as the back-up of highly developed packaging and food machinery industries, and considerable R & D effort in the food sector generally. Combined, these add up to a considerable trading advantage for the EEC and indicate those areas, both geographical and otherwise, of strength from which the Community can hope to expand its food and drink sector exports in future.

In my view, the future success of the EEC as a competitive exporter of manufactured foods and drinks will rest on the degree to which it can capitalise and build on the considerable trading advantages ("developed", locational, cultural and historical) which it already possesses. Locational, cultural and historical factors provide the Community with a firm jumping-off ground for further improvement but its future competitiveness will rest to a large degree on the extent to which its "developed" advantages can be improved. It seems, therefore, that there are three broad areas of research which need to be tackled without undue delay;

- 1) Information: Other than trade data (and even these are by no means perfect) there is, virtually, a complete lack of comparable economic data for the EEC food and drink manufacturing sector. This makes it



impossible to identify and quantify satisfactorily the competitive strengths and weaknesses of the EEC industry.

- 2) Market Research and Product Development: Longer-term and product research is needed to monitor requirements of the export markets so that the initial advantages offered by locational, historical and cultural factors will not be squandered and so that new lines of trade can be opened up.
- 3) Technical and Economic Research: Considerably more research of this type will be required to allow the necessary adjustments and improvements stemming from developments under 1 and 2 above to take place.

Great consideration is needed in order to decide the precise nature of the research required under each of these three headings, but until the necessary research has been done the Community may have difficulty in maintaining, and cannot hope to improve its position as an exporter of manufactured foods and drinks.

### Discussion

The discussion opened on Dr. Power's assumption that present trade patterns give an indication of comparative advantage. It was suggested that there are still too many obstacles to "natural" trade for this to be so. Dr. Power agreed that the statistics probably do not give a true picture of natural advantage in trade, but re-emphasised that they provide a much better indication of "trading advantage" as defined in the paper, and commented that, in any case, present trade patterns would be a more accurate guide to trading advantage for processed rather than for the more basic agricultural commodities.

Doubt was then cast on the importance of natural advantage when considering goods containing a large element of manufacture, although emphasis was placed on Europe's ability for primary production: its soil fertility, long growing season, ability to grow roots and forages do not emerge from the available statistics. Dr. Power accepted that Europe has considerable ability for primary production but stressed that what was in question was the Community's natural advantage in this over the world's most favourably endowed areas; he agreed that natural advantage was in any case of doubtful relevance when considering manufactured products, pointing out that this was the very reason why he had felt the concept of

natural advantage to be of little use for analytical purposes and had suggested the wider and more effective concept of trading advantage.

The comparison of efficiency in food processing based on the rate of growth of value added per head and on concentration of the industry was also questioned. Dr. Power commented that statistics are not available to allow efficiency comparisons on unit cost and on scale of operation. Basic work is needed in this area and this had been the kind of work which he had in mind when he had concluded that further economic research was required.

In discussing marketing and distribution for export, it was strongly contended that markets have to be found by entrepreneurs who go and find out what people want and what they can afford, make contacts and follow them up. Tastes can be developed only if per capita income allows. Marketing must also involve intense research into the capabilities of production in the light of land, climatic, husbandry and economic factors. "Quality" was put forward as an important advantage for exporting but it was agreed that this must be seen in the context of market requirements and that changes in requirements should be monitored. It was suggested that "quality" is less important when considering exports to feed a hungry world than when considering exports in a commercial sense. The two "markets" must remain separate. Moreover, the entrepreneurs who identify the markets for export must be backed up by technology. It was felt that the European industry has an enormous advantage in its ability to use technology. Dr. Power replied that he felt he had emphasised technological advantage in his presentation and hoped that the technical and economic research which he had suggested was required could be directed towards how best to service the future requirements of export markets. There was some comment that producers of raw materials, perhaps developing countries, would increasingly wish to do initial processing themselves to benefit from value added to the raw material, and may, therefore, be in competition with exporting companies. It was considered, however, that this would allow possibilities for specialisation and might lead to greater trade.

The possible advantage of an integrated market was also discussed. In Europe the idea of a single market stems from the basic concept of a united Europe. We must accept, however, that tastes vary, and realise that a gradual approach is needed to work towards unification of standards,

definitions and packaging and not towards uniformity of products as such. If there is a free flow of improved information and barriers to trade can be reduced or eliminated, perhaps the domestic market can effectively be enlarged and benefits drawn from economies of scale. Dr. Power hoped that European integration would provide opportunities for this.

## Appendix

### The developing countries

Europe Yugoslavia, Gibraltar, Malta, Cyprus, Europe n.e.s.

Africa All countries comprising the continent except South Africa.

America All countries comprising the continent, except Canada and the United States. (It includes the Caribbean Islands).

Asia : Far-East All countries comprising the continent except Japan, China (mainland), Korea (North), Vietnam (North), Mongolia and countries included in the Middle East.

Middle-East Syria, Lebanon, Israel, Jordan, Iraq, Saudi Arabia, Yemen, South Yemen, Kuwait, Bahrain, Trucial Oman, Muscat and Oman, Iran.

Also included in Total for Developing Countries - Oceania, except Australia and New Zealand.

WHERE DOES EUROPE'S COMPARATIVE ADVANTAGE LIE?  
IN AGRICULTURE?

PROFESSOR JAN DE VEER

The European Community is to a great extent self-sufficient with regard to food consumption. Agricultural products form the basis for food production and consumption and provide 88% of its requirements of vegetable food and feed calories and 96% of its demand for livestock products. For vegetable and animal fats (except butter) and vegetable proteins, the self-sufficiency rate is very low: for sugar, milk and dairy products the community tends to be a net exporter.

Nearly 60% of the food calories are derived directly from vegetable materials and about 40% from livestock production. This livestock production is, however, based on vegetable calorie conversion so that, of the vegetable materials consumed only 20% is used for food of vegetable origin and the other 80% goes to livestock production. About 80% of the agricultural area of the European Community is used for the production of food for livestock: (60% in the form of grassland and fodder crops).

Of the final agricultural production about 20% may be attributed to the conversion of vegetable materials to livestock products and 80% to vegetable production. Of that, 60% is feed production and 40% production of vegetable food and materials for food and vegetable origin.

Europe has 20% of the world population and a 50% share of the world consumption of raw materials though its share of world resources is less than half that. Despite its high degree of self-sufficiency it takes a large share of world imports of the most important food and feed materials. (In 1973: cereals 15%, fats and oils 26% and vegetable proteins 40%). This dependence on imports does not provide an argument for raising its food and feed self-sufficiency above its present level. Stock holding should provide for temporary shortfalls and in an emergency situation it would be relatively easy to become self-sufficient by cutting down livestock production, thereby saving vegetable calories, and adjusting the cropping plan to the requirements of a balanced diet. The Community's food supply is vulnerable, however, under emergency conditions, because of the dependence of agriculture and the

food processing industry on energy and transport within the Community.

The Community will probably achieve self-sufficiency and may even become a net exporter of vegetable calories either as processed food or in raw form. Population and domestic demand are stable and income growth is slowing down. Crop yields in the EEC are still fairly low and are likely to rise steadily. However, overall self-sufficiency does not imply that the composition of agricultural production will be adjusted to domestic demand. It will probably result in a combination of nearly indisposable surpluses in milk, dairy products, sugar and soft wheat and continuing import requirements in vegetable fats and proteins. It is unlikely that price relationships can be manipulated to balance supply and demand of domestic agricultural products within the EEC. This in itself is not the problem: it is rather to consider whether import substitution by expansion of production of vegetable proteins and fats and perhaps decreased exports of milk and dairy products and some foods might result in more efficient utilisation of Europe's resources and more advantageous international division of labour. We must also consider whether this is feasible from the agricultural and economic policy point of view bearing in mind regional factors and whether its effects on the economic and agricultural development of developing countries would be acceptable.

In general the location of agricultural production depends more on the availability and quality of natural resources than on the price ratio of labour to capital. Agriculture is very flexible in this and wage differentials do not provide an important basis for trade for the main products.

This flexibility may also allow an improvement of the economy in developing countries in providing agricultural employment in rural areas where natural resources are available or can be developed.

Transport costs vary enormously in relation to product value: they are relatively low for feedstuffs (cereals, fats and oilcakes) and relatively high for most livestock products, vegetables and fruits.

Changes in the volume and composition of agricultural production which involve a shift of fixed resources (land, labour, capital) such as an increase in farm size, happen very slowly, often over generations. This

inevitably affects the development of world trade. An unrestricted operation of a free market mechanism is not an effective means of achieving such structural changes in the long term nor are its consequences socially acceptable.

Since the beginning of the Middle Ages European agriculture has been tuned to a high degree of regional self-sufficiency and the maintenance of a rural population. Adjustment of farm structure and methods to the requirements of modern technology, improved transport systems and increased trade competition has speeded up considerably since World War Two but meets more resistance in Europe than in the 'new' rural area of North America and Australia, which are less burdened with the inheritance of the past.

When confronted with cheap food imports in the second half of the last century most European nations took recourse to protection of agriculture. This protection was intended to prevent the social and economic consequences of rapid structural change which would have occurred if original price policy had been maintained. In the first instance, protection was directed to cereal production but indirectly it was a support for agricultural production in general and particularly for the poorer, predominantly livestock producing rural areas. CAP is a replacement and continuation of those national policies and was or has been a prerequisite for the installation of a common market in other sectors in Europe. Amongst its aims is the protection and stabilisation of income from the land. This is mainly achieved by variable import levies for the major European crops.

#### The comparative advantages of West European agriculture

The comparative cost structure of European agriculture in relation to the composition of domestic demand led to a price policy with relatively high price levels for cereals, benefiting rural areas with favourable arable conditions, and to relatively low prices for products based on grass and fodder crops, generally grown on poorer soils. Maintaining relatively high levels of domestic cereal prices, however, is no longer an adequate instrument to adjust the volume and composition of production to domestic demand in general, and to prevent surplus production of milk in particular.

In an international framework Western Europe as a whole probably has a comparative advantage for intensive grassland exploitation and fodder

crops as a basis for the dairy industry. The EEC, however, already has a considerable milk surplus (about 15%) which cannot be sold at a price required to meet the cost of production. The dairy industry is and probably will remain a heavily protected industry in nearly all industrialised countries of the temperate zones. Both on the domestic market and on the export market butter fat and non-fat meet heavy competition from vegetable fats and proteins which can be produced at lower cost. The prospect of commercial exports of butter to countries achieving higher levels of income cannot be expected to become significant.

About 25% of the non-fat components of milk in the EEC are presently used for feed. Of this 60% carries a subsidy of approximately 50%. The use for feeding of calves is declining as milk production per cow increases and moreover, milk proteins are increasingly substituted by vegetable proteins in feeding.

Summarising, we may conclude that the prospects for important commercial exports of dairy products are small (except maybe for cheese) and that the EEC dairy sector already has a considerable surplus capacity which from the viewpoint of an efficient use of productive resources should be eliminated. In the long-term there may be some possibility of export to Middle East and North African countries if economic development there continues.

Within Western Europe the North-west coastal area (including the UK and Ireland) has comparative advantages for milk production. The originally mixed farming regions in the more central parts tend to shift to the more profitable arable use. This shift, however, meets serious structural resistances as it requires a further adjustment of the man land ratio.

Within the Community the area with sufficiently favourable structural and natural conditions for efficient modern arable farming which can be competitive with arable farming on the American continent is relatively small.

The price policy favouring cereal and sugar production has prejudiced the production of vegetable proteins and fats, and the development of complementary processing technology in Western Europe. An investigation into the possibility of developing such a complex of agricultural production and processing under natural conditions prevailing in the Community could be worthwhile.

A problem for Western Europe is to establish the optimal use of vast areas of agricultural land with a marginal suitability for arable production (cereals, sugar and potatoes) and/or insufficient comparative advantages for livestock production on the basis of grass and feed crops within the constraint of the domestic commercial market outlet.

Generally speaking, the production of vegetables, fruit and wine, which of course, are underestimated when expressed in calories, has been characterised by a strong rise in land productivity and a strongly growing domestic demand. In most cases the increase of yields and of demand has prevailed and some increase of area has still been possible. However, the growth of domestic demand is tending to slow down considerably and international competition, particularly from countries with complementary growing seasons, is increasing. This will necessitate factor adjustments to rising land productivities, decreasing area of production, and lead to a strengthening of inter-regional competition and of the demand for protection within the Community, as can already be observed. It does not seem likely that the Community will become an exporter of these products.

Western Europe is relatively poorly endowed with mineral resources and consequently requires high imports of raw materials. In addition, it is still an important net importer of food and feed, particularly of vegetable fats and proteins. On its export markets (and its domestic market) it meets increasing competition for its labour extensive industries.

This raises the question of how the Community is to pay for its indispensable imports; which are the comparative advantages to be exploited in place of the lost comparative advantages in the labour extensive industries; and how can the loss of employment be compensated for?

It is doubtful if agriculture can contribute much in this respect except perhaps by import substitution in the field of vegetable fats and proteins.

#### Discussion

The possibility of developing new uses for products by processing them



differently and of increasing productivity by using new technology was broached as an important means to make full use of the natural advantages of soil and climate which Europe has for agricultural production. Examples were given of producing energy from straw now wasted, medical products and agricultural chemicals direct from plants rather than from fossilised plants and of developing new pesticides and crop varieties to improve yields. New uses for base products were also mentioned to reduce wastage, such as have now occurred in large quantities in the form of flaked maize. Professor de Veer commented that these opportunities must be recognised and developed but did not feel they would represent a meaningful expansion of production or exports.

Great emphasis was placed on the need for a close relationship between the grower and the processor, especially if these new developments are to be pursued. The farmer must consider himself as a food producer and a part of the food industry. It was felt that Professor de Veer's overriding pessimism about the advantages of European agriculture is justified but that one major advantage is to be found in the combination of the skills of European agriculture and those of the rest of the food industry. Professor de Veer suggested that the critical attitudes and diversity of tastes of European countries forces the food processing industry to produce a great variety of high quality products which is in itself an export advantage.

Comment was made on Europe's potential for the production of foods from imported raw materials using her technological advantage combined with good market research and marketing to export a finished product with added value. Entrepreneurial drive was also seen as vital in the marketing and possible export of potential increased production. To produce more food at home would be a means of saving both imports and energy. As Europeans we must accept the general premise that we want a balance of production which will inevitably produce a surplus from time to time. Surpluses can be managed as long as they do not become too large. Indeed shortages are in general far more costly than surpluses. In a discussion of methods of dealing with surpluses there was some disagreement over the viability of making surpluses, e.g. butter, available to industry at reduced prices. It was generally agreed that the longer term implications of increased agricultural productivity were for alternative land use and alternative employment for farmers. But since everything has to be made of something, the agri-food industry should be producing the feedstock for new products, some of which might be non-food products.

## NEW TECHNOLOGIES IN FOOD PROCESSING

PROFESSOR E.J. ROLFE

### Introduction

The first steps of any export programme must be to identify the countries with potential markets and then the products which might be improved or gaps in the range of products available. Information on resources for storage, distribution and retailing of foods and food consumption is essential.

In developed countries such as Western Europe and the USA, sophisticated food distribution chains exist with supermarkets forming the main retail outlets. The latter development has demanded extensive pre-packaging of foods which in its turn has caused a dramatic expansion in the packaging industry and production of packaging materials.

Food eating habits also are changing and two of the major influences inducing the changes are

- i) the consumer demand for convenience foods to reduce the work and time spent in the kitchen, and transferring it to the food manufacturer.
- ii) product substitution, e.g. vagaries of climate and world events can reduce available supplies and inflate prices to such an extent that the consumer must turn to alternative foods.

An important consumption area which the food exporter must not overlook is that of catering establishments. They are finding it prohibitively expensive to replace obsolete kitchens and equipment and difficult to find suitably skilled staff and pay their wages. As a consequence they are turning now to food processors to provide quick frozen entree dishes and sweets which offer portion control, and require only the minimum of equipment at the caterers' premises for thawing and heating and no skilled cooks or chefs. The pattern of eating out is changing. Hotels and restaurants are finding it hard to hold their own as many customers experience through inflation the need to trade down. An increasing share is being taken by pubs and popular catering outlets. Welfare catering is a very large section

of the industry: for example, in the schools of England and Wales there are 5,893,000 children lunching daily at an annual cost of £476 million. Add 400,000 patients in hospitals in England, meals for old people, and catering for the Services, then the size of this business can be extremely large.

The possibility of export markets in developing countries must not be overlooked. The oil rich countries will no doubt change their food habits and will be seeking European type foods, whilst those other countries seeking to develop their tourist industry will also require supplies of European type foods. In all such cases the food technologist must take note of the rigours that the climate and distribution chain will place on the products. Thus knowledge of food habits and consumption patterns is essential to marketing planning. The marketing experts must participate in discussions with the development, production and accounts departments of the food manufacturing business. My impression is that the agricultur-  
alist and farmer are rarely involved in such discussions, but it would seem that only good can result from their involvement.

#### Innovation and new developments in food technology

There is already a substantial accumulation of knowledge in food technology, quite adequate to develop new ranges of food products, or improve existing ones and which could be used to stimulate export trade. Rather than further knowledge, successful innovation requires

- i) marketing to identify or recognise gaps in the food supplies of the importing countries, or to foresee foodstuffs for which a demand can be created, followed by
- ii) application of known technology to develop the required products and scaling up of the process to commercial production.

Developing of the necessary hardware for production can itself introduce difficult problems. For example, aseptic packaging of sterilised food is a low cost low energy food preserving technique which keeps to a minimum the nutritional losses and flavour changes. It is highly versatile and offers wide scope in the container system to be employed. Then why has it not become dominant, remembering that it was introduced as the Martin Process as long ago as 1968 for the production of canned split pea soup? A major part of the problem has been the lack of suitable equipment and only recently has an improved range of aseptic system components (e.g.

high speed fillers, properly sealed pumps, etc.) become available to the processor. Another weighty factor is inertia of a food industry already in possession of canning equipment. But now the process is becoming more widely used, particularly applied to liquid milk and milk products. Another example of inertia in the food industry is the failure of a new and rapid method for the conching of chocolate, because apparently it is not economic to replace the existing equipment.

A few of the new developments in food technology which have the potential of making an impact on the pattern of agriculture in the EEC and also of providing foods for export can now be considered. It must be remembered, however, that some processes, such as freeze drying, are expensive and can be applied only to expensive items able to bear the added cost.

#### Dehydrated foods

A wide variety of drying techniques and equipment are available, the choice made depending on the commodity, characteristics required of the product, and costs.

Freeze drying has set new high standards for quality and convenience, but high cost as compared with other methods of dehydration has limited its application. Expensive food items can carry the cost and hence freeze drying is widely used in the preparation of instant coffee.

Dehydration has the potential of becoming the ideal method of food preservation. Most foods, e.g. fruit, vegetables, meat, fish, milk, contain between 80 and 95% water, which is almost completely removed to leave only a small fraction of the original weight, containing all the nutrients, to be stored and distributed. Stability is conferred to the foodstuffs as they contain insufficient water to support the growth of micro organisms. In addition, the low moisture content inhibits many chemical forms of deterioration which would result in a loss of quality. Dehydration is accompanied by a drastic reduction in weight and volume is also markedly reduced, dramatically so if compression of the dehydrated food is permissible.

Figure 1. Comparison of the storage requirements for fresh and dehydrated vegetables.

Vegetable	Storage Space per ton net ft <sup>3</sup>		Gross Weight lb per ton net	
	Raw vegetable in sacks	Equivalent dehydrated in cans	Raw vegetable in sacks	Equivalent dehydrated in cans
Potato	65	21.5	2270	482
Cabbage	90	3.7*	2290	140
Carrot	70	4.7*	2280	195

\* compressed vegetable

Such logistical advantages are important when considering distribution and storage. When adequately packed to prevent access of moisture and oxygen, dehydrated foods will keep for protracted periods without refrigeration. Some accelerated freeze dried (AFD) strawberries prepared in 1960 and packed in nitrogen were stored on a shelf at ambient temperature and opened in 1977; they were found to be in perfect condition.

#### Frozen foods

Preservation of foods by carefully controlled freezing offers stability with the minimum loss of quality characteristics of the original foodstuff. The disadvantage is the necessity to have a reliable cold storage and refrigerated distribution chain, which is expensive to maintain. A breakdown in the equipment would result in loss of the frozen food through spoilage.

The frozen food industry has developed and expanded rapidly since the early 1950s, and has gained impetus in recent years with the introduction of home freezer storage cabinets. This provides the convenience of less frequent shopping for the housewife, and easy preparation of more diverse meals. The basic food commodities of vegetables, meats, etc., are obtainable in bulk frozen packs. The more recent developments are in frozen pre-cooked meals and in frozen confectionery which probably form the most important growth area at present.

An essential feature of the frozen food industry is the provision of carefully designed and engineered refrigerated storage and distribution facilities. It seems likely that such equipment will be installed in the Middle East where the riches from oil provide a high standard of living.

Shuwaikh Harbour is the principal port of Kuwait, where there is an increasing demand for high quality chilled and refrigerated foodstuffs. To accommodate this new development, a new dockside cold storage facility, perhaps the largest and most efficient in the Middle East came into operation in summer 1976. It consists of twenty cold rooms with a total volume of 30,100M.

#### Irradiated foods

Since the discovery by Appert of food preservation by means of heat, only two novel methods have emerged - accelerated freeze drying and irradiation with ionising rays. Both are of recent introduction and have yet to become commercially significant.

Irradiation processing could be of particular value to developing countries as refrigeration is not required for storage or distribution of the products. Also microbiological problems of food poisoning bacteria of salmonellae give rise to public health hazards.

#### Concentration

Liquid foods such as fruit juices and milk are concentrated to reduce packaging, distribution and storage costs. Evaporation is commonly employed, and to prevent chemical deterioration, the process should be accomplished at low temperatures under vacuum. Multi effect long tube falling film evaporators are most widely used.

#### Freeze concentration

The process is basically a simple one, to cool the solution and separate out much of the water as pure ice, and drain off the resultant concentrated liquid from the ice crystals. By this process water can in principle be removed at an energy consumption of only about 15 - 30% of single effect evaporation. Unfortunately the method has run into

difficulties of yield loss due to retention and entrainment of solutes with the ice phase and resultant high investment and processing costs have been a disincentive. The separation of the ice crystals from the concentrate is critical in the process. The cost of separation and the extent of solute losses with the ice strongly increases with decreasing crystal size. The cost of crystallisation in general increases with increasing crystal size.

#### Ultrafiltration and reverse osmosis

Other methods of concentration which avoid affiliation of heat and which are beginning to be commercially exploited are ultrafiltration and reverse osmosis. Water is made to diffuse from a concentrated solution through a selectively permeable membrane to an aqueous absorbing phase with a much lower or almost zero solute concentration. The driving force is a pressure difference across the membrane which exceeds the difference in osmotic pressure. The first large industrial ultrafiltration plant for concentration of whey came into operation in May 1972 in France. It concentrates 80-90 tons whey/day to a ratio of 1:4. The process is justified in cases such as:

- i) to reduce transport costs to drying on lactose plant.
- ii) delivery to pig farmers - transport costs are less and consumption by pigs may be increased because of smaller bulk.
- iii) whey concentrate may be used instead of whey powder in many products, e.g. ice cream, and save drying costs.

Ultrafiltration employs membranes which allow the passage of water and other small molecules but impede the passage of those with a molecular weight of about 500 or higher. Osmotic pressures are obviously of lesser importance and process operation pressures are between 1 and 10 atmospheres. The process is used to concentrate skim milk with simultaneous removal of part of the lactose. The protein enriched concentrate can be used as a food ingredient and a novel method of cheese production. The ultrafiltration concentrate is mixed with cream, starter and renin, and the mixture is put directly into moulds. The cheese then sets into its final form. The whey proteins remain in the cheese, which gives about 20% greater yield and the discharge of whey is avoided.

It is believed that dairy applications hold greatest promise for the food industry as ready use can be made of the separative capabilities of

ultrafiltration, e.g. removal of lactose from whey, concentrating skim milk with exclusion of electrolytes. Other possibilities are protein recovery from meat packing, dairy plant or cannery waste streams, not only for pollution abatement but also as a means of recovering useful and saleable protein and other nutrients.

#### Food preservation by means of heat

Canning is the familiar method of heat preserved foods which are stable for long periods, often years at ambient temperatures. In this context "canned foods" is used as a generic term irrespective of the type of container, including pouches, and often non-metallic. Stability is defined as the absence of microbiological hazards and not necessarily the retention of all desirable quality attributes of the food stuff. Sufficient heat is applied to destroy contaminating microorganisms and spores, with particular emphasis on pathogenic and food spoiling species, and re-infection is prevented by enclosing the food in a leak tight container. Canning forms the largest section of the food preserving industry and is undergoing relatively rapid change in most aspects of the process.

Innovations in can design and manufacture are being pursued to overcome the disadvantages of the high cost of tinplate, lead contamination, weight and cylindrical shape, and of difficulty in opening. There are three distinct innovations in the actual heat processing of canned foods:

i) To make use of higher temperatures:

A rise in temperature accelerates both chemical interaction between components of the food (inducing loss of quality) and the death rate of microbial cells and spores.

Production of UHT milk is expanding in Europe. It is sterilised and filled aseptically into a sterile container e.g. Tetran pack system where the container may be of polythene lined paper board. In Italy 42% of liquid milk sales is as UHT and in Germany 35%. There are many advantages over pasteurised milk, e.g. does not require refrigerated storage, avoids costly refrigeration in transport and distribution, thereby saving energy, and is easy for retail shops and homes without refrigerators.



Südmilch A.G., Stuttgart, West Germany, believes that it is possible to reduce or eliminate the European milk surplus by sterilising it and distributing it aseptically packed and ready for drinking, and that there is a substantial export market. The Company shipped over a period of 11 weeks in 1976 660,000 litres of aseptic milk worth DM 800,000 to Saudi Arabia for its school milk programme. The recent difficulties of Nestlé are seen as a major incentive to this approach. Few places in the Third World have the recombining installation necessary to reconstitute milk powder properly, and many infants have died or become ill when unhygienic water was added to the powder. Saudi Arabia initiated the project by asking assistance from the EEC because one of its major milk suppliers in the Lebanon had been destroyed by Civil War. The requirement is for more than 1.3 m. litres of milk. Perhaps UHT aseptic milk is a possible new agricultural and development policy within the EEC.

La Parmalat S.p.A., in Parma, Italy, is converting daily 1,000 metric tons of milk into twentyfive different long life products by means of aseptic containerising systems for the UHT products. An interesting range of novel aseptic products has been developed, e.g. vanilla, chocolate and butterscotch puddings, chocolate milk, etc. The output of one million litres daily is sold throughout Italy and exports to Greece and North Africa are increasing.

- ii) Where the can contents are solid (e.g. canned meats, thick purees), improvement is achieved by increasing the surface to volume ratio using either shallow rectangular cans - aluminium readily lends itself to the manufacture of such containers - or using flexible pouches.
- iii) Aseptic canning is the filling of a sterilised food product under sterile conditions into a previously sterilised package followed by closure under sterile conditions which effectively excludes the possibility of recontamination by microorganisms.

Aseptic canning offers the opportunity to can foods that have been sterilised by HTST methods and thus the product has improved flavour, colour and nutritional retention because of the reduced

heat input. Also the limitations imposed on can size are removed. The USA is developing the aseptic packaging of fruit and vegetable purees and pastes in large can sizes and 55 gallon drums for processors and institutions. Aseptic bulk storage and aseptic tank truck transport of partially processed liquid foods is another US innovation being introduced into Europe. Aseptic packaging has been confined mainly to liquid or flowable foods, but by using improved scraped surface heat exchangers, or using improved pumps and lines leading to the aseptic filler, chunk type foods such as chow mein and beef stew have been successfully processed.

- The process could have considerable potential to improve food supplies and resources in developing countries where warm conditions are conducive to rapid food spoilage. Aseptic containerised food would avoid the necessity to establish a refrigerated food distribution system.

#### Food modification and conversion

The protection of food supplies is obviously an extremely important aspect of food technology, but the other also very important area concerned with food modification and conversion must not be overlooked. The conversion may give a less stable product, e.g. flour into bread, but other important advantages may be derived, e.g. the food is made more palatable, more nutritious, more easily digested.

Of particular interest at the moment is the conversion of vegetable protein into texturised products, particularly meat analogues. To simulate existing foods not only flavour but also texture, bite, form and structure must live up to consumer expectations. The most realistic meat analogues are derived from spun protein. The process is expensive and probably offers little saving as compared with meat itself. The protein must first be extracted to provide an isolate. The latter is spun into threads, colour and flavour added together with fat and then "knitted" into meatlike products.

For reasons of cost, attempts are being made to improve the quality of the product from the cheaper extrusion process. The latter avoids the extraction and spinning processes, but does not yield a fibrous product - with a consequent deficiency in meatlike properties.

## Feed stocks for the chemical industry

When speaking of agriculture, the reference is usually to the production of food for human consumption. However, future developments of the industry must take into account a new growth area, (and potentially it is very large) to provide raw materials for the chemical industry. Sugar is an interesting example. It is easily obtained in a pure form, is a versatile polyhydric alcohol, and as such it will react to provide a wide range of novel compounds. The application of reactions such as the nucleophilic substitution of sulphonates, esterification, elimination, halogenation and oxidation have led to a large number of derivatives. Their value as biologically active materials, polymerisation intermediates, pesticides, food additives and surface active agents awaits development. Sugar esters of fatty acids are effective as emulsifiers and are particularly suited for inclusion in food products from a health safety point of view. The hexa-acetate is a bitter-tasting compound, and may find a use in bitter drinks, e.g. tonic and bitter lemon. Tate & Lyle have devised from sucrose a commercially available range of biodegradable detergents.

Starch can be converted by enzyme hydrolysis to liquid glucose, the composition of which can be tailored to meet a specific requirement, e.g. consisting largely of glucose for use as a sweetener instead of sucrose, or a mixture of oligosaccharides with low sweetening activity. Starches can also be modified chemically to improve their gel characteristics, resistance to retrogradation etc., and to give cross-linked starches, and starches in which some of the hydroxyl groups are replaced by acetyl, propionyl or ionising groups.

## Constraints on development

We can look at those constraints which will affect food processing and food exports.

### 1. Supply problems

Supply problems through depletion of non-renewable resources and minerals. Two examples will suffice:

- a) The limited supply and heavy demand for tin has forced up the price

of this metal, and this is reflected in the production and price of tinplate use in the manufacture of cans. Replacement by a material in more plentiful supply is possible. Aluminium is being used increasingly instead of tinplate for can manufacture - but bauxite is also a non-renewable resource.

- b) Fertilisers are an essential ingredient of agriculture when high yields of crops are required. Unfortunately, known deposits of phosphates are very limited and alternative sources are meagre and expensive in comparison.

## 2. Energy crisis

Energy is basic to all manufacturing processes and the enormous rise in the price of oil has forced industry to become more conscious of the energy content of its operations. But the manufacture of processing is not the whole of the story. Account must be taken of the energy content of:

- i) the associated packaging materials
- ii) storage, particularly refrigerated storage, and
- iii) transport and distribution.

It is to be expected that costs will rise substantially more in the future, and will introduce a new dimension when a comparison is made between appropriateness or suitability of alternative processing techniques. The ramifications of energy consumption finishing with the distribution of the end product are extensive, as may be illustrated by an examination of the comparison for energy utilisation for frozen and canned sweet corn made by the Central Research Department of General Foods Corporation:

12704 Btu/lb. product for frozen corn.

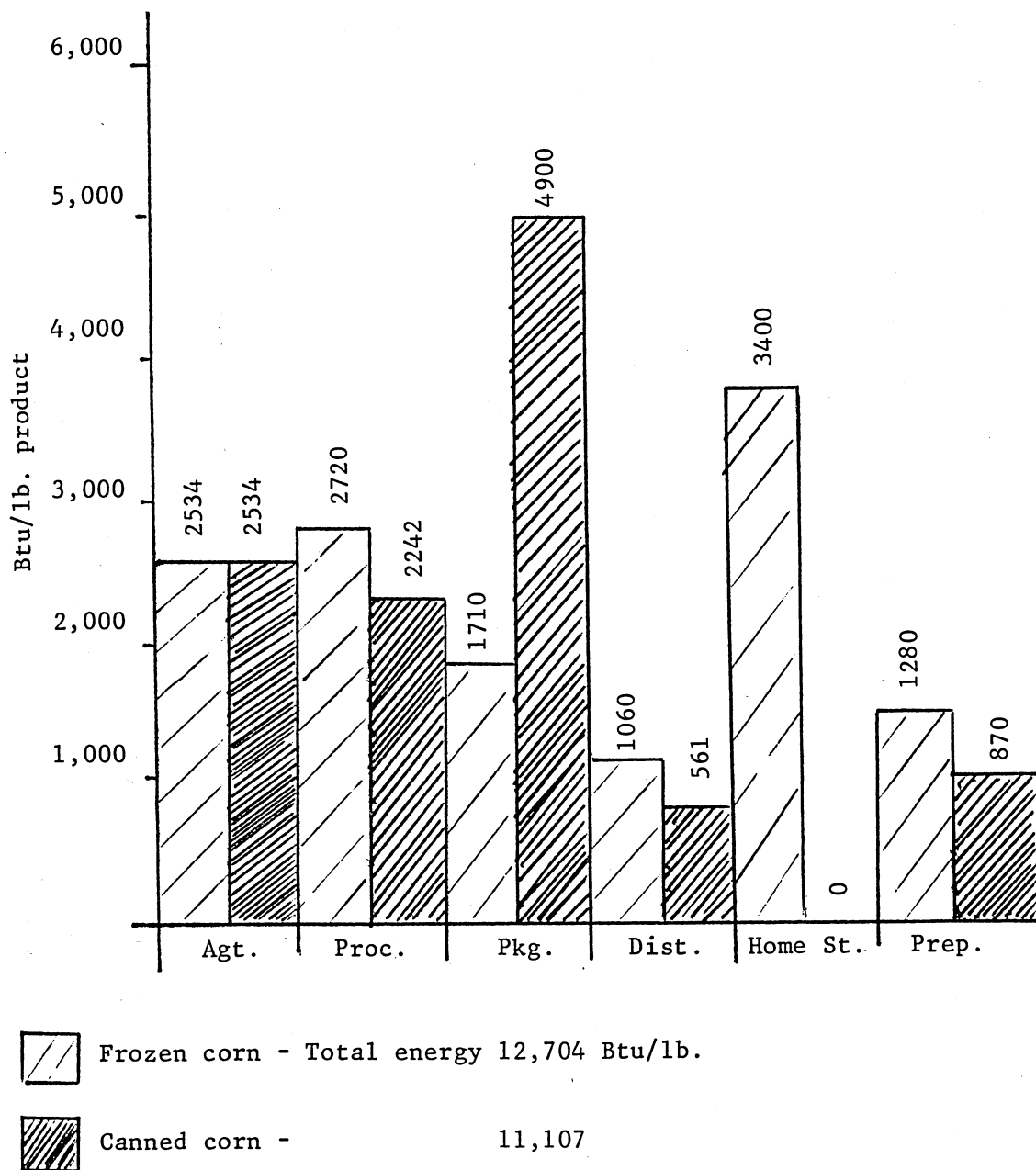
11107 Btu/lb. product for canned corn.

However, it is also reported that a comparison in Sweden indicated that the total energy requirement for canned peas is 25% greater than for frozen peas. It is evident that data on energy utilisation can vary considerably, and contributory factors will be the efficiency of the production unit and omission of some energy absorbing materials or operations.

## 3. Political considerations

These will divert and direct food developments, e.g. there is the

FIGURE 2: COMPARISON FOR ENERGY UTILISATION FOR FROZEN AND CANNED SWEET CORN



known possibility of imposition of tax on high fructose glucose syrup to prevent it from becoming a competitive sweetening agent with sugar.

#### 4. Food policies in developing countries

The developing countries in general export basic raw materials. They grow crops which are then sent to the developed countries for manufacture and in the process a very substantial value is added to the commodity, to benefit further the economy of the developed countries. The developing countries after gaining independence continued the role of exporting basic commodities, but now they are seeking economic development. The country must otherwise not only face having to buy the manufactured product back at a much higher cost, but also lose the badly needed employment that value-adding could have provided for the local population.

A further important aspect of such food policies is that there are substantial losses of food in tropical countries through damage by pests, microbiological spoilage, etc., which is very much to the detriment of a developing country's nutritional programme.

For these two reasons at least, it is important that such countries establish and develop a food industry to preserve, package and distribute their food supplies with a minimum of wastage.

Inter-state trade within the EEC is obviously an essential activity which, one hopes, will continue to develop to mutual advantage. However, the Community is not self-sufficient and must develop its export markets. The need is to identify markets which can absorb foods based on crops grown in temperate climates, again which have been manufactured and converted first to increase their value. The potential importing country must have the necessary infra structure and distribution chain, and this will be particularly important in the case of frozen foods, when looking towards the oil-rich but developing countries.

Turnkey food developments will in due time lead to the operation of effective food processing industries in many tropical countries which in turn will disturb present trading patterns. In the meantime opportunities exist for the EEC to export not only food, but also the technologies and equipment for both the agricultural and food processing industries, and thereby to make a contribution to the industrialisation of the developing countries.

## NEW TECHNOLOGIES IN CROP PRODUCTION

PROFESSOR J.P. HUDSON

We now turn to the consideration of what might happen in the near future in the context of the agri-food complex. We can speculate on what some of the future products might be: both amongst the crops we grow now and new crops which we may grow to serve new technologies.

The cereals and pulses that have played such a vital role in the emergence of civilised man will doubtless continue to be the main staple crops, because they multiply so quickly, grow so well, and are so easy to store and cook. However, new sources of food, denied to earlier man, may now become economic because of our much better understanding of how plants grow and yield, and the development of high technologies for extracting and preparing foods from raw materials.

Many parts of the European Continent (particularly of Britain) have 'plant climates' that are particularly favourable for certain types of plant growth. These natural advantages are of supreme potential importance because they are presumably permanent, and will still be with us even when all the oil has been used up. The challenge is to identify (a) areas that give a comparative advantage to particular plant species and (b) the species that are most favoured by particular areas, and then to develop agricultural methods that will reap full benefit from these most favoured relations.

That will require a better understanding than we have at present of the two related sets of conditions which determine cropping potential.

The first of these is the site attribute which covers physical parameters such as latitude, distance from the sea, aspect, altitude and slope, soil and availability of water. The second is plant weather; the subtle and complex relation between temperature, especially the differentials between air and soil temperature, fluctuations about the mean and extreme levels; rainfall in relation to evaporation rates and the water holding capacity of the soil; day length and light intensity; and windiness. The conditions in Europe, under those headings, are

determined by our geography, and there is no other area of the world of comparable size with a plant climate like that of Europe.

In considering the future we may review agri-food developments under five main headings bearing in mind questions of whether European agriculture has the vigour to develop in radical new directions, what new opportunities there may be and what Research & Development we should be doing now to provide a firm base for progress.

As in the past, there is sure to be continuous improvement in the way crops are grown (crop husbandry). This will probably include progress in mechanisation, improved management, reduction of random variations in yields (especially due to the effects of adverse weather) and the development of methods such as direct sowing which will use less fossil fuel energy. We can safely expect an increase in productivity of most of the present crops. However there may be a limit beyond which yields cannot be increased by the traditional ways of growing crops. It may nevertheless be possible to "take some crops back to the drawing board", in the light of better understanding of plant physiology and to grow them in entirely new ways. Various examples are currently being developed: the Long Ashton meadow orchard concept may well be in commercial use within ten years. Trees are planted 10 per square metre and are treated with growth regulants so that they bear a full crop biennially from the second year; this provides much higher yields in much shorter time.

We are concerned with raw materials as well as food. The traditional way of producing timber is to leave trees growing a long time, but a large proportion of our timber requirements could be furnished from coppiced forests, harvested every two or three years from a permanent root system to produce the wood chip and pulp now used to produce comminuted timber. This could increase enormously the productivity of European forests. Another breakthrough in growing method is the nutrient film technique, by which plants are grown in troughs with their roots in running water carrying nutrients. This method increases yields and productivity potential and is being accepted quite rapidly in the glasshouse industry.

There is still room for new breakthroughs in the way we grow our crops, and steady increases in productivity can also be expected from new and better varieties of traditional crops, with some added bonuses due to



new developments in genetics and plant breeding techniques. For instance, we have had the green revolution based on the breeding of dwarf varieties, and we are likely to develop new plant configurations, such as leafless peas and perennial wheat, but a major longer-term possibility is of combining normally incompatible genetic material by new breeding methods such as protoplast fusion and haploid breeding. By this type of genetic engineering it might even be possible to produce nitrogen fixation in non-legumes, and to improve the systems of photosynthesis in cool climate crops to make more efficient plants. These developments obviously take a long time and the plant breeders, scientists and geneticists must be well informed about the future needs of the food industry. To achieve the type of co-operation necessary between the food manufacturers and scientists, the former must be made aware of the profound changes which could be effected in crops and plant products, and the need for close co-operation is vital at the early planning stage between food scientists, farmers and processors.

A further approach is to develop new methods of utilising the present crops. The traditional ways of storing and cooking set rather strict limits on what plant species could be used as a source of food, but food technologies may enable acceptable products to be manufactured from completely new types of raw materials. Other developments may also be possible, such as using "nutritionally improved straw" as cattle food instead of burning it. A good deal of grass grown in Western Europe could be used more efficiently by fractionation, feeding part to cattle and part to pigs; interest is growing in this field. At the same time new forms of protein food have appeared on our markets - textured vegetable protein (TVP), mainly made from imported soyabean and other pulses, as an alternative to animal protein. There is likely to be an active search for other raw materials, specially crops that are more suited to Europe, as starters for TVP, and there is a need for a major effort on breeding varieties of the more efficient warmer climate crops, like soyabean, maize or navy beans that will crop well in the different temperature and daylength patterns found in Europe.

The next few decades may also see the introduction of crops that are entirely new to Europe. There is likely to be a trend towards seeking crops that meet particular demands (e.g. of the food industry) as well as finding new ways of using traditional crops.

The biggest breakthrough might be in the use of leaf protein as a raw material for human foods. Many forms of leaves can be extracted to produce a bland nutritious protein and this might be produced from a high yielding sward, frequently mown. This might include grass and clover but also plants which are not palatable to cows but have high growth rates in our conditions. A carefully selected range of species could be grown, in which some produce out-of-season leafage and others provide the main bulk of foliage when growing conditions are good, the components of the sward being chosen for their ability to complement each other's responses to weather in order to maximise growth. Scientists could probably develop a sward of this sort which could be grown in the milder part of Western Europe to be forage harvested once a fortnight for  $10\frac{1}{2}$  months of the year and producing a yield of leafy protein higher than we can get with any present crop.

TVP is now established on the market, based on expensive imported soyabean, but the food industry might well be interested in using a cheaper alternative to soya. There also is likely to be a big increase in fermentation processes, with new products produced by fermenting raw materials. Corn syrup from maize has emerged in the last few years as a new sweetener and other edible products are likely to be produced by fermenting cellulose and lignin (e.g. from coppiced tree species). There are many other possibilities, including the introduction of non-sucrose plant sweeteners and species that produce polyunsaturated fats, for which demand is growing as people become convinced that they will reduce the chance of dying from coronary heart disease.

The USA is making a systematic search for new crops in the tropics, but there is little evidence of similar activities in temperate regions - perhaps there should be? In seeking such new crops, agronomists and botanists should clearly consult the food industry so that they know exactly what to look for, which means that the food industry must analyse its own basic requirements. (A further approach is to aim at synthesis of food from single cell protein based on oil feedstock. This does have potential, though it does not seem to make economic sense to use fossil fuel to produce animal feed, unless that can be shown to be a more efficient use of energy than arable farming).

By 2000 AD many crops are still likely to be grown in much the same

way as at present, with marginal improvements in varieties, agronomic practices and utilisation. There may also be some brand new crops, grown in new ways for new purposes. There is likely to be more concern over the causes of variation in yields, and increased effort towards stabilising output in relation to weather conditions.

It seems possible that Europe may be importing much less food by the end of the century, and may have developed a significant export of some crops, or more probably of processed food products. This will call for a shrewd and informed judgement on which developments should be encouraged and to ensure that selective research and development is done in time to provide a sound technological base. Agriculture must have a bright future in many parts of Europe because of the natural advantages we have for growing plants, given the necessary ingenuity and imagination to develop them adequately.

### Discussion

Comment was made that the changes spoken of by Professor Hudson would only occur if the farmer and prime producers could be persuaded that change would be profitable, and if they could be sufficiently enthused to start the changes themselves and take the food processors along with them. It was suggested that research stations should be working much more closely with representatives of the food industry including wholesalers, retailers and processors, to get a better idea of the direction their work should take. The Joint Consultative Organisation, set up fairly recently, was already providing an opportunity for improving this type of co-operation between farming, the food industry and the Agricultural Research Council, and does influence the orientation of research. A broad picture of consumer requirements and trends must be developed, divorced from commercial secrets which are on a much narrower basis. There is a growing realisation of the need for co-operation.

The question of whether Europe is growing the right crops to gain full benefit from its natural climatic advantages was raised. Should efforts be made to redirect consumer tastes? Are cereals, on which the world depends, the best of all possible energy-providing crops or might it be possible to develop other crops with still higher calorie and protein potentials? Professor Hudson agreed that this could happen. Few of those reasons are

equally relevant now, yet we still grow those original crops though in obviously much improved forms. Developments of new crops could still happen however, and faster, because of advanced knowledge of plant genetics.

Professor Hudson was asked to consider in some detail the comparative advantages of Europe. Europe obviously has unused potential, especially for the export of processed foods, but the comparative advantages are not clear. Professor Hudson pointed out the great climatic advantages arising from the warmth of the Atlantic in winter, giving the western seaboard of Europe unusually mild weather for its latitude and fairly frequent rainfall. The particular combination of temperature, rainfall and latitude (which controls day length) dictates which crops will grow well. Many crops can be grown in Western Europe without irrigation, in a range of soils that are fairly new and rich. Winter vegetables, grass and quality fruit all grow particularly well in this climate, and we also have a climatic advantage for wheat production. The economic viability of producing protein from leaf crops was questioned, but Professor Hudson did not consider it impossible that this might turn out to be a development of major importance.

It was suggested that scientists in other parts of the world would be working towards similar improvements in crops and yields in their own climatic conditions, and that the balance is therefore likely to remain much the same. Professor Hudson agreed, but re-emphasises Europe's natural advantages of climate for plant growth, which should enable us to do certain things unusually well. Further comment was made that European pride in its agriculture (not found in many other countries) provides it with an enormous advantage, as does the existing combination of management ability and technological and scientific advances.

DEVELOPING COUNTRIES OF THE MIDDLE EAST  
AND POTENTIAL EUROPEAN FOOD EXPORTS -  
A VIEWPOINT

PROFESSOR GIAN PAOLO CASADIO

Economic growth in developing countries has been very much orientated towards industrialisation with the result that agriculture has been neglected. This is especially true of Middle East countries with the exception of Egypt, which has an important agricultural tradition and highly trained and qualified people. In economic development in China priority has been given to the agricultural sector though the discipline required for this type of system cannot easily be followed by other developing countries.

As a result of the world food crisis of 1973-1974 which brought about a massive transfer of real resources, and particularly capital movement in the oil rich nations of the Middle East, developing countries have emerged as large importers of food and feedstuffs.

Thus, in 1975, Arab States' imports of wheat amounted to 3.5 million tons, while imports of millet reached 149,000 tons, barley 258,000 tons, rice 400,000 tons, pulses 156,000 tons and meat 414,000 tons. This provides increased export possibilities for Western countries.

Certain countries whose particularly arid conditions do not allow agricultural growth were already importing foodstuff before 1973, but the oil revolution caused a huge increase of imports. The pattern of food consumption in these countries is very much influenced by the Western world.

Middle East food requirements, in addition, are expected to grow fast because of population pressures and growth, increasing urbanisation and industrialisation, rising income and living standards. They are likely to range between 3 and 4 per cent per year in the case of cereals, 4 and 5 per cent in the case of fruit and vegetables and as high as 5 and 7 per cent for meat, eggs, milk, sugar, fats and oils. In fact the region's food imports will probably double by 1985, all the more so because domestic production is only likely to increase at a rate of about 3 per cent per year in the next decade.

Therefore substantial opportunities for Western European suppliers of a wide range of agricultural products, inputs and processed foods do exist in the Middle East markets. Numerous examples can be given: wheat and wheat flour, barley, rice, pulses, seed oil, mixed feed, sugar, dairy products, meat and meat products, fresh fruit and notably apples. Inputs include selected breeds of livestock, notably pedigree Friesian and Jersey cows with high milk yields, sheep and lambs, agricultural machinery, and pesticides. There is also potential for processed food such as jams and marmalades with flavours like water-melon, strawberry and quince, canned fruit, notably canned apricots, preserved peaches in heavy or light syrup, cherry and plums; canned vegetables, notably canned peas, white beans etc., cheese of all types, canned and dried soups, canned meat, sausages and luncheon meat, vegetable oil. Particular attention must be paid to:-

- a) the appearance of the containers. For example, consumers prefer jams and marmalades to be packed in glass jars;
- b) proper packaging and labelling;
- c) the marketing through a small number of importers/wholesalers (who operate through their own retailing outlets, have ample financial resources and their own transportation and storage facilities) or, in the case of State dominated economies, through the specific State-controlled agency;
- d) the delivery schedules;
- e) the cost of airfreight;
- f) the competition from other suppliers, especially from the USA, Australia, New Zealand and the Eastern countries;
- g) a comprehensive after-care service, particularly for the supply of food inputs - including trading programmes and various forms of management assistance (such as the dispatch of trained stockmen to ensure that the required livestock settles down);
- h) the supply of other services (such as the preparation of detailed projects reports, provision of basic and detailed engineering data relating to the choice of production methods, equipment and machinery specifications; help in selection of machinery, pesticides etc.).

These countries are, however, very worried about being so heavily dependent on imports.

Most Middle Eastern countries are now giving top priority to the

expansion of domestic agricultural production to attain - in the long run - self-sufficiency for at least the basic products. Tremendous scope for Western European enterprises does therefore exist in the development projects to which massive investments are allocated in the framework of the national development plans.

Foremost among the region's numerous projects are those dealing with:-

- a) arid land agriculture, notably in the oil-rich states. Considerable areas rich in minerals might be turned into productive crop soil by use of water and watering techniques, such as watering crops with carefully measured droplets of water instead of dousing them, or by using highly saline water for a range of crops of salt-resistant strains. In some cases, priority is given to: prospecting, development and use of groundwater resources; drilling of artesian wells; construction of water pumping stations or reservoirs; supply and installation of irrigators to be used in major agro-industrial developmental projects; establishment of arid land research centres to develop hydroponics (such as that run by Abu Dhabi on Sadiyat Island and, more recently, by Libya under the supervision of the University of Arizona); the growing of trees in the desert using a salt-water feed until the roots can reach the subsurface water table. In this way attempts are under way to make it possible to grow other plants on the land there;
- b) land reclamation and conservation practices to build channels for rainwater drainage; for the improvement of existing irrigation networks; the breeding of drought-resistant crops in areas where irrigation is impossible; the promotion of proper soil and water practices; soil analysis; experiments with new drought-resistant crops for pasture improvement, and the introduction of new crop patterns; the sowing of more land by aeroplane; the building of dams and pilot farms; the supply of seed drills and wind screens to protect cultivated areas;
- c) manufacture of fertilisers, pesticides, agricultural machinery and equipment, synthetic protein (for incorporation in animal feeds);
- d) a wide range of processing industries, particularly fruit and vegetable canning and dehydration; production of fish protein, soft drinks, baby food, wheat flour, softwoods; the setting-up of slaughter houses; sugar refining; use of bagasse by-product for production of pulp, paper and particle board; cotton ginning; skin tanning; salt mining;

grain silos; flour mills and feedstuff plants.

The best option for mutual benefit is through the establishment of joint ventures combining the physical and financial resources of the region with the skills and equipment of the enterprises of the European countries. The type of joint venture enterprise can vary considerably and should be adapted to specific cases. Thus, a joint company might be involved mainly in exports such as, for instance, the envisaged establishment of a joint livestock company between the state-owned "Libyan Meat & Livestock Co." and the Welsh Nationalist Party to export about 200,000 Welsh lambs a year to Libya. Specialised consortia of Western companies can set up agricultural and food ventures in the region in return for investment from the oil-rich countries in their respective fields. For example, Australia is helping Iran to set up a number of food ventures while, in return, Iran is investing in Australian industries which will meet the domestic requirements of both countries and export to third countries.

Equally, Western European countries that want to become part of the oil business can offer package deals aiming at great self-sufficiency in food or at providing essential needs (e.g. supply and installation of water treatment plants). A formula of production sharing can also be agreed on, especially for fertilisers, with Western firms supplying the necessary manufacturing equipment, special skills and market outlets, in return for capital investment and part of the output. Furthermore, agricultural joint ventures can simply be financed by oil-rich countries and managed by Western European companies; and oil-rich countries can buy cultivable land in the developing countries outside the region (or even in the developed countries) while European firms take care of production and management.

Another possibility is for agricultural contracts to be awarded:-

- a) on a turnkey basis for construction of silage units, processing plants and so on, providing adequate technical assistance to train local manpower;
- b) to carry out consultancy services to formulate a water policy, prepare a national crop production plan or prepare feasibility studies.
- c) to build up breeding centres for cross-breeding low-yielding



indigenous breeds with high-yielding Western breeds, e.g. Friesians, as well as supply disease-resistant seeds of high yield and fast growth;

- d) to create experimental and pilot schemes, especially desalination plants, and apply advanced experience in arid land agriculture, as well as model villages to establish self-sustaining rural communities;
- e) to assist in the selection and execution of suitable projects and in the marketing of the products;
- f) to participate in basic research on major regional crops and provide training facilities for local scientists.

A further possibility is the European participation in the initiatives of the Pan-Arab agricultural organisations. Most important of these is the Arab Fund for Economic and Social Development (with headquarters in Kuwait) which has set up an Inter-Arab Authority for Agricultural Investment and Development (with headquarters in Khartoum) which aims at the development of Sudan's untapped agricultural potential. Thus, during a first phase (1976-1985) a total amount of US\$ 6.5 billion have been allocated to implement 100 infrastructural projects with direct returns in crop and livestock productions as well as in agro-industry. The Sudan should become a supplier of a considerable variety of foodstuffs in the dry regions.

Another significant development which might give further impetus to the presence of European enterprises in the Middle East is the establishment by the Council of Arab Economic Unity of the Arab League of four Arab joint companies. Two of these, namely, the Arab Company for Development of Animal Wealth - with a capital of 60 million Kuwaiti Dinars - and the Arab Company for Agriculture and Food Production - with a capital of 100 million Kuwaiti Dinars - are to assist the countries in the region in establishing joint ventures in the agricultural sector.

The assistance and initiative of the specialised regional and international economic organisations for relating managerial skills, marketing know-how and technology to financial and physical resources can further promote co-operation between the countries of the region and the Western European enterprises. Thus, the United National Industrial Development Organisation (UNIDO) can pave the way to agreements between countries for an exchange of experience and other forms of co-operation

in various aspects of the food processing industry. For example, meetings can be arranged between business men and industrialists to investigate partnership possibilities in projects from which both sides could benefit, and exhibitions can be staged for processing and packing food for export. In co-operation with the Arab Organisation for Agricultural Development, the FAO Investment Centre, the specialised Arab Funds, as well as the new International Fund for Agricultural Development (IFAD) - which is going to finance food production projects in poor food-deficit developing countries (including those of the Middle East) - can promote investments and identify projects for agricultural and food-processing developments. Further on, the FAO/Industry Co-operative Programme (ICP) could provide a forum for objective dialogue between government officials and industrial executives, and a channel to establish new agro-industries with participation by major multi-national firms.

Agriculture and irrigation projects both on an ad hoc basis and within the countries' overall development plans are also established by the UNDP representatives for each country of the region. In addition, the World Bank as well as a growing number of regional and national banks are helping to finance a number of agricultural projects, notably in the non-oil countries.

To take advantage of the ample opportunities, Western European enterprises must be prepared to deal with large-scale projects in the framework of "integrated" rural development. The goal of these projects is to make the countries self-sufficient and their effects will only be seen in 10-20 years but the Western European firms should be present now whilst investment is being made. Thus, for example, in Iraq, the consortia for the Nahr Saad livestock project are expected to be made up of land reclamation and livestock consultants, land reclamation contractors, livestock equipment contractors, livestock suppliers and so on, capable of developing large-scale milk and meat production through intensive irrigation and drainage networks of 20,000 hectares; dealing with imports of large numbers of Holstein-Friesian cows; and undertaking infra-structure works including roads, villages, electricity and drinking water systems. The participation of Western European enterprises in major developmental projects, such as the Jonglei Canal in the Sudan, which will release 120,000 ha. of semi-arid land for the growing

of crops; the Kenana sugar development; the Monsul Dam in Iraq; the Wadi Jizan scheme in Saudi Arabia, can also be favoured by adopting new formulae of economic co-operation.

I refer in particular to the supply of considerable quantities of foodstuffs (cereals, rice, dairy products, sugar and beef) in return for the supply of oil and other raw materials (phosphates, iron ore, etc.) by means of multi-annual grouped contracts involving a single organisation headed by the agricultural co-operatives or state-controlled agencies. In fact, Syria and Algeria have already approached the European Commission in Brussels to define contracts for the medium-term supply of agricultural products, a formula which could involve also the African countries (notably Togo, Nigeria, Ghana, the Niger, the Upper Volta and Mali, which have all expressed great interest in multi-annual contracts). This does imply a kind of organisation which is not easily accepted by the private enterprise system of Western Europe but de facto is a type of consortia exercise.

This gives some idea of the new marketing strategies which are coming up and which assume a more integrated and global aspect. This global approach is also important in education and training within the global packets concluded by developing countries with Western Europe.

Finally, of great importance for the promotion of Western European presence in the Middle Eastern agricultural schemes is the research work carried out on arid agriculture on the pattern already established by some American and Australian universities, such as the pioneering schemes being carried out by Durham University (in Oman at Al-Khabourah on the Batinah coast) and the University College of North Wales (in Saudi Arabia at Hofuf, a big oasis in the east), as well as the experimental cattle stations, model dairy, etc. being established by consultants and specialised private firms (such as OAD - Agriculture - of the UK; Farm Key of the UK, etc.).

Competition is fierce but the potential for export by the European agricultural sector is immense and should be seized.

## Discussion

The area of consideration was felt to have been much enlarged by Professor Casadio's paper in which he had stressed that a broad view of the export situation should encompass the educational system and food system as well as processed food itself. Europe has an advantage in the highly sophisticated information and technology which is at its disposal and this should be exported. It was suggested that in the long term, there would be a conflict between the export of food and of technology. Many developing countries are giving priority to agricultural expansion and aiming at self-sufficiency. Professor Casadio commented that these countries do not have the management ability to grasp technology very rapidly and will therefore offer us a market for perhaps 25 years. The new generation will be sent to the best universities and will be receptive to our ideas and products, but even so, the technology applied in these countries is likely to produce low cost food so that Europe may go on supplying food at the top end of the scale, as well as technology for two or three generations.

Markets vary enormously, and so much of Professor Casadio's description of entering the Middle East market would not apply elsewhere. The market must be identified. Technology is likely to be extremely important and its export must be initiated by an integrated European operation. We should aim at a European lobby combining a common effort by farmers and food processors. It will be important to forego internal competition in order to deal better with world competition. There was some discussion of the value of government intervention in this type of exercise, especially the possibility of a food export council. Professor Casadio commented that state controlled countries tend to prefer direct governmental contacts whilst free market economies were less keen because this would restrict their bargaining power. The economic stability of these countries may well be a problem but one can never predict what will happen. They tend to like large scale enterprises and fail to understand that Europe's strength lies in its small and medium size enterprises. The developing countries do not have the management ability to cope with large businesses nor as yet an adequate distribution system.

There will always be a market for food in the Middle East since the numerous constraints on agricultural production will prevent the achieve-

ment of self-sufficiency. Technological transfer is further advanced than food export and emphasis is needed on the latter though the two must be thought of as complementary rather than in competition.

RESEARCH AND DEVELOPMENT PRIORITIES FOR EUROPE'S AGRI-FOOD INDUSTRY

DR. A.G. KITCHELL

Export opportunities for the food processor do exist and must be taken whilst they are available. Implications for the grower are less obvious. If EEC policies for the agricultural sector are, as the economists present seem to think, likely to remain substantially unchanged, there could be a challenge to carry out research to find alternative, non-food uses for the agricultural surpluses that arise.

Professor de Veer suggested that the diversity of food products characteristic of the nine member states might offer advantages in that a wider range of products is immediately available for export and to meet export market needs. It seems likely that food processing is in a similar position to that which is said to prevail in agriculture. Technology has assumed great importance in agriculture within the EEC. Product prices rise, farmers adopt improvements and output increases. The average farmer is forced to adopt new technology to maintain his income. Farmers know that they cannot afford to resist change. The free movement of goods within the Community and preference for Community products leads to fierce competitive pressures to determine which producers will meet domestic demand. This might equally be said for food processors and such competition suggests each member of the Community must decide on the best Research and Development strategy to meet the challenge and to put itself in a strong position to export if the opportunity should arise.

There appear to be no specific Research and Development requirements for capitalising on export opportunities. Technologists, given clear guidance by marketing men, are well able to operate on the basis of existing knowledge. Application of existing knowledge in both production and processing sectors could transform the agri-food business in many of its aspects. Much of this knowledge about food does in fact relate to such things as hygiene and safety which will not make a profit but which do make a significant contribution to quality. Current industrial processes based on heating, cooling and dehydration are all variations on well understood principles. Entirely novel developments require a basic knowledge of the properties of raw materials which is at present lacking.

This would also be true for substituting alternatives for raw materials traditionally used in processing.

In the UK the slowness of industry to take up the results of research gives little encouragement to Government to invest more money in research, especially in applied research. Unfortunately, there are some classical examples of this deficiency that relate to the food processing field.

The representatives of the food processing industry present have already been asked directly for information on their exact requirements of the production sector and, for two decades, Governments have been asking the same question in respect of Research and Development needs. There has really been no satisfactory answer and industry cannot expect an increase or redistribution of resources available to agricultural and food research without a concerted effort on their part to present the requirements of the food processing sector as a whole.

If it were to be accepted that a perfectly respectable national objective for Government-funded Research and Development in the processing sector is to add value to imported or home produced materials, it might be easier to obtain support for more resources for that sector. There are also institutional factors, referred to by Dr. Power, that frustrate progress. An example of this is the Community reaction to the novel process for producing a less expensive sweetener - namely isoglucose for food industry use; a levy was introduced which did much to negate the Research and Development initiative. Legislation relating to food safety is likely to require toxicological testing of new foods or food sources which imposes additional and not inconsiderable financial burdens on processors.

In the UK, the boards of the Joint Consultative Organisation for Research and Development in Agriculture and Food have been concerned over the last three years with research strictly within commodities and now need to look between commodities and to food processing requirements. There has been recent consultation between the Food Board and the Arable Crops Board about likely indigenous crops for the production of TVP. The question asked was: is the food industry to continue to import soya or will the primary production sector offer a home-grown alternative?

This is very important for defining future Research and Development programmes. There is also a growing recognition in the production sector of the need to have regard not only for yield but also for the quality of produce, especially that likely to be processed into foods.

"Development" is a very expensive part of Research and Development and in fact has been said to cost on average about ten times as much as the research. In Great Britain about 30% of the total expenditure in the agriculture and food area goes specifically to the Advisory Services of the two agricultural departments for development work and applied research. Little of the remainder is devoted to development of research findings, either in agriculture or food. Much of it goes to strategic research in the Agricultural Research Council. On the food side a difference is that there is no equivalent of the Agricultural Development and Advisory Service and there is relatively little research or development sponsored by Government. The Ministry of Agriculture, Fisheries and Food does have a commitment to more development work (and to more food research) but it can only be realised when additional resources are made available.

There has been a survey made of current industrial food research in the EEC (Industrial Food Research in the Countries of the European Community: EUR 5181/1975). The report comments that industrial food research in Europe has considerable resources at its disposal though in the light of the importance of the problems these resources seem inadequate. Research and Development expenditure for these industries represents only 0.2 to 0.3% of their turnover but the main criticism is of the way in which the resources are used. Except perhaps in the UK, research must be restructured to limit the present wastage of resources, perhaps by greater use of research associations in the private sector. Meanwhile, the task is to encourage collaboration between existing research organisations and between such organisations and industry.

Three programmes are being developed within European Co-operation in the field of Scientific & Technical Research (COST) which covers the EEC plus other European countries. The first is on physical properties of foodstuffs; the second on effects of processing and distribution on quality; and the third on the effects of processing and distribution on nutritive value. The reason for the priority given to the first of these



is that the industry is undergoing a change from craft skills to a scientific basis for its operations. Improvement in the design of equipment and in the implementation and control of processing techniques is only achieved through knowledge of the physical properties of the raw materials. The objective of the programme is to derive, collect and store data on chosen aspects for use by those designing equipment or developing new processes. The second and third programmes are under intensive consideration. This is a genuine co-operative effort within Europe in the food sector. There are also agreed programmes under way with the Standing Committee for Agricultural Research (SCAR) within the EEC, on such things as beef production and land use. This Committee is now considering the possibility of introducing food projects.

### Discussion

Dr. Kitchell was challenged on his comment that no specific Research and Development requirements had been put forward by the parties concerned. Various examples were immediately suggested: to provide an adequate source of vegetable oils and proteins within Europe; to identify and develop acceptable non-nutritious foods because we are all trying to eat less; and to develop new non-alcoholic drinks for which there is an enormous market opening. Further suggestions included Research and Development on use of city and industrial waste; storage of certain crops to prolong the season, e.g. potatoes. The need for better knowledge of the Research and Development work which is being done in industry and which may not always be published was also re-emphasised. It was felt that enough information on hygiene and food safety is available to most firms concerned with perishable foods if they wish to make use of it. Much other knowledge and information is also available to industry but not used, partly because management is not educated to do so. This extension need is of great importance to the food industry. Dr. Kitchell replied acknowledging that much work was already being carried out in the agricultural sector on an alternative source of vegetable oils and proteins but not always with food industry needs in mind. He wondered what farmers would think about the development of non-nutritious foods but in any event Government support would arise from decisions made on nutrition policy which were the responsibility of DHSS not MAFF. New soft-drinks developments should be an industry responsibility and were not appropriate for government funding. Considerable effort is already being directed to the use of industrial and city

waste and this work has high priority in MAFF. Although it was agreed in relation to waste utilization that someone would develop a product or a process if there were a profit in it, it was suggested to Dr. Kitchell that Government and research leadership is necessary in the initial stages.

Further comment was put forward on the need for control of the resources which are available for Research and Development to ensure that they are used to the best advantage of the industry. There should be a level of research between the pure university type research and the commercial research where government resources are used to carry out basic research on general aspects of food not directly related to the profit motive to give more flexibility in food processing development. Industry cannot afford to carry out this type of strategic research. The need is now being recognised and there is also a move toward intra-community co-operation. The principal recommendation coming forward from the Food Board of the UK Joint Consultative Organisation is concerned with the need for facilities for food process engineering which integrate the background research with the development work and machinery design. There is also a need for research into better means of toxicological testing which is currently an extremely lengthy and expensive operation for industry before a new food material is accepted. This is very high on the priority list and it is a subject that could usefully be considered at Community level. Dr. Kitchell pointed out that this problem is certainly amongst the most important for food Research and Development and that public attitudes to food safety and the attendant risks need to be more realistic if the agri-food industry is to realize its full potential for future progress.

LIST OF PARTICIPANTS

D. BERAUD	Division for Agricultural Markets and Trade OECD, Paris.
PROF. D.K. BRITTON	Professor of Agricultural Economics and Head of Agricultural Economics Unit, Wye College.
PROF. G.P. CASADIO	Professor of International Economic Organisation, Istituto de Scienze Economiche, Università di Bologna, Italy, and formerly of OECD, Paris.
A. CHOMINOT	Department of Agricultural Economics, Institut National Agronomique, Paris-Grignon.
DR. E.S. CLAYTON	Reader in Agricultural Economics (Developing Countries) and Head of Agrarian Development Overseas Unit, Wye College.
G. COOPER	Agricultural broadcaster, Journalist and Researcher.
GILL DACOMBE	Research Assistant, Centre for European Agricultural Studies.
J.M. DALGLEISH	Consultant Engineer for Smedley HP Foods, Imperial Foods Limited, Leamington Spa.
PROF. J. EDELMAN	Chief Scientific Adviser to RHM. Formerly Professor of Botany at Queen Elizabeth College, University of London.
J.M. FORT	Managing Director, Wold Farm Foods, Grimsby.
N. GOLDENBERG	Scientific Adviser, Marks & Spencer Limited, London.
DR. J. GREEN	General Manager, Research and Development, H.J. Heinz Co. Ltd., Vice-Chairman of Council and Chairman of Research Committee of Chipping Campden Fruit & Vegetable Research Association.
J.E. HOSKING	Chief Executive, Agra-Europe, Tunbridge Wells.
PROF. J. HUDSON	lately Director, Long Ashton Research Station, Bristol
HON. C.G.W. JAMES	Director, Betteshanger Farms, Deal. Chartered Surveyor. The Anglo-Indonesian Plantations and Nchima, Tea & Tung Estates (Malawi).
A.A. KINCH	Barrister. Head of Food Harmonisation, European Commission, Brussels.
DR. A.G. KITCHELL	Scientific Liaison Officer with Chief Scientist's Group, Ministry of Agriculture, Fisheries & Food, London.
DR. J.T. MEADLEY	Director, Minster Agriculture, Thame, Oxfordshire.
H.E.G. MORGAN	Regional Farm Management Advisory Officer, ADAS, Aberystwyth.
A.M. MORGAN REES	Head of Planning and Economics Division, Tropical Products Institute, London.
D. POWELL	Director and Farms Manager, Betteshanger Farms, Deal.

DR. A. POWER	Food Economics Unit, Ministry of Agriculture Fisheries & Food, London.
IAN G. REID	Director, Centre for European Agricultural Studies.
PROF. E.J. ROLFE	Principal, National College of Food Technology, Weybridge.
J.H. SAPHIR	Director, Saphir, Sons & Co., London.
N.P. SAPHIR	Director, Saphir, Sons & Co., London.
M.J. VAUGHAN	Agriculture and Food EDC's, National Economic Development Office, London.
PROF. JAN DE VEER	Deputy Director, Landbouw-Economisch Instituut, The Hague, Netherlands.
LORD WALSTON, CVO	Farmer, Thriplow Farms Ltd., Royston, Herts. Formerly member of European Parliament.
PROF. DR. A. WEBER	Institut für Agrar-politik und Marktlehre der Christian-Albrechts Universität, Kiel, West Germany.
ANN WESTON	Research Officer, Overseas Development Institute, London.

TABLE DES MATIERES

		Page
INTRODUCTION	Ian G. Reid, Directeur, CEAS. ...	1
REMARQUES PRELIMINAIRES	C.G.W. James, Betteshanger Farms Ltd., Deal, Kent. ...	6
L'ALIMENTATION DE DEMAIN	Dr. J. Green, Directeur général, Service des études et recherches et du développement des produits, H.J. Heinz & Co.Ltd., R-U. ...	8
OU RESIDENT LES AVANTAGES COMPARES DE L'EUROPE?		
DANS L'INDUSTRIE DE TRANSFORMATION ALIMENTAIRE?	Dr. Aidan Power, Bureau des études économiques sur l'alimentation, MAFF, London. ...	13
DANS L'AGRICULTURE?	Professor Jan de Veer, Directeur adjoint, Institut Landbouw- economisch, Pays-Bas. ...	21
NOUVEAUX SYSTEMES AGRO-ALIMENTAIRES:		
TECHNOLOGIES NOUVELLES DANS LA TRANSFORMATION ALIMENTAIRE	Professor E.J. Rolfe, Principal, National College of Food Technology, R-U. ...	27
TECHNOLOGIES NOUVELLES DANS LA PRODUCTION ALIMENTAIRE	Professor J.P. Hudson, Ancien directeur du Centre de recherches de Long Ashton, R-U. ...	40
PAYS EN DEVELOPPEMENT ET POTENTIEL DES EXPORTATIONS ALIMENTAIRES EUROPEENNES	Professor Gian Paolo Casadio, Professeur de sciences économiques internationales à l'université de Bologne, Italie. ...	46
PRIORITES DE LA RECHERCHE ET DU DEVELOPPEMENT POUR L'INDUSTRIE AGRO-ALIMENTAIRE EUROPEENNE	Dr. A.G. Kitchell, Scientific Liaison Officer, Chief Scientist's Group, MAFF, London. ...	55

L'EUROPE EN TANT QU'EXPORTATRICE DE PRODUITS ALIMENTAIRES  
LA SCENE ACTUELLE DANS L'INDUSTRIE AGRO-ALIMENTAIRE EUROPEENNE

INTRODUCTION

L'agriculture européenne se trouve à l'heure actuelle devant deux dilemmes. Premièrement, l'existence de surplus de certains de ses produits doit représenter un gaspillage de ressources et, deuxièmement, son potentiel technique n'a pas encore été exploité à fond.

Ces deux phénomènes pourraient être utilisés pour remédier sur un plan général à la situation mondiale de l'alimentation et au sort de certains pays en voie de développement. Malgré cela, l'opinion des experts est que l'aide alimentaire directe, sauf dans les cas de famine caractérisée, est contre-productive et que l'apport le plus effectif que pourrait faire l'Europe à ce sujet serait de participer activement à des opérations de stocks stratégiques de produits alimentaires de régularisation afin d'équilibrer le marché mondial des produits alimentaires.

Ces deux phénomènes font apparaître plus clairement encore le besoin d'une redistribution de ressources que la CEE ne peut se permettre degaspiller, étant donné que les termes de l'échange sont susceptibles à la longue, d'être moins favorables à l'Europe occidentale. Elle a, en effet, peu de ressources naturelles. Même le pétrole et le gaz naturel sont épuisés et vont probablement devenir plus cher au fur et à mesure que l'on puisera à des réserves plus difficiles. La demande mondiale de matières premières va augmenter avec l'accroissement de l'industrialisation à travers le monde, pour être en cadence avec la croissance démographique et l'élévation des aspirations matérielles des populations du monde.

Etant admis que nos termes d'échange sont appelés à se détériorer, il est essentiel de cerner et définir les moyens possibles de développer l'industrie agro-alimentaire de la CEE qui seraient de nature à contrer ce mouvement.

L'agriculture et l'industrie alimentaire ont toujours eu tendance à se développer indépendamment et il importerait maintenant de voir comment ces deux secteurs pourraient collaborer de plein gré pour surmonter

ces difficultés. Ils auront besoin de sonder les possibilités de recherche et développement en commun dans les domaines de la production, la transformation et la commercialisation.

Parmi les ressources les plus importantes de l'Europe se trouvent :

1. Son climat et son sol.
2. Des ressources de travail humain relativement qualifiées en matière technique et d'organisation.

Ces ressources sont et devraient être développées par l'industrie agro-alimentaire dans le but de réduire les importations, d'augmenter le produit des exportations et généralement de perfectionner la distribution des biens de consommation.

Si l'Europe doit exploiter les ressources susvisées, il nous faut identifier les produits dans la production desquels l'Europe a un avantage économique comparé.

Nous devons aussi identifier les produits susceptibles de trouver des marchés.

Dans la réalisation de ces analyses il ne faut pas nous limiter aux produits alimentaires et denrées agricoles classiques mais considérer l'agriculture et l'industrie alimentaire comme un complexe de production unifié. Il se peut que, dans certains cas, l'agriculture ne fournisse pas un produit alimentaire mais seulement matière à l'industrie alimentaire.

L'objectif de base de cette sorte d'analyse est de dégager les moyens propres à produire en Europe des denrées alimentaires nouvelles et acceptables à faible prix de revient, et à les écouler sur les marchés tant à l'intérieur qu'à l'extérieur de l'Europe.

### Agriculture

L'on constate que les sols et le climat de l'Europe occidentale donnent à son agriculture un avantage comparé dans quatre classes de produits de culture :

1. Prairies d'élevage, herbes et cultures fourragères (au nord et à l'ouest).

2. Tubercules: pommes de terre et betteraves sucrières.
3. Fruits et légumes.
4. Vins.

L'on peut dire aussi que certaines parties de l'Europe occidentale ont un avantage de longue durée dans les cultures céréalières.

L'agriculture de l'Europe occidentale, toutefois, souffre de certain désavantages, à la fois d'ordre institutionnel et technique, à cause desquels ses coûts de production sont élevés. Parmi ces désavantages, citons:

1. La Taille petite de l'exploitation agricole moyenne, qui conduit à une utilisation mal rentable des ressources et à une maîtrise défectueuse des capitaux et compétences humaines nécessaires pour pouvoir exploiter une technologie de pointe avec ses coûts élevés et dépenses élevées d'énergie connexes.
2. L'Europe a peu de terres non utilisées dans lesquelles l'agriculture puisse prendre de l'expansion de manière à tirer profit des économies d'échelle. Elle est aussi forcée de s'engager sur une voie longue et onéreuse, celle de la restructuration de son agriculture reposant sur la diminution progressive des populations vivant de l'agriculture. Une haute densité de population crée une forte concurrence dans l'utilisation des sols, entraînant des prix fonciers élevés et forçant l'agriculture européenne à exploiter des zones marginales.
3. La nature parcellisée de la structure de l'agriculture européenne est aussi une cause d'inefficacité et de cherté de la mise en marché de la production.
4. L'avantage comparé des terres de pâturage et des cultures fourragères herbeuses a tendance à être effacé par la transformation de ces ressources en alimentation humaine à travers les élevages de ruminants, procédé notoirement inefficace en termes techniques, mais pas toujours en termes économiques.



## Industrie alimentaire

L'opinion la plus répandue est que l'industrie de transformation des produits alimentaires en Europe n'est pas susceptible de connaître des changements importants dans ses matières premières de base. Si toutefois ces approvisionnements devenaient plus rares et plus chers, l'industrie de transformation alimentaire serait obligée de traiter des matières premières moins uniformes, entraînant alors par nécessité la mise au point et l'usage de procédés permettant d'employer ces matières plus rentablement au moyen de leur restructuration et leur réforme. Il en coûte presque toujours très cher de produire une plus grande uniformité dans des matières biologiques. L'industrie alimentaire pourrait aussi avoir à se procurer une plus grande proportion de ses matières premières en provenance de la propre agriculture de l'Europe. Il semble probable que ces matières premières, et les matières nouvelles éventuelles, serviront à produire des imitations, à la fois dans la saveur et la présentation, de produits alimentaires actuels et seront utilisées comme des "prolongements".

Des évolutions de cette nature nous amènent à nous demander non seulement si l'agriculture européenne peut oui ou non être une source avantageuse d'obtention des matières premières essentielles, mais encore si oui ou non l'industrie de transformation alimentaire européenne a des avantages sur le plan des compétences humaines et de l'échelle des opérations, comparée avec les industries de transformation alimentaire concurrentes.

## Les marchés

Aussi bien avant que depuis l'établissement de la CEE, certains pays de l'Europe ont exporté des produits agricoles et alimentaires sur une échelle considérable. Ce commerce extérieur a été presque exclusivement orienté au niveau d'un seul type culturel d'alimentation.

Si toutefois l'Europe doit devenir exportatrice de produits alimentaires, il se pourrait que son industrie de transformation alimentaire soit obligée de créer des imitations de denrées alimentaires appartenant à d'autres types de régimes, particulièrement des imitations correspondant aux habitudes alimentaires des pays en développement les plus riches du Moyen Orient, de l'Asie, l'Indonésie,

l'Afrique et l'Amérique du sud. Le Japon est devenu aussi un marché de produits alimentaires de première importance. Et dans la mesure où le secteur agro-alimentaire dans les pays du bloc communiste ne parvient pas à se développer en proportion avec la demande effective accrue de leurs populations, ils pourraient devenir aussi un marché pour certains produits alimentaires.

Le développement de l'industrie agro-alimentaire exigera de gros investissements dans la production le traitement et la transformation. Un investissement de cette envergure réclamera un marché bien organisé si l'on veut parvenir à réduire les risques à un niveau qui soit supportable ou attrayant pour les investisseurs.

Il sera nécessaire d'assurer la sécurité de l'offre des produits alimentaires et matières premières essentiels. Cela nécessitera la mise en oeuvre de stocks alimentaires stratégiques de régularisation destinés à garantir les approvisionnements manufacturiers. Cette exigence correspond parfaitement à la nécessité de contribuer à résoudre les problèmes de la faim et la malnutrition causés par les catastrophes naturelles et la plus grande variabilité de la production agricole des pays en voie de développement.

#### Recherche et développement

Si l'industrie agro-alimentaire européenne doit maintenir ou accroître sa compétitivité, dans quelle direction doit-elle faire porter ses efforts en matière de recherche scientifique et réforme institutionnelle dans la production agricole et la transformation et commercialisation des produits alimentaires?

C'est dans le contexte décrit ci-dessus que le Centre for European Agricultural Studies avait organisé ce Séminaire sous le généreux parrainage du Charitable and Family Trust de H.J. Heinz II, Betteshanger Farms Ltd. et Saphir Sons & Co.Ltd. Son propos était de rassembler des responsables de décisions des pays européens appartenant à l'agriculture, au commerce et à l'industrie, aux administrations, et aux milieux techniques, scientifiques et universitaires, et de provoquer une concertation d'idées faisant autorité, sur le thème des perspectives probables d'évolution dans les entreprises agro-alimentaires de la CEE au cours des quinze ou vingt prochaines années.

Le Centre for European Agricultural Studies se doit aussi de remercier les organismes de parrainage et les participants de leurs communications respectives.

A la fin du séminaire, les participants demandèrent que les conclusions qui suivent soient portées à l'attention des Commissaires de la CEE à l'Agriculture et l'Industrie, des ministres de l'Agriculture des Etats membres et des dirigeants des organisations directement intéressées par l'industrie agro-alimentaire de la CEE:

"L'assemblée est tombée d'accord pour constater:

- (1) Que des possibilités réelles existent pour développer dans un ordre de grandeur important les exportations de produits alimentaires tant frais que transformés provenant de l'industrie agro-alimentaire des pays de la CEE.
- (2) Que des possibilités réelles existent en vue d'accroître très sensiblement l'exportation de la technologie de l'industrie agro-alimentaire, y compris les programmes d'enseignement et de formation en tant que composantes intégrales.
- (3) Qu'il est nécessaire d'encourager activement l'amélioration de l'intégration et la coordination entre les producteurs, transformateurs, distributeurs et consommateurs de produits alimentaires, au moyen du perfectionnement des organismes et procédés actuels tant au niveau communautaire qu'au niveau des pays.
- (4) Qu'il est nécessaire de faire un usage plus efficace de ces organismes et procédés améliorés dans l'action en vue de développer les exportations.
- (5) Qu'il faut réserver une plus grande importance aux exportations alimentaires ainsi qu'aux réductions des importations alimentaires dans les programmes de recherche et développement tant au niveau communautaire qu'au niveau des pays".

IAN G. REID  
Le directeur

INHALTSANGABE

		Seite
EINLEITUNG	Ian G. Reid, Direktor, CEAS.	... 1
ERÖFFNUNGSREDE	C.G.W. James, Betteshanger Farms Ltd., Deal, Kent.	... 6
ERNAHRUNG IN DER ZUKUNFT	Dr. J. Green, Generaldirektor für Forschung und Entwicklung, H.J. Heinz & Co.Ltd., GB.	... 8
WO LIEGT DER VERHALTNISMASSIGE VORTEIL EUROPAS?		
AUF DEM GEBIETE DER LEBENSMITTEL- VERARBEITUNG?	Dr. Aidan Power, Einheit für Ernährungswirtschaft, MAFF, London.	... 13
AUF DEM GEBIETE DER LANDWIRTSCHAFT?	Professor Jan de Veer, Stellvertretender Direktor, Landbouw- economisch Instituut, Holland.	... 21
NEUE AGRI-ERNAHRUNGSSYSTEME:		
NEUE TECHNOLOGIEN IN DER LEBEN- SMITTELVERARBEITUNG	Professor E.J. Rolfe, Leiter des 'National College of Food Technology', GB.	... 27
NEUE TECHNOLOGIEN IN DER NAHRUNGS- MITTELERZEUGUNG	Professor J.P. Hudson, ehemal. Direktor, Long Ashton Research Station, GB.	... 40
ENTWICKLUNGLÄNDER UND POTENTIAL EUROPÄISCHER LEBENSMITTELEXPORTE	Professor Gian Paolo Casadio, Professor für Internationalökonomie, Universität Bologna, Italien.	... 46
FORSCHUNGS- UND ENTWICKLUNGSVORRANGS- GEBIETE FÜR EUROPAS AGRI- ERNAHRUNGSINDUSTRIE	Dr. A.G. Kitchell, Scientific Liaison Officer, Division Ernährungswissenschaft, MAFF, London.	... 55

EUROPA ALS NAHRUNGSMITTELEXPORTEUR  
ENTWICKLUNGEN IN DER EUROPÄISCHEN AGRIERNÄHRUNGSINDUSTRIE

EINLEITUNG

Die europäische Landwirtschaft steht gegenwärtig vor zwei Dilemmas: Erstens, muss das Vorhandensein von Überschüssen in gewissen von ihr erzeugten Produkten eine Verschwendung vorhandener Mittel repräsentieren. Zweitens, ist ihr technisches Potential noch nicht vollstens genutzt worden.

Diese zwei Phänomene könnten dazu nutzbar gemacht werden, die Gesamternährungssituation der Welt und die missliche Lage, in der sich gewisse weniger entwickelte Länder befinden, zu erleichtern. Experten sind jedoch der Meinung, dass direkte Ernährungshilfe, ausser in drastischen Hungersnotfällen, gegenproduktiv sei und dass Europa am wirksamsten durch eine aktive Beteiligung an der Handhabung von strategischen Pufferlebensmittelvorräten zur Regelung des Welternährungsmarktes beitragen könne.

Diese zwei Phänomene weisen auch auf die Notwendigkeit einer Umgliederung von Mitteln hin, deren Verschwendung sich die EWG kaum leisten kann, wenn man sich vor Augen hält, dass die Bedingungen des Handels sich früher oder später wahrscheinlich zum Nachteil Westeuropas verändern werden. Westeuropa hat wenige Bodenschätze. Selbst Petroleum und Naturgas sind endlichbegrenzt und werden mit Abzapfen schwierigerer Reserven wahrscheinlich teurer werden. Die Rohmaterialnachfrage der Welt wird mit dem Wachstum und den höheren materiellen Ansprüchen der Bevölkerung entsprechend grösseren universellen Industrialisierung weiter ansteigen.

Von der Voraussetzung ausgehend, dass die Bedingungen des Handels sich für uns vermutlich verschlechtern werden, ist es von Wichtigkeit, Möglichkeiten zur Entwicklung der Agriernährungsindustrie der EWG zu finden, die einem solchen Trend entgegenwirken können.

Traditionsgemäss haben sich Landwirtschaft und die Ernährungsindustrie unabhängig entwickelt, und wichtig ist nun, zu sehen, wie diese beiden Sektoren zusammenarbeitend mit dem Problem fertig werden können. Es wird für sie dazu notwendig sein, die Möglichkeiten einer

gemeinsamen Forschungs- und Entwicklungstätigkeit auf den Gebieten der Erzeugung, Verarbeitung und Marktversorgung zu untersuchen.

Europas hauptsächliche Hilfsquellen sind unter anderem:

1. Sein Klima und Boden.
2. Seine in Technik und Organisation bewanderten und erfahrenen Arbeitskräfte.

Diese Hilfsquellen müssen und sollten durch die Agriernährungsindustrie im Interesse einer import-einsparenden, export-steigernden und leistungsfähigeren Nahrungsmittelversorgung für Verbraucher im allgemeinen, entwickelt werden.

Wenn Europa die vorstehend aufgeführten Hilfsquellen vollstens nutzen soll, ist es unerlässlich, dass wir diejenigen Produkte identifizieren, deren Erzeugung für Europa wirtschaftlich von Vorteil wäre.

Auch müssen wir diejenigen Produkte identifizieren, für die aller Wahrscheinlichkeit nach Märkte vorhanden sein werden.

Bei Durchführung derartiger Analysen dürfen wir uns nicht allein auf herkömmliche Landwirtschafts- und Ernährungsprodukte beschränken sondern wir müssen Landwirtschaft und Ernährungsindustrie als einen einheitlichen Erzeugungskomplex ansehen. Es kann sein, dass Landwirtschaft in einigen Fällen nicht ein Nahrungsmittel sondern nur eine Substanz für die Ernährungsindustrie produziert.

Das Grundziel solcher Analysen ist, Vorschläge zu machen, auf welche Weise neue, kostenmässig niedrige, akzeptable Nahrungsmittel in Europa erzeugt und sowohl innerhalb als auch ausserhalb von Europa abgesetzt werden können.

#### Landwirtschaft

Boden und Klima von Westeuropa geben seiner Landwirtschaft einen gewissen Vorteil in vier pflanzlichen Anbauproduktlassen:

1. Gras und Blattfutterpflanzen (Nord/West).
2. Knollenpflanzen: Kartoffeln und Zuckerrüben.

3. . Früchte und Gemüse.

4. Wein.

Man könnte hier anführen, dass Teile von Westeuropa durch Getreideanbau langfristige Vorteile haben.

Westeuropäische Landwirtschaft hat jedoch institutionsmässig sowie technisch gesehen gewisse Nachteile, die sie zu einem Hochkostenerzeuger machen. Zu diesen gehören unter anderem:

1. Die kleine Grösse des Durchschnittsagrarbetriebs mit der demzufolge ungenügenden Ausnutzung von Mitteln und ungenügender Verfügbarkeit über die Sachkenntnisse und Kapitalien, die zur Nutzung weiterentwickelter Technologien mit den damit verbundenen hohen Kosten und hohen Energieaufnahmen notwendig sind.
2. Europa hat wenig unbenutztes Land in dem seine Landwirtschaft eine Ausdehnungsmöglichkeit hätte, um so die stufenmässigen Einsparungen zu gewinnen. Auch ist es in den langsamen und teuren Vorgang der Umgliederung seiner Landwirtschaft durch Reduktion der Landbevölkerung hineingezwungen. Hohe Bevölkerungsdichte führt zu einem starken Wettbewerb in Landbenutzung und somit zu hohen Landpreisen und hat die europäische Landwirtschaft gezwungen, Grenzgebiete anzubauen.
3. Die atomistische Natur der europäischen Agrarstruktur ist auch einer der Gründe für teure unrationelle Marktversorgung.
4. Der relative Vorteil eines Anbaues von Gras und Blattfutterpflanzen geht bei ihrer Umwandlung in menschliche Nahrung durch Wiederkäuer, einem in technischer aber nicht immer in wirtschaftlicher Hinsicht notorisch unrationellem Vorgang, scheinbar verloren.

#### Lebensmittelindustrie

Der herkömmlichen Auffassung nach wird die Lebensmittelverarbeitungsindustrie in Europa, was grundlegende Rohmaterialien anbetrifft, keine grösseren Veränderungen untergehen. Sollten jene Vorräte jedoch knapper und kostspieliger werden, wird die Lebensmittelverarbeitungsindustrie mit weniger einheitlichem Rohmaterial fertig werden müssen, was zwangsmässig zur Entwicklung von Verfahren für eine rationellere Benutzung solcher Materialien durch Umgliederung und Neubildung, führen muss. Erzeugung grösserer Einheitlichkeit in biologischem Material ist

fast immer ein teures Unterfangen. Die Ernährungsindustrie könnte auch gezwungen sein, einen grösseren Prozentsatz ihrer Rohmaterialien aus Europas eigener Landwirtschaft zu beschaffen. Vermutlich werden diese Rohmaterialien, sowie eventuelle neue Vorräte, zur Erzeugung von Imitationen von Geschmack sowie Beschaffenheit bestehender Agrarprodukte zur Anwendung kommen; und sie werden als "Extenders" benutzt werden.

Durch derartige Entwicklungen wird die Frage aufgeworfen, ob einerseits die europäische Landwirtschaft eine nutzbringende Anlieferungsquelle für die benötigten Rohmaterialien sein kann und ob andererseits die europäische Lebensmittelverarbeitungsindustrie ähnlichen Industrien der Konkurrenz gegenüber in Bezug auf Sachkenntnisse, Erfahrung und Unternehmungsausmass Vorteile besitzt.

### Märkte

Sowohl vor als auch nach Grundung der EWG haben gewisse Länder einen beträchtlichen Exporthandel in Agrar- und Ernährungsprodukten betrieben. Dieser Handel ist fast ausschliesslich eindietätisch-kulturorientiert gewesen.

Wenn Europa jedoch zu einem Lebensmittelexporteur werden soll, könnte die europäische Lebensmittelverarbeitungsindustrie gezwungen sein, Imitationen der Nahrungsmittel anderer dietätischer Kulturen auszuarbeiten, insbesondere von solchen der wohlhabenderen Entwicklungsländer im Mittelosten, in Asien, Indonesien, Afrika und Südamerika. Japan ist auch zu einem grösseren Ernährungsmarkt geworden. Und insofern als die Entwicklung der Agri-Ernährungsbetriebe in den Ländern des kommunistischen Blocks mit der zunehmenden effektiven Nachfrage ihrer Bevölkerungen nicht Schritt halten kann, könnten auch sie Märkte für gewisse Produkte werden.

Die Entwicklung der Agri-Ernährungsindustrie wird grosse Kapitalsanlagen für Produktion und Verarbeitung notwendig machen. Solche Kapitalsanlagen werden, wenn Risiken auf ein für Kapitalanleger tragbares bzw. anziehendes Niveau herabgebracht werden sollen, eines gelenkten Marktes bedürfen.

Verlässliche Anlieferung der Grundnahrungsmittel und Rohmaterialien wird unerlässlich sein. Dies wird die Handhabung von strategischen Puffer-Futternvorräten, um Herstellungsanlieferungen zu gewährleisten, erforderlich machen. Solche Erfordernisse passen sehr wohl in den Rahmen der Bestrebungen, für das Problem von Hunger und Unterernährung



durch Naturkatastrophen und durch die grössere Veränderlichkeit des Landwirtschaftsertrages der weniger entwickelten Länder, eine Lösung zu finden.

#### Forschung und Entwicklung

Wenn die europäische Agri-Ernährungsindustrie ihre Konkurrenzfähigkeit aufrechterhalten bzw. erhöhen soll, auf welche Aspekte sollte sie dann ihre Bemühungen auf dem Gebiete wissenschaftlicher Forschung und institutioneller Reform in Agrarproduktion, Lebensmittelverarbeitung und Marktversorgung richten?

Gegen diesen Hintergrund war es, dass das Zentrum (Centre for European Agricultural Studies) dieses Seminar unter der generösen Förderung des H.J. Heinz II Charitable and Family Trust, der Betteshanger Farms Ltd. und der Saphir Sons & Co.Ltd. organisierte. Das Angriffsziel war, die Politikbildenden unter den europäischen Landwirten, Geschäftsleitern, Verwaltern, Wissenschaftlern und Akademikern zusammenzubringen und eine massgebliche Diskussion über die voraussichtlichen Entwicklungen der Agri-Ernährungsbetriebe in der EWG im Laufe der nächsten 15-20 Jahre in die Wege zu leiten.

Das Zentrum (Centre for European Agricultural Studies) spricht den Förderern und Teilnehmern des Seminars für ihre entsprechenden Beiträge seinen Dank aus.

Am Schluss des Seminars stellten die Teilnehmer das Ansuchen, die nachfolgende Erklärung den EWG-Kommissaren für Landwirtschaft und Industrie, Ministern für Landwirtschaft der Mitgliedsstaaten und Leitern der direkt mit der Agri-Ernährungsindustrie der EWG zu tun habenden Organisationen zur Kenntnis zu bringen:

"Wir sind in Übereinstimmung darüber:

- (1) Dass wirkliche Möglichkeiten für eine Entwicklung umfassender Exporte sowohl in frischen als auch verarbeiteten Nahrungsmittelprodukten aus der EWG-Agriernährungsindustrie bestehen;
- (2) Dass wirkliche Möglichkeiten für weitere umfassende Exporte der technologischen Mittel der Agriernährungsindustrie, unter Einschluss von Erziehungs- und Ausbildungsprogrammen, bestehen;

- (3) Dass bessere Integration und Koordination von Nahrungsmittelerzeugern, -verarbeitern, -verteilern und Nahrungsmittelverbrauchern durch Perfektionierung der bestehenden Organisationen und Methoden auf Gemeinschaftsbasis und auch nationaler Ebene gefördert werden müssen;
- (4) Dass diese perfektionierten Organisationen und Methoden auf wirkungsvollere Weise im Exportförderungsversuch zum Einsatz gebracht werden müssen;
- (5) Dass in Forschungs- und Entwicklungsprogrammen auf Gemeinschaftsbasis sowie nationaler Ebene sowohl auf Nahrungsmittlexporten als auch Nahrungsmittelimporteinsparung der entsprechende Wert gelegt werden muss."

Ian G. Reid

Direktor

Oktober 1977

## **REPORTS**

1. 'The Common Agricultural Policy: A Synthesis of Opinion'. Rosemary Fennell. Price £1.25.
2. 'Livestock Marketing Systems in E.E.C. Countries: Belgium/Luxembourg'. Anne McLean Bullen and David H. Pickard. Price £1.50.
3. 'Livestock Marketing Systems in E.E.C. Countries: Italy'. Anne McLean Bullen and David H. Pickard. Price £1.50.
4. 'Livestock Marketing Systems in E.E.C. Countries: Denmark'. Anne McLean Bullen and David H. Pickard. Price £2.00.
6. 'Livestock Marketing Systems in E.E.C. Countries: France'. Anne McLean Bullen and David H. Pickard. Price £4.00.
8. 'Survey of the Potato Industry in the E.E.C.'. Price £3.00.
9. 'The Dutch Ware Potato Marketing System'. N. A. Young. Price £5.00.

## **MISCELLANEOUS STUDIES**

1. 'Soil Classification, Land Valuation and Taxation—The German Experience'. C. J. Weiers and Ian G. Reid. Price £1.00.

## **OCCASIONAL PAPERS**

1. 'The World Commodity Scene and the Common Agricultural Policy'. Simon Harris. Price £1.50.
2. 'Green Money and the Common Agricultural Policy'. R. W. Irving and H. A. Fearn. Price £1.75.
3. 'E.E.C. Trade Relations with the U.S.A. in Agricultural Products'. Simon Harris. Price £2.00.

## **SEMINAR PAPERS**

1. 'The Future of the Family Farm in Europe'. Jointly with the Regional Department of Social Services for the Family Farm, Veneto Province, Italy. Price £1.00.
2. 'Part-time Farming: Its Nature and Implications. A Workshop Report'. G. Fuguitt et al. Price £2.00.
3. 'The Place of Part-Time Farming in Rural and Regional Development'. Edited by Ruth Gasson. Price £3.00.
4. The EEC Milk Market and Milk Policy. Price £6.00.
5. 'EEC Agricultural Statistics: Problems in their Interpretation and Use.' Jointly with the SOEC, Luxembourg. Price £2.00.



