

Volume II

**APPLICATION OF  
ATOMIC SCIENCE  
IN AGRICULTURE  
AND FOOD**

**VOLUME II**

**Present position,  
future trends and techniques**

*REPORT OF THE WORKING CONFERENCE  
HELD AT OEEC HEADQUARTERS, PARIS  
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*The Organisation for European Economic Co-operation comprises the following Member countries: Austria, Belgium, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Sweden, Switzerland, Turkey and the United Kingdom. The Organisation came into being with the signing of the Convention for European Economic Co-operation on 16th April 1948, when Member Governments pledged themselves "to combine their economic strength, to join together to make the fullest collective use of their individual capacities and potentialities, to increase their production, develop and modernise their industrial and agricultural equipment, expand their commerce, reduce progressively barriers to trade among themselves, promote full employment and restore or maintain the stability of their economies and general confidence in their national currencies". Representatives of each of the Member countries meet daily at the O.E.E.C. headquarters, Château de la Muette, Paris, to discuss their economic problems and work out common solutions. The United States and Canada participate in all the work of the Organisation as Associate Members. Spain participates, as a full Member and on an equal footing with the Member countries, in the work of the agricultural bodies of the Organisation and is associated in its other activities. Yugoslavia is represented by an observer and like Spain also participates in the work of the European Productivity Agency.*

*The European Productivity Agency, which is responsible for the publication of the present report, was set up as a new branch of the O.E.E.C. in May 1953. Its task is to stimulate productivity, and thereby raise European standards of living, by influencing not only Governments but also industrial, agricultural and research organisations, private and collective enterprises and public services. One of its primary aims is to convince management and workers alike of the benefits of productivity and to enlist their co-operation.*

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## PREFACE

In 1957, a mission of European research workers visited the United States of America under the auspices of the European Productivity Agency to obtain first-hand information on the existing and potential application of atomic tools to research work in agriculture and food. The report of the mission \* has recently been published in Volume I of this series.

Arising out of the recommendations of the mission, four American consultants have been working with the Agency to advise Member countries of O.E.E.C. on the planning and execution of research programmes. They have also sought to stimulate co-operation in research and experimental work at the national and international level, and, by personal contact with scientists and research institutes, have made a survey of the present stage of development of the subject in Europe. During the consultants' stay in Europe, a mission was organised to the United Kingdom in order to supplement the experience and training gained in the United States: owing to the heavy demand for participation, this activity will be repeated in 1959.

The present publication comprises the report of a European Conference held at O.E.E.C. Headquarters in July 1958, together with the technical papers presented thereat. The purpose of the conference was to review the present stage of development in the application of atomic science in agriculture and food in Europe and the United States, including its economic implications in soil and plant science, animal science and food preservation. The conference also considered the question of training facilities for research workers and aspects of pollution by waste materials from atomic establishments and made proposals for international co-operation. Over 100 specialists from 18 Member countries and Associated countries of O.E.E.C. attended the conference, together with representatives of a number of international organisations. A list of those participating in the conference will be found in Annex II.

The E.P.A. wishes to express its indebtedness to the United States authorities for making available the valuable services of the four consultants, Dr. J.S. Butts, Dr. N.W. Desrosier, Dr. B. Connor Johnson and Professor R.A. Olson, and also wishes to acknowledge its gratitude to the United Kingdom authorities for the excellent facilities provided for the mission on the occasion of its visit to that country.

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\* "Applications of Atomic Science in Agriculture and Food"



C O N T E N T S

C O N F E R E N C E R E P O R T A N D R E C O M M E N D A T I O N S

INTRODUCTION . . . . . 9

SURVEY AND APPRAISAL OF PROGRESS

    Present position. . . . . 10

    Potential contribution of atomic science to agriculture and food. . . . . 11

RECOMMENDATIONS

    Organisation and administration . . . . . 12

    Finance . . . . . 12

    Education and training. . . . . 12

    Exchange of information . . . . . 13

    Facilities for the irradiation of material. . . . . 13

    Co-operation with industry. . . . . 14

    Application of results of research. . . . . 14

    Health/Safety regulations . . . . . 14

INTERNATIONAL CO-OPERATION . . . . . 14

FINAL COMMENT. . . . . 16

CLOSURE OF CONFERENCE. . . . . 16

P A P E R S P R E S E N T E D

PROGRAMME FOR THE APPLICATION OF ATOMIC SCIENCE IN AGRICULTURE AND FOOD IN THE  
UNITED STATES J. S. Butts. . . . . 19

APPLICATION OF ATOMIC SCIENCE IN AGRICULTURE AND FOOD IN THE UNITED KINGDOM  
J. C. Bournnell . . . . . 26

REPORT OF THE EPA/OEEC MISSION TO THE UNITED KINGDOM V. Middleboe . . . . . 32

POSITION AND TRENDS IN OEEC MEMBER COUNTRIES IN THE APPLICATION OF ATOMIC  
SCIENCE IN AGRICULTURE J. S. Butts . . . . . 45

DEVELOPMENTS IN ATOMIC SCIENCE IN SOIL AND PLANT RESEARCH IN EUROPE AND THE  
UNITED STATES R. A. Olson. . . . . 55

RADIO-ISOTOPES IN SOIL RESEARCH A. Schuffelen . . . . . 75

THE USE OF RADIO-ISOTOPES FOR SOIL ANALYSIS CONTROL A. Van den Hende. . . . . 79

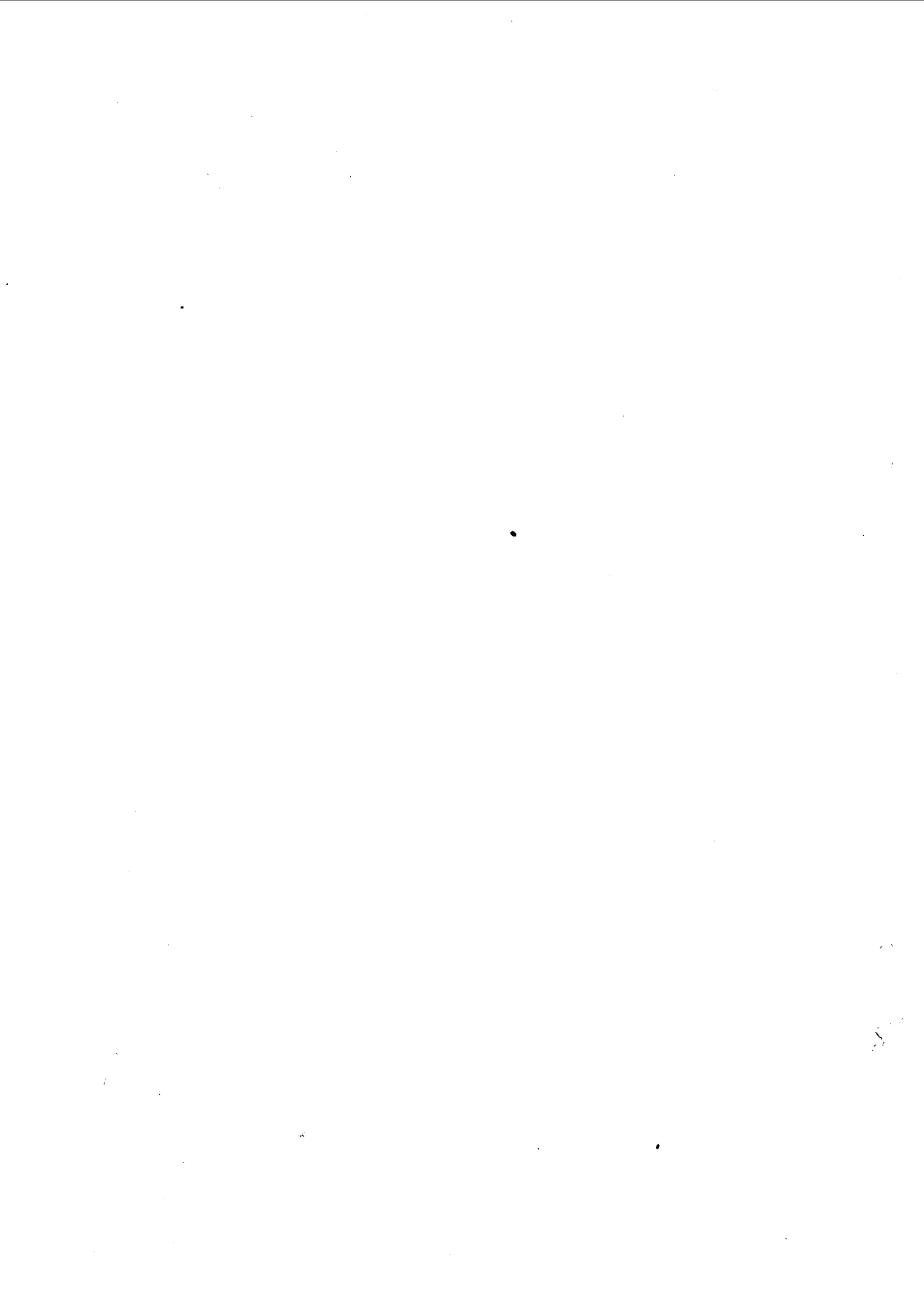
DEVELOPMENT OF METHODS AND PRINCIPLES OF PLANT BREEDING RESULTING FROM THE APPLICATION OF ATOMIC SCIENCE A. Gustafsson . . . . .	85
SAFEGUARDING OF AGRICULTURAL INTERESTS FROM POSSIBLE DISCHARGES OF RADIOACTIVE MATERIALS FROM ATOMIC ENERGY ESTABLISHMENTS	
I Administrative aspects J. G. Carnochan. . . . .	89
II Technical aspects H. G. Wortley . . . . .	92
AGRICULTURAL ASPECTS OF CONTAMINATION ARISING FROM THE USE OF ATOMIC ENERGY R. Scott Russell . . . . .	97
FOOD IRRADIATION RESEARCH AND ITS PRACTICAL APPLICATIONS IN EUROPE AND THE UNITED STATES N. W. Desrosier . . . . .	102
THE WANTAGE RESEARCH PROGRAMME IN FOOD PRESERVATION S. Jefferson . . . . .	150
A NOTE ON THE FOOD IRRADIATION RESEARCH AT THE LOW TEMPERATURE RESEARCH STATION AT AMBRIDGE B. Coleby . . . . .	154
ESTABLISHMENT OF THE FOOD IRRADIATION CENTRE AT KARLSRUHE J. Kuprianoff. . . . .	157
PROGRESS IN THE APPLICATION OF ATOMIC SCIENCE TO ANIMAL BIOCHEMISTRY IN EUROPE AND THE UNITED STATES B. C. Johnson. . . . .	163
THE USE OF RADIO-ISOTOPES IN THE STUDY OF THE MINERAL NUTRITION OF ANIMALS J. Moustgaard. . . . .	192
THE USE OF RADIOACTIVE CARBON IN THE STUDY OF THE ROLE OF VITAMINS IN ANIMAL METABOLISM A. Wacker. . . . .	207
THE USE OF RADIO-ISOTOPES IN THE STUDY OF THE PHYSIOLOGY OF DOMESTIC MAMMALS WITH SPECIAL REFERENCE TO THE REPRODUCTIVE FUNCTIONS C. Thibault. . .	214

A N N E X E S

I PROGRAMME OF THE CONFERENCE . . . . .	233
II LIST OF PARTICIPANTS. . . . .	240

## **Conference report and recommendations**





## INTRODUCTION

An International Working Conference on the "Application of Atomic Science in Agriculture and Food" in O.E.E.C. Member and Associate Member countries in Europe and North America was held at the O.E.E.C. Headquarters, Château de la Muette, Paris, from 21st to 25th July, 1958. The Conference, which was organised by the European Productivity Agency of O.E.E.C. (in consultation with the O.E.E.C. European Nuclear Energy Agency), had the following objectives:

- to review the general position in the development of the application of atomic science to agriculture and food in Europe and North America (O.E.E.C. Member and Associate Member countries):
- to review the present status of the work, its economic significance, and future trends in
  - (i) soil and plant science and genetics
  - (ii) animal science; and
  - (iii) food preservation:
- to discuss present difficulties and problems and to make suggestions for their solution: e.g. difficulties in the training of scientists; and the agricultural aspects of contamination arising from the use of atomic energy, including the safeguarding of agriculture and food interests from possible discharges of radioactive materials from atomic energy establishments:
- to put forward proposals in connection with the continued co-operation between O.E.E.C. Member and Associate Member countries in Europe and North America in this field.

Participants in the Working Conference included scientists and research workers specialising in the field of agriculture and food from universities, research stations and atomic energy agencies or establishments; government officials responsible for the organisation and development programmes connected with the application or possible effects of atomic science in the production, marketing and distribution of agricultural and food products; and representatives from the agriculture and food industries actively interested in these questions. Members of the F.A.O. Contact Group were also included in country delegations in order to ensure a good co-ordination of the work with that of F.A.O.

Representatives were also present from the following international organisations: International Atomic Energy Agency (I.A.E.A.); Food and Agriculture Organisation of the United Nations (F.A.O.); United Nations Educational, Scientific and Cultural Organisation (UNESCO); International Institute of Refrigeration (I.I.R.); Council of European Industrial Federations (C.E.I.F.); and the Confédération Internationale de Techniciens

Agricoles (C.I.T.A.). The agenda of the Working Conference which includes the names of the speakers who presented conference papers will be found in Annex I: a list of the Conference participants is set out in Annex II.

Mr. René Sergent, Secretary-General of the O.E.E.C., welcomed Conference delegates to the Headquarters of O.E.E.C., drawing their attention to the objectives of the Organisation in promoting European co-operation, and in particular, to its function in stimulating common planning and action and the pooling of knowledge and resources between Member and Associate Member countries for the benefit of the participating area as a whole. Mr. Roger Grégoire, Director of the European Productivity Agency of O.E.E.C., described the scope of the total E.P.A. programme designed to promote the development of European industry, commerce and agriculture, to promote higher standards of living and to assist the Europe of the future in keeping with its tradition to make a major contribution to world affairs. Dr. King, Deputy Director of the E.P.A. emphasised the value of the contribution made by science and technology to European development and drew attention to the various methods which should be used by the countries in the co-operative effort. Mr. Pierre Huet, Director of the European Nuclear Energy Agency of the O.E.E.C. described the development of that Agency and its work for the promotion of peaceful uses of atomic energy in Member and Associate Member countries of the O.E.E.C.\*

#### SURVEY AND APPRAISAL OF PROGRESS

##### Present Position

The Working Conference in reviewing the developments in Member and Associate Member countries of O.E.E.C. expressed considerable satisfaction at the progress recorded in many countries. The work by E.P.A./O.E.E.C. had contributed considerably to this development. It was emphasised, however, that nuclear science is a field in which progress was, comparatively speaking, rapid and sometimes spectacular. This called for even greater effort and co-operation on the national level by the countries themselves and also for closer international co-operation between Member and Associate Member countries of the O.E.E.C. Such co-operation would naturally be supplemented by the work of international organisations operating on a world basis (e.g. I.A.E.A. and F.A.O.), which had and would continue to make very important contributions in this field.

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\* See the pamphlet "THE O.E.E.C. EUROPEAN NUCLEAR ENERGY AGENCY - Structure and Functions, First Joint Undertakings"; O.E.E.C., Paris, August 1958. Copies of this may be obtained free on request.

## Potential Contribution of Atomic Science to Agriculture and Food

In the course of a panel discussion it became clear that the applications of atomic science to agriculture are likely to take two main forms. Firstly, the use of radio-isotopes and other radiological techniques as a research tool; secondly, the use of radiation techniques for the preservation of food, forage and the control of certain pests and diseases. It was difficult to evaluate the economic potentiality of a research tool, but the range of the discussion fully demonstrated that there were many fields where the use of radio-isotopes and other ionising radiations had not yet been fully accepted in research techniques. The possibilities in the basic study of the mechanisms of heredity, the immediate practical use in plant breeding, the application in the study of the metabolism of livestock and in the physiology of the plant were referred to: the importance in the study of soil physics and chemistry and in cultivation methods were also stressed and the use of radio-isotopes as a research tool comparable to the use of mutagenic chemicals in plant breeding.

In the irradiation field it seems clear that within a decade or so the application of gamma radiation or the use of such machines as linear accelerators might well prove to be economic. Such irradiation might, for instance in food preservation, be used in conjunction with more orthodox methods of food preservation such as refrigeration.

Reference was made during the conference to the potential savings to the United States agriculture of the application of research in atomic science. Dr. Libby of the United States Atomic Energy Commission conservatively estimated a possible saving in the present use of total fertiliser of 1 per cent but it is believed that a 40 per cent saving is possible with some crops. In plant breeding Dr. Libby has estimated \$100 million would be saved from the development of a rust resistant oat mutant. Again elimination of the screw worm fly has been quoted as leading to a possible saving of \$20 million. Although it was not possible to make close estimates of the economic contribution which similar research might make to European agriculture within the next decade, one would expect the potential savings to be of the same order as those which had been estimated for the United States. In many parts of Europe agriculture is very intensive and the use of very highly specific strains of plants and animals and the high inputs of fertilisers, insecticides and herbicides all suggest that atomic science has potentialities in such an intensively farmed area as Europe which would at least equal those of the United States.

Arising out of its survey and appraisal of progress, the Working Conference wished to draw attention to the conclusions and recommendations set out in the following paragraphs:

## RECOMMENDATIONS

### Organisation and Administration

The Working Conference felt it necessary at the outset to draw attention to the fact that atomic (or nuclear) science was not a new science in itself. It is a new series of techniques which must be added to the other more traditional tools used in research and practice by those concerned with the application of science in agriculture and food.

In many countries the traditional Agricultural Research Councils or allied bodies are utilised as the channels for supporting work in atomic science in agriculture and food. In some countries central organisations had been set up for atomic energy (such as Atomic Energy Commissions) and in certain cases these deal, inter alia, with research in agriculture and food. In one country, at least, a special centre and organisation have been set up to deal solely with the application of nuclear science in agriculture and food. Whatever the organisation, nuclear science as far as agriculture and food are concerned must be regarded in its true light, and therefore the new technique should be utilised when applicable by all research workers in soil and plant science, animal science and the science of food preservation.

The advent of atomic energy and its by-products should not be used to force the centralisation of research work unduly. Central facilities are, no doubt, both useful and necessary but the actual research should continue to be decentralised where practicable, care being taken to ensure that the normal research institutes and the Universities were utilised to the fullest capacity.

### Finance

The Working Conference felt it necessary to draw the attention of governments, industry and allied authorities to the need for a greater investment in agriculture and food research. On this, among other factors, depends the raising of the standard of living of rural populations and the maintenance of the cost of living indices at a reasonable level despite inflationary tendencies.

### Education and Training

Educational requirements in regard to nuclear science in agriculture and food fall under three major headings:

- (i) Education at undergraduate and post-graduate levels;
- (ii) Basic training in the handling and use of radio-isotopes;
- (iii) Training in the agriculture and food applications of atomic science.

The Working Conference recommended that all University undergraduates in agriculture and allied faculties should be given indications of the application of nuclear science in the various subject-matter fields covered by their courses. Post-graduate students pursuing courses in soil and plant science, animal science and food science should be given appropriate intensive training in the use of the new tool in their respective spheres. Furthermore short refresher courses should be initiated for those who have graduated to

allow them to grasp the potential value and use of atomic science in agriculture and food. It was requested that this recommendation is brought to the attention of the coming E.P.A./O.E.E.C. European meeting of representatives of the Agricultural Faculties of Universities and Institutes of a similar standing in Agricultural Education.

At present there is an acute shortage of agricultural graduates with a satisfactory basic training in the handling and use of radio-isotopes. Much assistance to other countries has already been given in this field by the United States (Oak Ridge), the United Kingdom (Harwell) and France (Saclay). It is recommended that this co-operation be continued and further developed. Reference to this subject is made below under the heading International Co-operation.

Similarly there is a very great need for facilities for training in the application of nuclear science to the various agricultural fields: i.e. soil and plant science, animal science, food science, etc. Here again there is very wide scope for co-operative efforts between countries.

#### Exchange of Information

Exchange of information is best carried out through personal contact between scientific personnel and a regular flow of suitable printed material. The Working Conference felt it necessary to draw the attention of governments and other authorities to the need for increased national and international contacts through conferences, meetings, study tours, fellowships and sabbatical leave for study in other countries. Much money and time can be saved through the provision of such facilities.

It was noted that the Commonwealth Agricultural Bureaux through its various abstracts and the United States abstracts "Nuclear Abstracts", - "Biological Abstracts", "Chemical Abstracts", "Bibliography of Agriculture" and "Fisheries Abstracts of the United States Wild Life Service" provides a satisfactory service to research workers in soil and plant science and in animal science.

There is, however, at present a need for a suitable abstract service in the field of food preservation including the application of nuclear science in this field. It is hoped that one of the major centres in Europe or the United States will see its way to publish regularly abstracts in this field concerning research work throughout the world. In the meantime E.P.A./O.E.E.C., with the help of its consultants, might provide a quarterly newsletter dealing with developments and achievements in food irradiation.

There is a need for a list of institutions utilising nuclear science in research projects in Europe. Such a list should be complemented by a list of similar institutions in the United States and Canada. It is recommended that E.P.A./O.E.E.C. endeavour to provide a first issue of this index which need not necessarily include too much detail. Members of the Working Conference undertook to provide a list of the institutions in their own countries towards this first text, and F.A.O. will collaborate in the work.

#### Facilities for the Irradiation of Material

At present sixteen out of the eighteen Member or Associated European countries of the O.E.E.C. have built or are planning to build atomic piles. It is recommended that such piles should provide facilities during reasonable hours for the irradiation of materials in agriculture and food. In the meantime it is hoped that countries in which atomic energy has been more highly developed will continue to provide these facilities to countries less advanced in this field. Reference is again made to this matter under the heading International Co-operation below.

### Co-operation with Industry

It was noted that in some countries private industry was taking an active interest in the development of nuclear science in agriculture and food. This is a very welcome development and it is recommended that official authorities and their research stations should maintain close contact with such firms and ensure that they are kept informed of the latest results from official research both on the national and international levels. It was recommended that at a suitable future date the E.P.A./O.E.E.C. should organise a meeting of representatives of the agricultural food industries in Europe actively working or interested in this field; this meeting should also be attended by representatives from the official research stations.

### Application of Results of Research

Under the heading "Potential Contribution of Atomic Science to Agriculture and Food" an estimate is made of the economic contribution of atomic energy to progress in the field of food and agriculture. In this connection the Working Conference felt it necessary to draw attention to the wide gap which, under present circumstances, too often exists between the proving of research results and their application on the farm and plant level. There is a need for even greater efforts to reduce this gap, and on these efforts will depend the profitability of investments through the use of the newer techniques to be derived from the application of atomic science to agriculture and food.

### Health/Safety Regulations

It was considered essential that countries should have a suitable code of health safety regulations for staff handling atomic materials. The need to follow closely such regulations should be emphasised and regular reminders should be given to ensure that no laxity occurs as a result of undue familiarity with handling radioactive material.

## INTERNATIONAL CO-OPERATION

In making its recommendations in regard to future co-operation on the international level, the Working Conference took into consideration the work in hand by the I.A.E.A. and F.A.O. and also the need for E.P.A./O.E.E.C. to intensify co-operation between Europe and North America for the better development of the resources of the participating area. It was felt that on the scientific level there was a need for special activities in four fields, viz:

- (i) soil and plant science;
- (ii) plant genetics;
- (iii) animal science;
- (iv) food preservation.

The Conference was informed of the meeting being organised by F.A.O. on food preservation in the United Kingdom in the autumn of 1958 and that F.A.O. also proposed to hold a training course for agricultural advisers in agricultural aspects of radioactive contamination during 1959. Attention was also drawn to the "contact group" established by F.A.O. on the scientific level between representatives of European countries; this

group holds meetings periodically. The Conference also noted that I.A.E.A. has at present under consideration proposals in connection with grants for fellowships and for contract research. It was considered that the work of the various international organisations in this field should be closely linked.

There is no doubt that the O.E.E.C. is in a specially favourable position to develop co-operation between its Member and Associate Member countries, in view of the existence of its European Nuclear Energy Agency and its European Productivity Agency, both of which have already made a very valuable contribution in the field of atomic science and atomic development. The following proposals are therefore made for consideration in the Organisation's future work.

Developments in food preservation are of great interest to the O.E.E.C. in its role of co-ordinating agricultural policies and promoting international trade. E.P.A./O.E.E.C. should therefore follow progress very closely in this field in order to be prepared for any developments which may occur in the case of some commodities in the not too distant future. In keeping the position under review, it will be necessary for the O.E.E.C. policy groups dealing with agriculture and food to take into consideration the production and market trends which may result from food preservation by irradiation. E.P.A./O.E.E.C. should also maintain a very close connection on the international level between associations representing producers, marketing organisations, food processors and wholesale and retail distribution associations as well as associations for consumers. A great deal of public education and consumer education will be necessary.

The new techniques provided by atomic science will no doubt expedite developments in animal and plant production, fertiliser use, etc. O.E.E.C. will need to consider policy decisions that may have to be taken; for example, as to whether cattle should continue to be bred for milk with high butter fat content or high protein, mineral and vitamin content.

A subject meriting urgent consideration by the O.E.E.C. is that of safeguarding agricultural interests from possible discharge of radioactive materials from atomic energy establishments. In some Member countries a special organisation for the work has been set up in which the Ministry for Agriculture, Fisheries and Food has a very important role to play. It would, therefore, be useful for O.E.E.C. to make arrangements allowing for a continual exchange of experience between Ministries for Agriculture, Fisheries and Food on this question. It is also appropriate that O.E.E.C. should stimulate co-operative action between adjacent Member countries where the possibility of inter-country contamination may arise.

The plant built at Mol, Belgium, for reprocessing of irradiated fuel by the EURO-CHEMIC Company, sponsored and developed by the European Nuclear Energy Agency of O.E.E.C., could play a very important role in providing facilities for irradiating material in agriculture and food as a service to Member countries. It was recommended that consideration by the appropriate authorities be given to this question as work developed.

A Conference such as the present one on developments in the application of atomic science to the whole field of agriculture and food in European countries and in North America can yield valuable results through bringing together the various interested groups from universities, research stations, government administrations and private industry. E.P.A./O.E.E.C. should endeavour through its European and American consultants to promote this type of co-operation on the national level, particularly in the field of food preservation. It should also arrange for periodic reviews of progress by means of similar working conferences which might be held at centres outside O.E.E.C. headquarters and in



co-operation with other international organisations.

E.P.A./O.E.E.C. has also a role to play in the following fields:

- (i) organisation of missions to the United States and to European countries to study the work in progress in these areas;
- (ii) further training in the United States or in Europe of personnel already in the various fields and, where possible, through providing fellowships; and
- (iii) the provision of European and United States consultants to advise and assist Member countries. In this connection it was pointed out that the four United States consultants to the E.P.A. during the past year had contributed very valuable help to European workers in the various fields. A period of time would be necessary to apply the results of these country visits and those of the Mission to the United States.

It was considered that Missions should not be too heterogeneous in character.

Reference has been made in several of the preceding paragraphs to the E.P.A. and O.E.E.C. initiating or developing co-operative action between Member and Associate Member countries; such co-operative action should include joint research projects. It is considered that E.P.A./O.E.E.C. consultants should bear in mind the need for better regional co-operation where this is appropriate, for example in Scandinavia or in the Mediterranean area.

#### FINAL COMMENT

In conclusion, members of the Working Conference wished to place on record their indebtedness to the Committee of Deputies of the Ministerial Committee for Agriculture and Food of O.E.E.C. and to the European Productivity Agency for arranging the conference at this appropriate time to review progress in developments in the application of nuclear science to agriculture and food in Europe and North America. The high level of the discussions at the Conference proceedings and the very informative submissions of the various guest speakers constituted a most valuable interchange of ideas and experience and contributed to greater European co-operation in this new scientific field.

#### CLOSURE OF CONFERENCE

At the closure of the Working Conference the General Rapporteur conveyed congratulations and good wishes to the participants on behalf of Mr. Rabot, the Director for Agriculture and Food, who had been unable to join the meeting due to pressure of work in connection with the discussions on the Free Trade Zone proposals. The General Rapporteur also described the programme of E.P.A./O.E.E.C. in the field of agriculture and food placing the Conference within the general context of the work.