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SYMPOSIUM ON RESEARCH FOR THE FOOD INDUSTRY
SIMPOSIUM OOR NAVORSING VIR DIE VOEDSELBEDRYF

PRETORIA, 20 November 1964

Food Technology Division
of the
National Nutrition Research Institute

Voedseltegnologie-afdeling
van die
Nasionale Voedingnavorsingsinstituut

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH
WETENSKAPLIKE EN NYWERHEIDNAVORSINGSRAAD

C O N T E N T S

I N H O U D

CONSIDERATIONS IN DETERMINING RESEARCH NEEDS IN INDUSTRY

OORWEGINGS WAT IN AG GENEEM MOET WORD WANNEER DIE NAVORSINGSBEHOEFTES VAN 'N BESONDERE SEKTOR VAN DIE NYWERHEID BEPAAL WORD

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SYNOPSIS

Well planned research, aimed at serving a specific sector of industry must have clearly defined study objectives based on the needs of the industry concerned. In identifying these needs many technological and economic factors have to be considered, and from an analysis and weighing of these factors a research programme can be formulated. The paper deals briefly with the more important factors considered during a survey of the food processing industry undertaken with a view to assisting with the formulation of a research programme for the Food Technology Division of the National Nutrition Research Institute.

SAMEVATTING

Goedbeplande navorsing wat daarop gerig is om n bepaalde sektor van die nywerheid te dien, moet presies ingestel word op die behoeftes van die betrokke nywerheid. Verskeie tegnologiese en ekonomiese faktore is van belang by die vasstelling van hierdie behoeftes en deur die faktore te ontleed en teen mekaar op te weeg, kan n navorsingsprogram geformuleer word. Die referaat gee n kort uiteensetting van die belangrikste faktore wat in die loop van n opname van die voedselverwerkingsbedryf oorweeg is met die doel om n navorsingsprogram vir die Afdeling Voedseltegnologie van die Nasionale Voedingsnavorsingsinstituut te help formuleer.

It has become clear that the expansion of an industrial economy is strongly influenced by the advancement of science and technology. In modern times discoveries and inventions are, however, seldom made by persons working alone, but are almost invariably the result of the efforts of teams of scientists, engineers and technologists, working in permanent research organizations. The type of equipment and personnel involved in applied research, and the time required for investigations with even modest objectives, makes research very expensive; consequently, the objectives of applied research in terms of economic goals must be defined and the research should be carefully planned and strictly controlled, in order to keep research expenditure within the bounds set by the anticipated economic returns. With this in mind, a survey of the food processing industry was made, jointly by the Industrial Economics Division and the National Nutrition Research Institute of the C S I R, in order to determine whether the research programme of the Food Technology Division of that Institute should be re-orientated or extended to aid in the development of the industry. Similar surveys have been made of other branches of industry in relation to the research programmes of other divisions or institutes of the C S I R. As experience is gained with these surveys, a certain modus operandi is being developed and certain aspects of industry are beginning to appear as guide lines to be considered when planning research. The directions in which research is likely to result in economic gains, either through increased productivity or extension into new markets, normally depends on a combination of many different technical, commercial and organizational aspects of the industry. Normally the precise nature and extent of the influence of each of these on the research needs of a particular branch of industry, is difficult to define and to predict, but some aspects have been found quite fruitful to consider. By way of illustration a few examples are dealt with in this paper.

GROWTH AND DEVELOPMENT IN RELATION TO OTHER INDUSTRIES

Rapid economic expansion in a particular branch of industry appears not only to create a need for technological advances; it also seems to provide the opportunity for doing research for the individual firm, or for the branch of industry as a whole. An example of rapid industrial expansion combined with successful research undertaken during the last few years, is to be found in the fishing industry and the work done by the Fishing Industries Research Institute in Cape Town.

Slow growth, stagnation, or even economic decay may, on the other hand, also create a need for industrial research but for a different reason; consequently this research will be financed and organised in a different way.

There have been many examples in recent times of products and the associated industries losing ground to new products which are themselves the results of research and technical advances in other fields. One of the classic examples was the replacement of the horse-and-buggy industry by the motor car industry. More recent examples have been the loss of markets for animal fats as a result of the development of detergents; the loss of markets for the wattle tanning extract as a result of the development of synthetic tanning agents and the greater use of plastics in shoes; the emergence of synthetic fibres which have threatened the position of the traditional products, i.e. silk, cotton and wool; and the changing situation in the timber industry with corrugated cardboard containers breaking into the market for wooden containers. These are all examples of competition between whole branches of industries, as opposed to competition between individual firms. When a product is losing ground to a rival product, the only effective competitive weapon of the industry concerned, is scientific research which, to be effective, must be organized and financed on an adequate scale. It is in these circumstances that co-operative industrial research is usually most effective. In South Africa, wool affords a good example, as there are large areas of the country which are not suitable for the production of anything other than wool. The textile industry is international in scope and is much less vitally concerned. The textile manufacturers can switch from one type of yarn to another and remain in business, but the farmers who produce the raw material are likely to go out of business if wool loses ground to synthetics. It is logical, therefore, that research on wool should be financed mainly by the wool growers and the governments in the countries concerned. Similarly, in South Africa, research which aims at finding alternative outlets for wattle extracts is financed jointly by the wattle growers and the Government. In South Africa, the production of quick-growing South African timbers is likely to exceed the internal demand in the forseeable future. It is against this background that the C S I R has been called in to assist the timber industry in research on timber utilization.

INDUSTRIAL TECHNIQUES USED

The newer science-based industries are bound to be more research-minded than the older, traditional industries. To do research for these science-based industries, which usually also do extensive research themselves, appears to be more fruitful and easier to finance and organize than for the traditional industries which employ older techniques and in which a more parochial approach frequently appears to be a typical feature of managerial thinking. For example, there is no need to sell research to firms like I B M, Philips, Bell, I.G. Farben, Vickers and so on. These companies, active in fields like electronics, aerodynamics and pharmaceutics literally depend on their laboratories for their livelihood. On the other hand, identifying the needs for technical advances and organizing research for, say, the ceramics industry where the main process, clay burning, is as old as the hills, is much more difficult. This, of course, does not imply that research in the field of the older techniques, like weaving, tanning, steelsmelting, glassmaking, etc., is not required; on the contrary, much work remains to be done to increase the efficiencies of the older industrial processes. Indeed, in many cases, science has much leeway to make up before it can be accepted with confidence by the practitioners of an age-old craft. A typical research project in this field would be the development of a continuous production process where a batch operation is still being used in an industry where the market is sufficiently wide to justify continuous production. We have, for example, lately seen the development of continuous processes for making sheet glass and butter, and continuous steelmaking will probably soon be achieved. One could for instance suggest research into continuous brick-making if a survey proved the cost structure to be favourable and the market large enough.

COST STRUCTURE

An analysis of the general cost structure of a particular branch of industry, in terms of the relative importance of the cost of materials and labour used and the capital required for production, will assist in providing a clue to the research needs of the industry. In capital intensive industries, for example, significant cost savings can be achieved in many cases by increasing factory plant utilization. In such cases technical research, aimed at reducing variations in production volume, or aimed at the diversification of factory equipment, or at the integration of various processes could be considered. In cases where the cost of materials used is the major cost item, research into the more complete utilization of raw materials may be indicated, while research into mechanization and automation may be possibilities in labour intensive industries.

STRUCTURE AND ORGANIZATION OF AN INDUSTRY

The research needs of those branches of industry which are closely knit and well organized, and where the interchange of ideas between companies is free, are often readily determined and are usually of a fundamental nature, while in branches where individual companies find co-operation difficult or impossible, very little or only small scale technical research can be done. In the former case collective research can usually be organized and financed on a long term basis, while for the latter only ad hoc projects can be undertaken.

OVERSEAS AFFILIATIONS

In South Africa many industries have overseas affiliations, and the nature of these connections appears to play an important role in determining their research needs. Where the South African company is a branch or wholly owned subsidiary of an overseas firm, the necessary technical know-how is usualy available from overseas and no local research is needed; in fact, some local companies are so firmly bound to their parent companies that any deviation from home practice is allowed only by special permission from the parent company. On the other hand, companies which are entirely South African have frequently no direct sources of overseas information and consequently are entirely dependent on developing their own local know-how. This is especially true where these firms export goods in competition with overseas firms. It may be expected that as South African industrial exports increase, more and more local industrial research will be required.

SUPPORT FROM OTHER INDUSTRIES

The technical knowledge available to certain branches of industry through the suppliers of machinery, equipment, packing materials and manufactured raw materials, frequently plays an important role in satisfying the short and long term technical needs of the manufacturer. This is specially so where the branch of industry is served by one or more other industries which are in keen competition with one another. In some cases, the supplying industry has a complete laboratory service available to assist customers (or potential customers) with the development of their production processes. The extent of support an industry gets from associated industries plays an important role in identifying the fields of research in which the C S I R should steer its projects.

MARKET SITUATION

As the local market for the products of a particular branch of industry tend to become saturated, and the industry contemplates export, a need for technical research can often be anticipated. When industries export for the first time, or find a new customer overseas, they are often confronted with new and frequently unexpected, technical problems. For example, two countries have recently refused to accept South African sugar which for years has been sold on overseas markets. (The Sugar Milling Research Institute in Durban has, fortunately, already solved this problem).

RAW MATERIAL SUPPLIES

Surpluses and shortages of produce and supplies almost invariably lead to a search for new products or alternative raw materials. The anticipation of the future supply to an industry, by investigating the expected trend in the supply and demand for certain raw materials, can frequently provide the clue to the research needs of an industry.

MERCHANDIZING

Trends in merchandizing, as for instance the distribution of de-boned fresh frozen meat through super-markets instead of through the traditional family butcher, frequently create a need for the development of new methods of packaging and product handling. Most of this type of development requires little research in the strict sense of the word, but in certain instances problems with considerable technical content can arise.

The examples which have been presented here are intended to be comprehensive. In fact, at the outset, the point was made, that it is difficult to generalize about the relationships of research to the technical, commercial and organizational aspects of industry. Normally these vary from industry to industry, from place to place and from time to time. From the surveys of branches of industry which are being undertaken by the Industrial Economics Division in conjunction with the research laboratories of the C S I R, there is beginning to emerge a clear understanding of industrial research as a recognized field of activity. As more experience is gained and the check-lists are improved upon and elaborated with each survey that is undertaken, repetitive patterns are beginning to emerge. In these patterns can be seen the beginnings of a new science - the science of industrial research!

RESEARCH IN INDUSTRY

NAVORSING IN DIE NYWERHEID

W.G. HANCOCK

EPIC OIL MILLS LTD.

SYNOPSIS

A review of the primary needs of research in industry, stressing the fact that industrialists are continually concerned with the non-technical aspects of business and have little time and opportunity to think of technical research and development, or to appreciate the complexities of research. The research worker on the other hand does not always appreciate that industry's most urgent need is the finished product and not some intricate abstract formula contained in a learned publication.

SAMEVATTING

'n Oorsig van die belangrikste navorsingsbehoeftes van die nywerheid met klem op die verskynsel dat nyweraars voortdurend besig is met die nie tegniese aspekte van die sakewêreld en min tyd of geleentheid kry om aan tegniese navorsing te dink, of om met die kompleksiteite van navorsing vertroud te raak. Aan die ander kant besef die navorser dikwels nie dat die nywerheid 'n dringende behoefte het aan klaar-produkte en nie abstrakte formules wat in 'n vaktydskrif aangebied word nie.

In these days of scientific advance, the word research works heavily overtime, and it would appear from general context, that the exact meaning of the word is not fully understood, or alternatively, that the word is used loosely.

Even a discussion of the meaning of the word "research" would take up the time that is allowed for this paper, and to include a review of research in industry would occupy a complete symposium.

As a result a number of short cuts will have to be taken and the first will be to define research. The concise Oxford Dictionary gives "careful search or enquiry after or for", "endeavour to discover facts by scientific study of a subject", "course of critical investigation". Of these meanings, attention should be drawn to several important words viz: "careful", "scientific" and "critical". Of these requirements, the least understood is probably the term "scientific". In modern lay usage anything even slightly esoteric becomes dubbed scientific, from forecasting the future of man from passages in the pyramids, to modern space literature. These flights of fancy are as far removed from the strict meaning of the word scientific as it is possible to go.

Since research is a dynamic matter, the term "scientific method" should be examined. Many volumes have been written on this subject, but they can be summarised in the following manner :-

1. Collect the known facts;
2. Construct a theory to cover these facts;
3. Devise experiments to check further deductions from the theory;
4. Collect the known facts including those from operation 3: and so on, ad infinitum.

So the dynamic operation of research is a time consuming operation which requires rigorous discipline on the part of the operator, who might sometimes be inclined to follow devious exploratory routes during the course of his investigations.

The primary requirement of research <u>in industry</u> is that it must be of use, both practically and financially.

Here, it is necessary to digress to look at an industrial organization. Somebody with the object of producing something, obtains capital, erects a building, equips it with machines, employs labour to operate the machines to produce the product, to sell at a profit, with which to give the suppliers of the capital a return on their money. The operators of the machines cannot function without direction, so management will be required, nor can the whole operate without ancillary departments, whether they be of major or minor importance, such as the calculators of wages or the sweepers and cleaners.

It may be difficult for anyone working in isolated laboratories to realise that the industrial research laboratory must operate in the same manner as the factory to which it is an appendage, and the fundamental requirement is that it must at least pay for itself, and should operate at a profit.

Should they decide to do their own research they would have no facilities for training their workers and they would require the finished article. It is suggested that this is a further use for our technological institute, viz. a training ground for research workers.

If it is accepted that suitable brains are randomly distributed then the raw material is apparently there. As far as the universities are concerned, the academic training is available but whether they can absorb all the suitable material is doubtful. According to overseas experience, this cannot be done, so that there should be an extension of training. Again on overseas experience, this has been realised by extending the facilities of technical schools to absorb those, who, for one reason or another, have not been accepted for or were unable to accept the university training. We can assure the supply of raw material but we have got to maintain it. The cynic Dean Swift only once relented in his views on scientific thought, and that was when he gave his opinion on research. "He gave it for his opinion that whoever could make two ears of corn or two blades of grass to grow upon a spot where only one grew before, would deserve better of mankind and do more essential service to his country than the whole race of politicians put together".

The latter part of the quotation may be treading on dangerous ground and should be ignored, but the message is still there - the nation must see to it that there is the incentive for the researcher to work, by seeing to it that his position in the national structure is assured. Experience in the highly developed countries overseas, has shown that competition for the services of research workers is very keen, and here in South Africa, with the whole field of development wide open, it is essential that the best brains must be kept here to develop the resources that are undoubtedly available to us.

(1) Is this not being done by CSIR

And so there is a dual use for the suggested technological institute:
(1) to carry out research for the companies who want it, and
(2) to train future researchers so that they can enter industry duly equipped.
Is this feasible? The answer to this question is that it must be, since it must bring in its train enormous advantages in addition to the two already outlined. The technological institute could function as a central source of industrial knowledge; it could at least remove the capital cost of equipment for the small company; it could economise in manpower, since the company requiring its services could purchase the manpower it wants when it requires it, and it could enable the purchaser to buy the services of fully trained brains, rather than the probably mediocre staff it could afford, in its own employment.

It must be concede that a co-operative undertaking such as this is faced with difficulties of administration, since the purchaser of its services with an idea, would want the results for itself. However, similar conditions exist elsewhere, and if the will to succeed was there, difficulties of this nature could surely be overcome. The advantages must outweigh the disadvantages. It remains an idea, based on some forty years of industrial experience, of seeing the smaller and medium sized undertakings failing to develop at the rate they should. In many cases they have the ideas and the dynamism, but lack the money.

Surely, the national industrial research undertakings and the Industrial Development Corporation, to name but two, could either individually or together, see if this suggestion could be put into practice.

In conclusion, a word of warning, again in the form of a quotation from Dean Swift, could be added "He had been eight years upon a project for extracting sunbeams out of cucumbers, which were to be put into vials, hermetically sealed and let out to warm the air in raw, inclement summers".

Let all those engaged in industrial research not fall into this attractive trap, but rather let them see to it that research is directed to the real needs of the country's industrial undertakings because in this way the greatest national service can be rendered.

NUWE MIELIEPRODUKTE

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SYNOPSIS

In view of the increased production of maize the necessity for research with the object of developing new maize products and establishing new possibilities for their use in human nutrition is stressed.

The following are mentioned as examples of new maize products and processing procedures:

The cooking of maize meal and mahewu by drum drying; the manufacture of fruit flakes where maize meal acts as the carrier of the fruit; the development of instant maize soup powders and the preparation of green mealie meal and maize-buttermilk porridge. It is also pointed out that a method has been developed whereby maize meal can be baked into wheaten bread. A sweet maize rusk was also developed by private enterprise and will soon be marketed.

In conclusion the puffing process for the preparation of pre-cooked maize meal and maize products is discussed.

SAMEVATTING

Gesien die stygende mielieproduksie word die noodsaaklikheid van navorsing oor mielies ten einde nuwe mielieprodukte te ontwikkel en nuwe moontlikhede vir hulle in menslike voeding te skep, beklemtoon.

ŉ Paar nuwe mielieprodukte en prosesse vir die verwerking van mielies word genoem:

Die gaarmaak van mieliemeel en magou deur walsdroging; die vervaardiging van vrugtevlokke met mieliemeel as draer van die vrugte; die ontwikkeling van kitsmieliesoppoeiers en die bereiding van groenmieliemeel en mielie-karringmelkpap. Daar word ook daarop gewys dat ŉ metode ontwikkel is waarvolgens mieliemeel in koringbrood verbak kan word. Ook het ŉ privaatonderneming ŉ soet mieliebeskuitjie ontwikkel wat nou bemark sal word.

Ten slotte word die pofproses vir die bereiding van klaargaar mieliemeel of mielieprodukte bespreek.

INLEIDING

Wat omvang van produksie betref, is mielies vandag die belangrikste graangewas in die wêreld en ook die belangrikste stapelvoedsel van ʼn groot gedeelte van die Suid-Afrikaanse bevolking. Uit die statistieke verstrek in ʼn jaarverslag van die Mielieraad is dit duidelik dat mielieproduksie in Suid-Afrika sedert die Tweede Wêreldoorlog fenomenaal toegeneem het. Die mielieproduksie het gestyg veral a.g.v. verbeterde boerderymetodes, wat grotendeels weer die gevolg is van navorsing wat op die gebied van mielieverbouing gedoen is. In die 1945/46 seisoen was die totale produksie 1.65 miljoen ton en die plaaslike verbruik 1.84 miljoen ton. Suid-Afrika moes dus 0.19 miljoen ton mielies invoer om die plaaslike behoeftes te bevredig. In die 1962/63 seisoen is 5.08 miljoen ton mielies geproduseer, 2.90 miljoen ton is plaaslik verbruik en 2.11 miljoen ton is uitgevoer. As gevolg van die groot oorproduksie van mielies, moes nuwe markte vir mielies gevind word.

Met die oog hierop en ook om die binnelandse gebruik van mielies en mielieprodukte sover moontlik uit te brei, het die Mielieraad in 1957 fondse aan die Universiteit van Stellenbosch beskikbaar gestel vir navorsing om ʼn goedkoop metode te vind vir die vervaardiging van ʼn mielieproduk wat maklik en sonder om dit lank te kook, vir menslike verbruik voorberei kan word.

Een groot beswaar teen die gebruik van mielies is dat dit so lank neem om gaar te word. In die 1958 jaarverslag van die Mielieraad[2] word vervolgens ook gemeld dat die Universiteit van Stellenbosch daarin geslaag het om ʼn produk te ontwikkel waaruit mieliepap gemaak kan word deur eenvoudig water of melk daarby te voeg.

Ook die Nasionale Voedingnavorsingsinstituut (N V N I) doen etlike jare reeds navorsing met die doel om die gebruik van mielieprodukte te bevorder. Hierdie werk het daartoe gelei dat die Mielieraad verlede jaar besluit het om die N V N I voortaan finansieel te steun.

KLAARGAAR MIELIEPAPPOEIER EN GEDROOGDE MAGOU

Een van die nuwe mielieprodukte wat in die afgelope tyd verder ontwikkel is, is die reeds genoemde klaargaar mieliemeel. Heelwat werk is in dié verband, en ook in verband met die droging van magou, aan die N V N I gedoen, in besonder wat die bepaling van die graad van gaarheid en die verband tussen die drogingstoestande en die gaarheid van die produkte betref. Ons sal hier nie verder daarop ingaan nie, maar verwys na ʼn voordrag wat een van ons in Maart 1964 by die Suid-Afrikaanse Vereniging vir Voedselwetenskap en -tegnologie in Pretoria gehou het en wat in die Junie-uitgawe van die tydskrif „Food Industries of South Africa" verskyn het.[3]

MIELIEMEELVRUGTEVLOKKE

ʼn Produk wat in die Instituut ontwikkel is en wat die afgelope jaar baie belangstelling gewek het, is die mieliemeelvrugtevlokke. By hierdie produk is die smaak van die vrugte oorheersend en die mieliemeel dien slegs as draersubstans. Die verhouding van vrugte tot mieliemeel is 1:1 bereken op ʼn droëstofbasis. Hierdie produk sal moontlik die verbruik van mielies vermeerder veral daar dit ook groot moontlikhede as ʼn uitvoerproduk besit. Aangesien ʼn artikel oor die vervaardiging van vrugtevlokke reeds in „Food Industries of South Africa"[4] gepubliseer is, sal kwaliteit bevat. So ŉ produk sal dan ook meer ekonomies wees om te produseer.

TABEL 1

Opbrengs, vog- en proteïeninhoud van groenmieliemeel op verskillende stadiums van rypheid

Oes nr	Aantal dae na blom	Opbrengs						
		% vog in pitte	Gewig van gedroogde en gemaalde produk (kg)	% opbrengs verkry van koppe en blare en baard	% opbrengs verkry van skoongemaakte koppe	Voginhoud van meel (g/100g)	Proteïeninhoud (g/100g) (Nx6.25)	Totale proteïen verkry van die oes (kg)
1	30	77.1	7.6	5.4	9.7	6.7	12.9	1.0
2	39	61.9	17.3	13.4	21.6	9.0	10.1	1.8
3	51	43.9	30.6	27.6	33.3	6.6	10.0	3.2
4	60	37.1	36.2	37.3	45.8	8.2	9.9	3.6
5	132	11.5	31.6	51.8	58.5	6.0	10.2	3.2

Gedurende die komende mielieseisoen sal die vervaardiging van groenmieliemeel verder ondersoek word deur monsters 45 dae na die blomtyd te pluk.

MIELIE-KARRINGMELKPAP

Deur mielies in karringmelk te kook kan ŉ baie smaaklike pap berei word. In die geval waar heel wit mielies gebruik word, moet daar egter lank gekook word en kom die saadhuide wat vir baie mense onaanneemlik is nog as velletjies in die pap voor.

As die heel mielies eers met ŉ hamermeul gemaal word kan egter nie meer as 5% droë materiaal gebruik word nie, anders word die pap so dik dat dit nie meer in bottels verpak kan word nie. Die kooktyd is dan wel baie korter maar die produk is meer poedingagtig.

Gepofte heelmielies en gepofte stampmielies (gebreekte mielies sonder kiem en huid) is ook getoets. Goeie produkte is daarmee verkry. Met die gepofte stampmielies is egter ŉ korter kooktyd nodig as met die gepofte heelmielies. Die produk is egter minder korrelrig en is geneig om jelei-agtig te word wanneer te lank gekook word.

Het u al die pappe geeet?

MIELIEMEEL IN BROOD

In hierdie verband het sekere publikasies reeds verskyn,[6, 7] en word die werk derhalwe net kortliks saamgevat.

Daar was twee redes om ŉ ondersoek uit te voer om mieliemeel in brood te gebruik, naamlik: die oorproduksie van mielies waarvoor nuwe afsetmoontlikhede gevind moes word en die feit dat koring nog ingevoer moet word. Die invoer van koring, wat ongeveer 2 miljoen sak per jaar beloop, sou aansienlik verminder kon word as bv. 25% van die meel in brood met mieliemeel vervang sou word.

Vroeër is gevind — onder ander ook in proewe wat by die Elsenburg Landboukollege van die Universiteit van Stellenbosch uitgevoer is — dat tot 15% wit en tot 10% geel mieliemeel met standaard koringmeel gebak kan word, maar dat die smaak van die brood verander wanneer meer mieliemeel toegevoeg word. Proewe is ook deur die N V N I gedoen, en gaargemaakte mieliemeel wat met alkali behandel was, is o.a. gebruik, maar die mieliegehalte van die brood kon nie verder verhoog word sonder om die smaak te verander nie. Verdere eksperimente is uitgevoer met die doel om, deur die toevoeging van bepaalde meelverbeteraars, ŉ koringbrood wat 25% mieliemeel bevat te verkry wat goed sou vergelyk met ŉ gewone koringbrood.

ŉ Hele reeks bakproewe is uitgevoer waarby o.a. kaliumbromaat, askorbiensuur en kaliumjodaat by die bakmengsels gevoeg is en die resultate het getoon dat dit moontlik is om ŉ wit koring-mieliemeelbrood van goeie kwaliteit, wat uit 25% mieliemeel en 75% koringmeel bestaan, te bak, mits 50 mg askorbiensuur of kaliumbromaat plus 10 g bakkersvet per kg van die meelmengsel bygevoeg word. Sulke wit brode is in volume, tekstuur en smaak gelykstaande aan dié van ŉ gewone koringbrood. Die bevinding van ŉ laboratorium-proefpaneel is bevestig deur ŉ proef wat met behulp van 50 gesinne in Pretoria uitgevoer is.

Proewe is ook met bruinbrood uitgevoer en is bevind dat in dié geval slegs 15% mieliemeel toegevoeg kan word.

TOEPASSING VAN DIE POFPROSES OP VOEDSEL

Die poffing van voedselprodukte met die doel om klaargaar produkte te vervaardig, is ŉ betreklike moderne metode. Op dié wyse is ontbytvoedsel, southappies en hondevoedsel vervaardig. Die metode kan ook aangewend word vir die vervaardiging van gaar mieliemeel. Die graad van gaarheid van die mieliemeel is nog nie deur ons ondersoek nie, maar dit sal afhanklik wees van die spesifieke metode en toestande van poffing.

Pofprosesse word gewoonlik in twee tipes verdeel:[8]

1. Prosesse, by atmosferiese druk, wat berus op die vinnige aanwending van hitte om die nodige, uiters snelle, verdamping van water te verkry.

In die praktyk word die uitgangsmateriaal in water geweek, daarna gekook totdat dit ŉ bepaalde voginhoud bereik het en ten slotte in ŉ oond geplaas en die temperatuur vinnig tot 450°-575°F verhoog. Hierdie verhitting moet baie vinnig geskied en mag hoogstens 30 sekondes duur.

2. ŉ Drukverlagingsproses waarin die druk op oorverhitte, klam partikels skielik verminder word.

Die drukverlaging kan op twee maniere bewerkstellig word:

(a) Die klep van ŉ geslote houer waarin die partikels onder hoë druk verkeer, word oopgemaak sodat die druk op die partikels oombliklik na atmosferiese druk verlaag word. Die apparaat is bekend as ŉ pofkanon.

(b) Die warm materiaal kan vanaf die atmosfeer na ŉ geëvakueerde houer oorgedra word.

Die eerste metode van drukverlaging word gewoonlik in die praktyk toegepas. Die tweede word net in spesiale gevalle gebruik.

Die poffing self word veroorsaak deur die skielike uitsetting van waterdamp (stoom) binne in die partikels. Die partikel behou sy uitgesette vorm deur die dehidrering wat volg op die snelle diffusie van waterdamp uit die partikel.

Poffing deur middel van ŉ kanon veroorsaak ŉ toename in volume van agt- tot sestienvoud by koring en ses- tot agtvoud by rys. Oondpoffing verhoog die volume van rys slegs drie- tot vierkeer.

In dié verband is geen syfers vir mielies beskikbaar nie, maar die pofproses vergroot die volume van mielies aansienlik.

Om die verlangde brosheid te behou, moet gepofde produkte by ŉ voginhoud van hoogstens 3 persent gehou word. Selfs ŉ voginhoud van 5 persent veroorsaak al taaiheid van die produk.

Rou of behandelde grondstowwe kan gebruik word in die pofkanon. As gevolg van die kort verhittingstyd word die proteïene in die materiaal ook baie min gedenatureer.

Die pofkanon self bestaan uit ŉ silindervormige houer (soos die loop van ŉ kanon) wat aan die een kant met ŉ deksel en aan die ander met ŉ drukmeter en ŉ damp-inlaatklep afgesluit is. Hierdie deksel is so gekonstrueer dat die kanon blitssnel geopen kan word. Verhitting word gewoonlik deur middel van eksterne gasvlamme en regstreekse inleiding van oorverhitte stoom bewerkstellig.

Vir die poffing van graan word in die literatuur[8] bv. die volgende metode beskryf: Die verskillende bestanddele word gemeng tesame met soveel water (11-12%) dat ŉ vaste deeg ontstaan. Van hierdie deeg word stukkies afgesny en gerol om dit rond te kry en die pofkanon daarmee gevul. Die kanon word nou met die deksel afgesluit, verhit en damp ingelaat tot die druk ŉ maksimum van 200 lb/vk dm bereik het. Wanneer die verlangde druk bereik is, word die deksel vinnig oopgeskuif en die inhoud van die kanon skiet dan in ŉ opvangapparaat. Die produk is daarna gereed vir verpakking.

Dikwels word gebreekte graan eers geweek en dan gepof.

Met moderner apparate is die proses meer aaneenlopend m.a.w. die verskillende stappe vanaf menging van die grondstowwe tot by verpakking is ononderbroke.

Daar word reeds verskillende gepofte graanprodukte in Suid-Afrika vervaardig en bemark. Die N V N I is van plan om meer studies oor gepofte voedselprodukte in die toekoms te doen.

SLOT-OPMERKINGS

Die soektog na nuwe aanwendings van mielies as voedsel vir die mens sal nog lank voortgesit word omdat mielies so n belangrike deel van ons totale voedselvoorraad verteenwoordig. Dit is egter n moeilike veld van navorsing wat slegs met sukses bekroon kan word indien die ontwikkelde produkte suksesvol bemark kan word. Dit vereis dat die produkte meerendeels relatief goedkoop moet wees, in die publiek se smaak moet val en in die eetgewoontes moet kan inpas. Veral wanneer bemarking onder die Bantoe beoog word, speel die prys van die produkte n belangrike rol.

Die voorbeelde van navorsingsprojekte wat hier genoem is, is voorgelê slegs ter illustrasie van een fase van die Instituut se aktiwiteite ter bevordering van die benutting van Suid-Afrikaanse produkte. Hoewel n aansienlike deel van ons navorsingsaktiwiteite aan mielies gewy word, is dit nie die enigste waaraan aandag gegee word nie. Op soortgelyke wyse doen die Instituut ook navorsing om die benutting van ander landbou-, akkerbou- en visprodukte te bevorder.

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THE AFLATOXIN PROBLEM IN SOUTH AFRICA

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SYNOPSIS

During October 1963 it became known that certain farmers suffered losses after feeding their stock on rations which presumably contained mouldy grain. At about the same time a survey of the fungiflora on the groundnut crop which was being harvested, indicated that the production in certain areas was heavily infected with Aspergillus flavus whilst other areas were relatively free of infection.

A committee of experts was appointed with ministerial approval, under the chairmanship of Dr. B.C. Jansen of Onderstepoort. The terms of reference included the collation of all published knowledge on the problem of mycotoxicosis, particularly aflatoxicosis, and the coordination of future research on this problem.

The development of the problem, measures adopted to curb it and the part played by the C S I R in elucidating certain aspects will be discussed fully in this paper.

SAMEVATTING

Gedurende Oktober 1963 het dit bekend geword dat sekere boere veeverliese gely het nadat hul diere gevoer was op ŉ rantsoen wat vermoedelik verskimmelde graan bevat het. Tegelykertyd het ŉ opname van die skimmelflora op die grondboontjie-oes aangetoon dat die produksie in sekere gebiede swaar besmet was met Aspergillus flavus terwyl ander gebiede relatief vry was van besmetting.

ŉ Komitee van deskundiges onder die voorsitterskap van dr. B.C. Jansen van Onderstepoort is met ministeriële goedkeuring aangestel om o.a. alle kennis i.v.m. mikotoksikose, en in besonder aflatoksikose, te versamel en verdere navorsing daaroor te koördineer.

Die ontplooiing van die probleem, die maatreëls getref om dit te bekamp en die aandeel van die W N N R in die opklaring van sekere aspekte daarvan word in die referaat behandel.

The suspicion that certain moulds are the cause of various forms of poisoning in man and beast has existed for many years. Towards the end of the 19th century it was confirmed that cases of ergotism and poisoning from wheat infected with Gibberella zeae could be attributed directly to the presence of the relevant moulds. Nevertheless, the prevalence of mycotoxicosis passed largely unrecognized and unappreciated in Western countries until 1960 when the spotlight was sharply focussed on this problem. During this year large numbers of turkey poults in the United Kingdom suddenly died of an unknown disease and research forces were mobilised to determine the cause(s) of the mysterious fatalities. The symptoms of the disease appeared to indicate poisoning by ragwort or senecio. The rations consumed by the birds were thoroughly investigated by workers of the Tropical Products Institute[1] in London and by the Unilever Research Laboratory at Bedford. These workers were able to demonstrate that a toxic factor present in the feed was confined to a particular consignment of groundnut meal imported from Brazil. This toxin was shown to be a metabolite of the fungus Aspergillus flavus and was therefore given the name of aflatoxin. Nesbitt et al.[2] proposed that a physico-chemical method based on the fluorescence of the toxin in ultra-violet light be used for the semiquantitative estimation of aflatoxin. They showed that the latter was in fact a mixture of four different compounds. Two of these compounds emitted a blue-purple fluorescence and the other two a green fluorescence in ultra-violet light. The four compounds were therefore designated B_1, B_2, G_1 and G_2. Veterinary researchers devised as a confirmation of the chemical test for aflatoxin a biological test based on the fact that the toxin produced characteristic lesions in the livers of ducklings.

South African researchers, who had since 1961 been studying the problem of the occurrence of toxic moulds on cereal crops, did not fail to appreciate the gravity of the problem. The Microbiology Research Group of the C S I R commenced with a survey of the mycoflora present on the 1963/64 groundnut crop, which was being harvested at that time. It was found that the produce of certain areas was heavily infected with A. flavus and since prevailing weather conditions favoured the development of the fungus, the Oilseeds Control Board was warned that part of the crop might be infected or become infected with aflatoxin. At about the same time the Veterinary Research Institute at Onderstepoort received reports of stock losses by farmers. Investigations quickly established that aflatoxin poisoning was the cause of these losses and the facts were reported to the two Ministers of Agriculture. The latter appointed a committee of experts under the chairmanship of Dr. B.C. Jansen of Onderstepoort to advise them on the problem. The mandate of the Committee included the collation of all existing knowledge on mycotoxicosis and on aflatoxicosis in particular, the co-ordination of further research in this field and the issuing of advice and recommendations to all bodies directly concerned.

At its earliest meetings the Jansen Committee recommended that an emergency laboratory be established to determine the exact degree of infection of the groundnut crop already taken over by the agents of the Oilseeds Control Board but not yet sold. The Board accepted the recommendation, stopped sales immediately and undertook to collect samples for analysis from every stack of groundnuts at each depot. It offered its laboratory and staff for the purpose of conducting analyses, and more chemists were recruited at the C S I R, Onderstepoort, S.A. Bureau of Standards and the Soil Research Institute to expedite the investigation. As the analyses progressed, stacks which were found to be free from infection were released for sale while infected stacks were retained until such time as they could be dealt with. By the end of November 1963 the total tonnage of infected nuts had been established. The Board therefore decided to send a mission to Europe in order to find a market for these nuts and gather more information on the pathological and technical implications of aflatoxin contamination. The Mission was able to sell the available tonnage on the grounds that the average aflatoxin content of the groundnuts did not exceed 2 p.p.m. Such a latitude is permissible because the European balanced feed industry operates on such a vast scale that it is relatively easy to utilize infected groundnut meal in such dilutions that the final concentration of aflatoxin in animal feeds is negligible. It may here be mentioned that the oil expressed from contaminated groundnuts is free from aflatoxin which remains in the presscake.

Through the co-operation of many research institutions in Britain and Holland the Mission obtained a wealth of technical information. It was learnt that the toxicity of aflatoxin B_1 had already been determined and the LD50 ascertained to be in the vicinity of 28γ for ducklings weighing 50 g. (It has since been established that ducks, turkeys, New Hampshire fowls, cattle, pigs, dogs and monkeys are susceptible to aflatoxin, the young animal being in every case more sensitive than the adult). It was also learnt that, of all animals tested, trout are most affected by aflatoxin while sheep are adversely affected only if they are in poor condition.

The question now arises whether human beings are affected by aflatoxin. It is not yet known whether the ingestion of sublethal doses of aflatoxin by humans does, in fact, produce hepatomas — the great question that is at present exercising the minds of workers in this field. If this should prove to be the case, the implications will be extremely far-reaching. Climatic conditions in many parts of Africa and Asia are ideal for the growth of fungal contaminants, and it would be difficult or impossible to store grains and legumes in these areas under conditions which would prevent the development of mould contamination. An indication of the importance attached to this problem by world health bodies is afforded by the world-wide interest shown in a symposium held in the U S A in March, 1964. This symposium was attended by representatives of various health authorities who assembled together to hear the contribution of the foremost scientists in the field of mycotoxicosis. The possible implications of the aflatoxin problem on the South African population are considered so important by the President of the C S I R that he has ordered the establishment of a Division of Toxicology in the National Nutrition Research Institute. In this department the pathological effects of toxic substances present in foods will be studied. The first project, the study of histological changes caused by aflatoxins in different body organs, is already under way. Both light and electron microscopy are being employed and histochemical techniques are being developed for the observation of finer intracellular biochemical changes.

CONTRIBUTIONS MADE BY THE C S I R TO THE KNOWLEDGE OF AFLATOXIN

Two investigations other than the contributions already mentioned have been completed by the C S I R. These investigations comprised the following:

(1) A combined effort by the Microbiology Research Group and the National Chemical Research Laboratory which led to the elucidation of the chemical structure of the aflatoxins (see van der Merwe et al.[3]). A culture of *A. flavus* which had been isolated from South African maize meal was grown on a substrate of maize meal from which the aflatoxins were then isolated, separated and purified. After

various tests on the pure substances a structural formula was proposed for each of the four aflatoxins. These formulae have in the main been confirmed by American research workers[4]. Aflatoxin is a crystalline compound, soluble in chloroform and methanol, stable at temperatures up to $150^{\circ}C$ and decomposed by contact with dilute alkali. Knowledge of the exact conditions under which the fungus produces its toxic metabolite was obtained in the course of this investigation, and this made it possible to suggest precautions against the growth of moulds especially during the storage of grains and legumes.

(2) De Iongh et al.[5] suggested the possibility that aflatoxin present in the feed of domestic animals might find its way into milk, eggs or meat. On investigation, minute quantities of a toxic substance related to the aflatoxins were detected by these authors in milk but not in eggs or meat. This investigation was repeated by Dr. Abrams of Onderstepoort in collaboration with the Division of Food Technology of the National Nutrition Research Institute. A group of cows was fed a daily ration which included 5 lb of groundnut meal containing 8 p.p.m. aflatoxin. The milk of the cows was concentrated and roller dried under vacuum at low temperature. It is possible by the chemical method to detect 0.002γ of aflatoxin, in the prescribed aliquot of test solution, but the dried milk nevertheless gave a negative result. A portion of the milk powder was then fed to chickens at a level of 50 per cent by weight of the total rations. A further portion was extracted with methanol and chloroform and the concentrated extract was given to a batch of test ducklings in suitable daily doses. None of the animals died or showed signs of ill health and no lesions were found in the livers of the birds killed after 10 days for post mortem inspection. The findings of de Iongh et al. were therefore not confirmed in this investigation. However, Dr. Abrams arrived at the interesting conclusion that if the factor present in the milk tested by de Iongh et al. were as toxic to infants as to ducklings, a baby weighing 10 lb would have to drink as much as 27 litres (6 gallons) of milk per day before it could be adversely affected.

FUTURE RESEARCH PLANS

It is common knowledge that *A. flavus* has a very wide distribution in nature and will thrive on wheat, maize and sorghum as well as on legumes such as beans, peas, groundnuts and soyabeans if the storage conditions are favourable for mould growth. It will produce a toxic metabolite under certain conditions, namely a minimum of 9 per cent moisture in the seed, a relative humidity of 80 per cent and a temperature of $8^{\circ}C$ or more, the optimum being about $36^{\circ}C$. Groundnuts appear to be more susceptible to mould infestation than the other commodities mentioned, and in spite of all the precautions taken and the special practices recommended by agricultural advisers, mould-contaminated groundnuts are still being produced. With commendable zeal, the Oilseeds Control Board is actively promoting the interests of the oilseeds industry by sponsoring research at the C S I R on the following lines:

(1) The development of a process by which aflatoxin can be removed from contaminated groundnuts so that oil and groundnut meal free from aflatoxin can be produced. Promising results have already been obtained with a solvent which will simultaneously extract oil and aflatoxin. In the normal refining process where the oil is treated with dilute alkali the latter destroys the aflatoxin which is then removed via the water phase.

(2) If for some reason or other an oil expressing plant cannot readily be adapted to meet the requirements of the modified process, it will be necessary to detoxify any contaminated meal that may be produced. The possibility of extracting the protein from the meal as a cheap toxin-free concentrate is being considered. Such an extract may be used to enrich low-protein foods or, if left in the crude form, to furnish a high-protein ingredient for balanced rations.

(3) Strains of the various moulds present on domestic cereals and legumes will be isolated and screened for toxicity, whether actual or potential. A total of 22 species toxic to day-old ducklings have so far been isolated[6]. More than half of these also caused acute poisoning in albino mice and rats. The toxicology and chemical structure of the active constituents of these toxic metabolites will be studied.

On reflection it is surprising that the discovery of the antibiotic-producing fungi such as the Penicillia did not lead to a systematic consideration of the possibility that fungal metabolites might be produced which are toxic to higher organisms. When it became known that substances are produced by certain fungi which are lethal to micro-organisms it could reasonably have been anticipated that there might be fungal metabolites which are harmful to higher organisms.

Now that the wheels of science have been geared for efficient action the prospects of eradicating the aflatoxin problem are good. Agronomists are confident that they will succeed in preventing mould contamination on the land, and veterinary research has already indicated that the admixture of small percentages of lightly-infected oilcake can safely be allowed in the rations of certain adult animals. It has become increasingly evident, however, that the question of mould contamination in food products needs to be re-assessed, and food processors will be well advised to remain alert to this problem in the future.

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DIE GEBRUIK VAN OLIESAADPROTEÏENE IN MENSLIKE VOEDING

(Met spesiale verwysing na voedsels wat in ander lande gebruik word)

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SYNOPSIS

A review is given of the proteins of the main oil-seeds used in human nutrition. Those protein products prepared from soya-beans are discussed in detail because they may be of importance not only to a future soya-bean industry but possibly also to the present-day groundnut industry in South Africa.

Protein products discussed are those used chiefly (a) as a food as such, (b) as a supplement to other food products and (c) as an additive in food processing for technological reasons.

SAMEVATTING

n Oorsig word gegee van die proteïene van die vernaamste oliesade wat in menslike voeding gebruik word. Slegs dié proteïenprodukte afkomstig van sojabone word uitvoerig bespreek omdat hulle van belang kan wees vir sowel n toekomstige sojabone-industrie as die hedendaagse grondboon-industrie in Suid-Afrika.

Die proteïenprodukte wat bespreek word is dié wat hoofsaaklik gebruik word (a) as n voedsel as sodanig, (b) as toevoegsel tot ander voedselprodukte en (c) as n bymiddel in voedselvervaardiging cm tegnologiese redes.

Die vernaamste oliesade wat vir die vervaardiging van menslike proteïenvoedsels gebruik word is sojabone, grondboontjies, katoensaad en sonneblomsaad. Die belangrikste bestanddele van die sade word in Tabel 1 aangegee. Volledigheidshalwe word die biologiese waarde van die proteïene en die beperkende aminosure ook aangegee. Soos uit die tabel gesien kan word varieer die proteïeninhoud van die geblansjeerde en ontvette oliesade tussen 50 en 63 persent en het ontvette katoensaad die hoogste proteïeninhoud. Weens hul hoë proteïeninhoude kan oliesade en die produkte daaruit berei 'n baie belangrike rol speel in menslike voeding.

Die verhouding van die verbruik van dierlike en plantaardige proteïene in 'n aantal lande word in Tabel 2 aangegee. In die meeste van dié lande is die plantaardige proteïen hoofsaaklik afkomstig van die stapel graanvoedsel, maar in Japan lewer oliesade, veral soja, 'n belangrike bydrae. Om dié rede sal die Japanse voedselprodukte wat uit sojabone vervaardig is, by voorkeur bespreek word.

In 1962 is 1,700,000 ton sojabone in Japan verbruik. Vir menslike voedsel is verbruik 100,000 ton heel soja en 250,000 ton ontvette soja. Een miljoen ton is gebruik vir die produksie van soja-olie. Volgens hierdie gegewens word 'n belangrike gedeelte van die proteïenvoedsel nog steeds uit heel sojabone berei, soos dit ook in vroeër eeue gedoen is. Dit skyn asof die herwinning van die olie eers in die laaste paar eeue bekend geword het.

Die gebruik van oliesadeproteïene kan oor die algemeen in drie groepe verdeel word: (a) as 'n voedsel wat as sodanig in die normale eetgewoontes inpas, (b) vir die proteïenaanvulling van ander voedselprodukte en (c) as bymiddel wat om tegnologiese redes by verwerkte voedsels gevoeg word.

VOEDSELS UIT OLIESADE BEREI

Die voedselsoorte wat hoofsaaklik uit oliesaadproteïene vervaardig word, is ook van die oudste in die geskiedenis van menslike voeding. Hoe die Chinese hul normale dieet met sojabonemelk, -kaseïen en -pasta aangevul het is alreeds in die jaar 2838 v.C. op skrif gestel. Selfs vandag nog gebruik baie van die Oosterse volke plantaardige proteïenprodukte as alledaagse voedsel. Sommige van dié produkte het selfs inslag gevind in lande soos die V.S.A. en Kanada, wat bv. verpakte Miso of Tofu uit die Ooste, veral Japan, invoer.

Die Japanse sojabonevoedsels kan in twee groot groepe verdeel word, naamlik gefermenteerde en nie-gefermenteerde voedsels. (Die samestellings van voedsels van die twee groepe word in Tabel 3 aangegee).

Gefermenteerde voedsels

Daar is verskeie soorte gefermenteerde sojabonevoedsels soos bv. Miso, 'n souterige sojaboonpasta; Shoyu, 'n sojaboonsous wat as 'n geursel gebruik word en Natto, stukkies sojaboon wat bedek is met 'n taai sap wat deur fermentasie 'n mufagtige smaak verkry. Hierdie produkte bevat almal nog baie van die bestanddele van die sojaboon en die proteïenbestanddele is nie spesiaal geëkstraheer nie.

Nie-gefermenteerde voedsels

Vir die vervaardiging van die tweede groep, die nie-gefermenteerde sojaboonvoedsels, word die proteïengedeelte min of meer volledig geëkstraheer. In die vervaardigingsproses word gebruik gemaak van die amfotere aard van die proteïenmolekuul wat dit moontlik maak om dit in kolloïedale vorm uit oplossings neer te slaan. Die vernaamste produk wat so vervaardig word is Tofu, waaruit weer verskillende ander produkte vervaardig word soos bv. Kori-Tofu, Yuba, ens.

Die vervaardiging van Tofu en Tofu-produkte

Die vervaardiging van Tofu en die ander produkte geskied volgens die prosedure soos in Figuur 1 skematies aangegee is. Hierdie proses het reeds twaalfhonderd jaar gelede uit China na Japan gekom en Tofu voorsien vandag nog sowat 3-5% van die totale proteïeninname van die Japanse bevolking. Vars Tofu word algemeen in stukke van 300 g gesny en so verkoop of andersins in die vorm van n wors in Saran verpak. Die sojamelk wat vir die vervaardiging van verpakte Tofu gebruik word bevat 10% vaste stowwe en die kalsiumsulfaat, soms saam met polifosfate, word regstreeks voor vulling in blikke toegevoeg. Omdat Tofu, asook verpakte Tofu, egter maklik bederf, is daar gepoog om ander produkte met 'n beter houbaarheid te vervaardig, soos bv. Kori-Tofu, n ontwaterde produk. Die jongste produkte is ingemaakte Tofu wat deur die Towa Shokuryo Co. vervaardig word en ook gedroogde Tofu-poeier.

In die vervaardiging van dergelike Tofu-produkte word sojabone oornag in water geweek en dan met toevoeging van water in n steen- of karborundummeul gemaal. Die mengsel (gewigsverhouding water : bone = 10:1) word dan vir n paar minute by 100°C gekook en die melk, wat 5-6% vaste stowwe bevat, word in n soort vrugtepers afgeskei. Die sojamelk word voor verdikking ietwat gekonsentreer (tot omtrent 10% vaste stowwe) om toe te laat vir die verdunning wanneer die kalsiumsulfaatoplossing later toegevoeg word; daarna weer gefiltreer en in n dun lagie gepasteuriseer en afgekoel. Daarna word 0.4% kalsiumsulfaatoplossing toegevoeg en die mengsel dadelik in n blik (van 1 lb) gevul, onder vakuum verseël en vir 17 minute by 120°C (totale tyd $1\frac{1}{2}$-2 uur) in stoom gesteriliseer en daarna afgekoel.

Gebakte Tofu

n Ander produk wat as sodanig en ook ingemaak verkoop word, is Abura-Age. Soos uit Figuur 1 gesien kan word, word dit uit gewone Tofu vervaardig. Die Tofu word eers in koue water gedompel om vry kalsiumsoute te verwyder, dan word die stukke in doeke gehul en in spesiale kaste, van omtrent 30 x 20 x 10 cm, gepers. As daar omtrent 50% vog in die Tofu oor is, word dit in stukke van omtrent 5 x 10 x 2 cm gesny en vir nog n kort tydperk op bamboesmatte gelê sodat nog vog verlore kan gaan. Die stukke word dan in n spesiale bakmasjien in raapolie vir omtrent 15 minute by n temperatuur van 150-160°C gebak. By die vervaardiging van Abura-Age moet daar toegesien word dat die proteïene nie gedurende die proses te ver gedenatureer word nie anders word die Abura-Age poreus as dit gebak word en swel dit nie uit nie. Ontvette sojameel kan ook gebruik word vir die vervaardiging van hierdie produk.

'n Ander produk is Gan-Modoki, wat as Abura-Age wat groente bevat beskryf kan word.

Kori-Tofu

Kori-Tofu is n produk wat oorspronklik hoofsaaklik gedurende die winter in die noorde van Japan vervaardig is maar vandag word moderne bevriesingsapparate vir die bereiding daarvan gebruik. Vir die stolling van die sojamelk word kalsiumchloried gebruik waardeur Tofu met ŉ bietjie growwer struktuur en 80% vog verkry word. Nadat dit in stukke gesny is, word dit by -15^oC of -10^oC vir 20 minute of 2-3 uur respektiewelik bevries en daarna vir 2-3 weke by -1^o tot -3^oC gehou. Na dié tyd, waartydens sekerlik ŉ stadige denaturasie van die proteïen plaasvind, word die stukke by kamertemperatuur ontdooi en die meeste water deur middel van ŉ sentrifuge of met rubberwalse verwyder. Die stukkies is sponsagtig en oplosbare soute kan maklik verwyder word deur hulle vir 1 tot 2 uur in water te was. Daarna word die stukkies stadig vir 10 uur by 70^oC gedroog. Voordat Kori-Tofu verpak word, word dit vir omtrent 2 uur met ammonia behandel sodat die stukke later makliker in water swel as dit gebruik word.

Yuba is die duurste sojaboneproteïen produk. Dit word verkry deur sojamelk te verwarm, die proteïenfilm wat op die oppervlakte vorm elke keer te verwyder en in dun lagies te droog.

Kinugoshi kan ook nog vermeld word. Dit is meer ŉ heel sojaboneproduk omdat die wei nie verwyder word nie. Die melk word met slegs 5 dele water in plaas van die gebruiklike 10 dele water berei, verwarm en 0.4% kalsiumsulfaatoplossing toegevoeg. Die mengsel word ook gebruik vir verpakte Tofu, bv. in worsies van 200-300 g wat nadat dit gestop is nog vir 40-60 minute by 90^oC in ŉ waterbad verwarm word.

Melksurrogaat uit oliesade berei

In verband met sojamelk kan nog gemeld word dat daar in Hongkong ŉ fabriek is wat 2 soorte sojamelk vervaardig, nl. gewone sojamelk en sojamelk met ŉ moutgeur. Die fabriek vervaardig vandag 600 miljoen half-pint bottels sojamelk per jaar. Die prys per bottel is 10 sent en dit verkoop uitstekend. In die proses word omtrent 65% van die sojaproteïen en 75% van die vet geëkstraheer en die afval, wat 90% water bevat, word as veevoer verkoop.

In die vervaardiging van hierdie melk word die sojabone vir 8 tot 10 uur in water geweek. Die water word elke uur hernu. Die bone word dan gemaal en gepers en die filtraat so verkry word vir 20 minute gekook. Daarna word toevoegings van bv. suiker en vitamienolie ingemeng, die mengsel gehomogeniseer, in bottels gevul en verseël en dan vir nog 12 minute by 150^oC gesteriliseer.

Melk wat 3.3% proteïen en 4.2% vet bevat, word in Indië ook uit grondboontjies vervaardig. In die vervaardiging word die proteïen van die vetvrye meel met behulp van ŉ klein hoeveelheid alkali opgelos. Die onoplosbare koolhidrate word verwyder en die proteïen met behulp van suur, hitte, kalsium- of magnesiumsoute neergeslaan.

By die afsaksel wat by ŉ pH van 6.6-6.8 verkry word, word natriumsitraat, natriumfosfaat, natriumbikarbonaat en kalsiumglukonaat (61 mg kalsium in 100 g melk) gevoeg of dit word vir 45-60 minute met kalkwater verwarm (60^oC) en 0.26 % kalsiumfosfaat en 0.11% natriumsitraat toegevoeg. Daarna word dit gehomogeniseer. Uit 1 lb grondboontjiepitte word 8-9 lb melk verkry.

Daar mag in hierdie verband gemeld word dat Tempeh, ŉ gefermenteerde, gedroogde voedselproduk wat in die Filippyne geëet word, ook van sojamelk gemaak word. In die afgelope jare is baie navorsing ook in die V.S.A. nierop gedoen. In die vervaardigingsproses word sojamelk met Aspergillus oryzae, of ook Rhizopus oligosporus of

Neurospora sitophilis, afhangende van die temperatuur, gefermenteer.

Nuwe sojaprodukte

Daar is verskillende nuwe sojaprodukte wat deur die voedselnavorsingsinstituut in Tokio ontwikkel is, nl. kits-Tofu, sojabonemeel met n hoë proteïeninhoud, n sojaproteïengel, sojajogurt en sojakaas. Kits-Tofu word gemaak deur die sproeidroging van sojamelk waarby kalsiumsulfaat en polifosfate gevoeg is. Die poeier word ook in die vervaardiging van verpakte Tofu en in die bereiding van n meer gekonsentreerde sojamelk gebruik.

n Ander nuwe ontwikkeling wat nog van groot belang mag word is n eetbare (gespinde) vesel wat in die V.S.A. van geïsoleerde sojaproteïen vervaardig word. Die tekstuur word deur verstewigingsmiddels of deur ensieme gekontroleer. Die filamente van die vesel word deur sg. bindmiddels soos bv. alginate, gom, ens. saamgehou. Die produk is goed verteerbaar en omdat dit neutraal van smaak is, kan dit nie alleenlik bv. by n vleisproduk gevoeg word nie, maar ook by enige proteïenproduk van enige verlangde struktuur, tekstuur of aroma. Sodanige produkte kan geberg word deur verkoeling of bevriesing of kan ook gedroog of ingemaak word.

OLIESAADPRODUKTE AS PROTEÏENSUPPLEMENTE

Benewens die ontvette meel verkry van oliesade (met 10-50% proteïen) word ook kommersiële proteïenkonsentrate met omtrent 70% proteïeninhoud, asook geïsoleerde proteïene, as voedselsupplemente gebruik.

Die proteïenkonsentrate word meesal uit heksaangeëkstraheerde oliesade vervaardig en soos reeds hierbo beskryf is, met water of alkali geëkstraheer. Die proteïen (omtrent 88% van die geëkstraheerde proteïen) word uit die filtraat by die isoëlektriese punt met suur neergeslaan en dan regstreeks gedroog. Wanneer die wateroplosbare proteïenaat as produk verkies word, word die suur met alkali geneutraliseer. In die geval van geïsoleerde proteïen word die vlokkies eers ontsuiker deur ekstraksie (by pH 4-5) met water-bevattende organiese oplosmiddels of deur waterekstraksie van vlokke wat met stoom behandel is, en daarna gedroog (sien Figuur 2).

Die mele van oliesade word dikwels in n mengsel met ander produkte soos graan of afgeroomde melkpoeier gebruik as n proteïenryke supplement. n Supplement wat in Peru ontwikkel is, bevat byvoorbeeld 30 of 35% katoensaadmeel en het n proteïeninhoud van ongeveer 26%. n Indiese meerdoelvoedsel bestaan weer bv. uit grondboontjiemeel (60%), kiker-ertjiemeel (20%) en afgeroomde melkpoeier (20%) of uit grondboontjie-proteïenisolaat (52%) en afgeroomde melkpoeier (48%). Incaparina, n produk wat in Guatemala ontwikkel is, is n mengsel wat bestaan uit die mele van katoensaad, sorghum en mielies en is met vitamien A en kalsiumsoute verryk. n Ander INCAP-mengsel bestaan weer uit gebakte grondboontjiemeel gemeng met 10 of 20% katoensaadmeel. Nog n INCAP-mengsel weer bevat meel van katoensaad (38%), sorghum (28%), mielies (28%), gedehidreerde blare (3%) en voedselgis (3%).

In die Filippyne word tot 38% van n mengsel van kokosneutmeel en cassavameel in gebakte goedere gebruik. Die kokosneutmeel bevat 23% proteïen.

In die Libanon word tans navorsing gedoen om goedkoop sesamproteïenprodukte te vervaardig.

OLIESAADPROTEÏEN AS BYMIDDEL IN VOEDSELVERWERKING

Voorbeelde van proteïene wat as bymiddel in die vervaardiging van voedselprodukte om rede van die fisiese eienskap van die proteïen gebruik word, is die volgende:

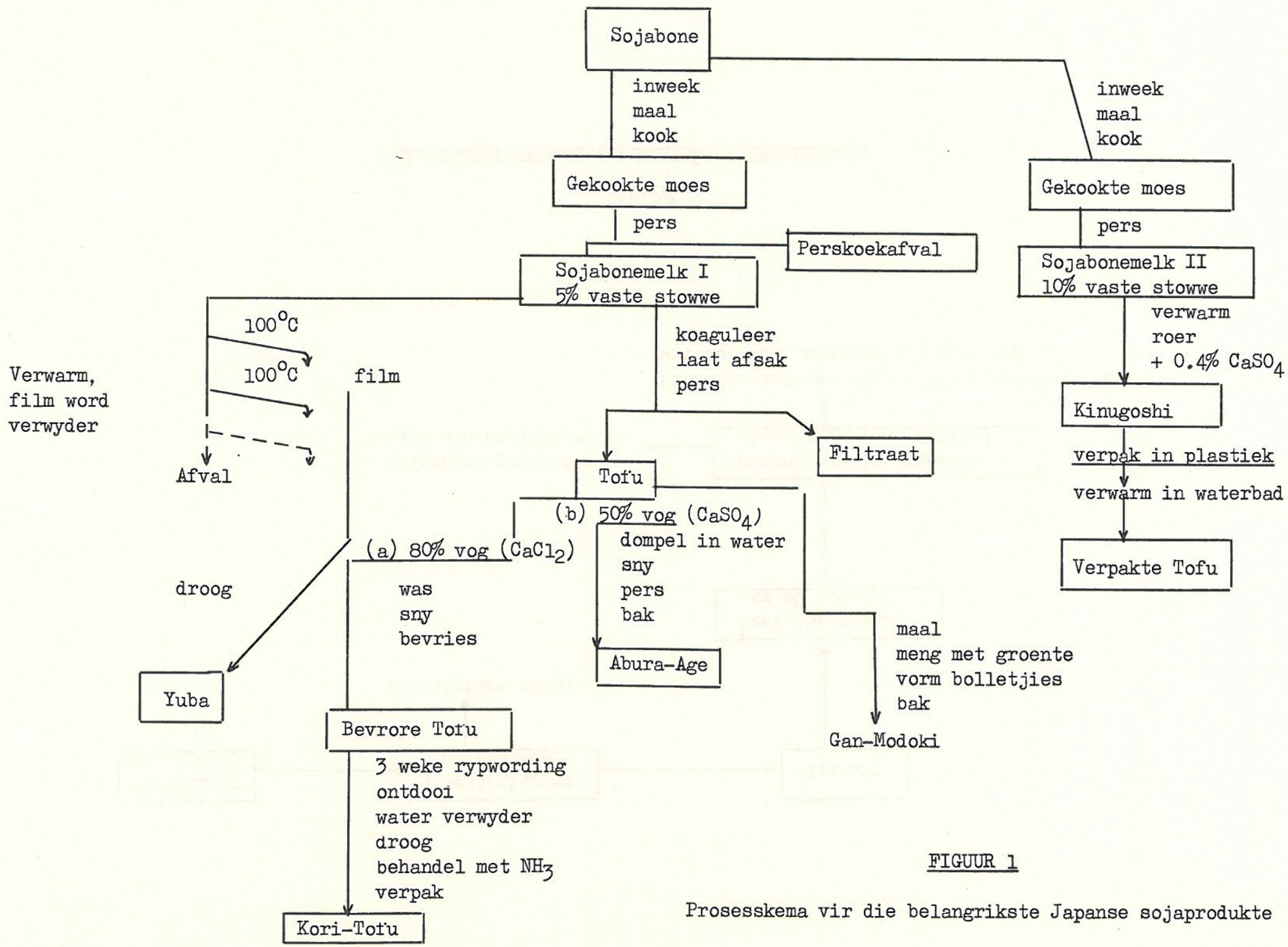
(i) Gelsoy, is 'n ongedenatureerde sojaproteïen. Vanweë die feit dat die proteïen water goed bind en ook goed emulsifiseer, word dit gebruik in ingemaakte vleis, worsies en vleisbrood asook in meringues en lae-vet bevrore nageregte.

(ii) 'n Pepsien-gehidroliseerde proteïen word gemaak om klitsmiddels te vervaardig vir gebruik in die vervaardiging van fudge, sponslekkers, koekversiersels, ens.

SLOTOPMERKINGS

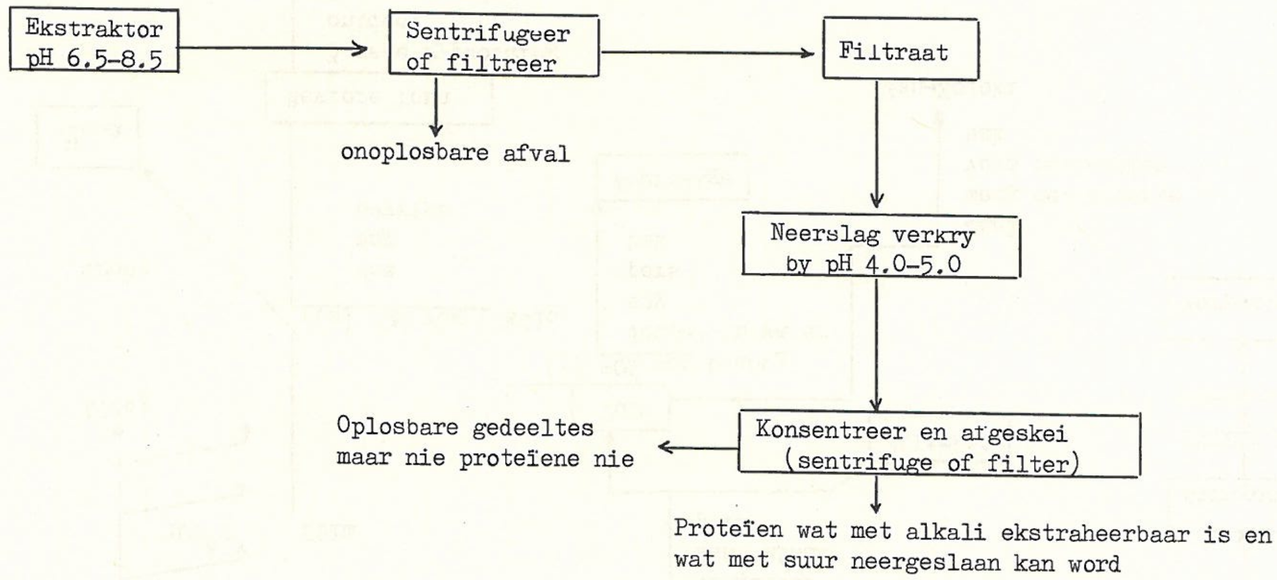
Gebruik van planteproteïene in die vorm van die produkte wat beskryf is of van ander wat nog ontwikkel mag word het reeds veel bygedra en kan nog meer bydra om die wêreldtekort aan proteïenvoedsels te verlig.

Sommige van die proteïenprodukte wat hier beskryf is, sal moontlik ook in Suid-Afrika 'n mark kan vind en hier vervaardig kan word. Daar is egter navorsing nodig om die smaak van die produkte meer by die Westerse smaak en dié van ons Bantoebevolking aan te pas en, verder, om na te gaan of ons grondboontjies as grondstof vir die bereiding van die produk gebruik kan word. Navorsing hieroor word tans deur ons Afdeling Voedseltegnologie gedoen. Langs dié weg kan moontlik nie net 'n nuwe nywerheid opgebou word nie, maar sal so 'n nywerheid veel kan bydra tot die oplossing van ons eie voedingsprobleme.



FIGUUR 1

Prosesskema vir die belangrikste Japanse sojaprodukte



FIGUUR 2

Algemene prosedure in proteïenvervaardiging

TABEL 1

Die wêreldproduksie en die benaderde samestelling van oliesade wat tegnologies die belangrikste is

Oliesaad	Wêreldproduksie (miljoen ton)*	Proteïen (Nx6.25) %	Olie %	As %	Doppe %	Proteïen in geblansjeerde en ontvette saad %	Biologiese waarde van proteïene in meel	Beperkende aminosure
Sojabone	27.8	43.0	20.0	5.0	8	52	65	Metionien, (lisien)
Katoensaadpitte	16	32.5	36.4	4.7	-	63	62	Lisien
Grondboontjiepitte	14	30.3	50.0	3.0	20-35	57	56-59	Lisien, (metionien)
Sonneblomsaad	-	19.5	29.3	3.4	43	61	64	Lisien
Saffloer	-	13.5	32.5	3.2	49	63	-	-
Sesamsaad	-	25.0	50.0	5.0	4	50	62	Lisien

*Sluit nie die produksie van die USSR in nie

TABEL 2

Die daaglikse per capita verbruik van dierlike en plantaardige proteïene (FAO, 1956)

Land	Getal inwoners (miljoen)	Proteïen verbruik	
		Dierlike (g)	Plantaardige (g)
Suid-Afrika	12	29	46
Japan	87	13	45 (1962 totaal* 70.8g proteïen waarvan 10% sojaproteïen was)
Guatemala	3	13	43
Peru	9	13	43
Nederland	10	41	39
Verenigde Koninkryk	51	44	41
V.S.A.	160	63	29
Australië	9	63	29
Kanada	14	63	29

*Volgens gegewens verstrek deur die Ministerie van Gesondheid, Japan.

TABEL 3

Samestelling van Japanse sojaboneprodukte*

Produkte	Vog %	Proteïen (Nx5.7) %	Vet %	Koolhidrate %	Ca mg%	Sout %	Prys vir 100 g proteïen in jen	Prys vir 100 g produk in jen (100 jen = R2)
(a) Gefermenteerde								
Miso, rooi, gesout	50.0	14.0	5.0	14.3		11.7	110	14
Miso, wit, soet	49.0	10.0	1.7	30.8		5.3	-	-
Shoyu, donker	72.2	6.9	0.6	2.0		18.0		
Shoyu, lig	71.3	5.3	0.4	3.0	-	20.0	100	7
Tamari	68.4	12.0	1.1	0.5		18.5	-	-
Natto	58.5	16.5	10.0	10.1		-	90	15
Hanno-Natto	38.1	25.9	12.4	9.2		9.8	-	-
(b) Nie-gefermenteerde								
Tofu, gewone	88.0	6.0	3.5	1.9	120	0.6	115	7
Abura-Age	44.0	18.6	31.4	4.5		1.4	160	30
Kara-Age	3.6	27.0	66.3	-		1.2	210	60
Gan-Modoki	64.0	15.4	14.0	5.1	270	1.4	115	18
Atsu-Age	79.0	10.1	7.0	2.8		1.1	-	-
Yuba	8.7	52.3	24.1	11.9		3.0	320	170
Kori-Tofu	10.4	53.4	26.4	7.0	-	2.6	70	87

*Volgens Y. Sakurai

TABEL 4

Opbrengs van die verskillende proteïenprodukte uit 10 kg sojabone

Produk	kg
Sojabonemelk	
(a) met 5% vaste stowwe	100
(b) met 10% vaste stowwe	45
Tofu	40-50
Abura-Age	50
Gan-Modoki	65
Kori-Tofu	45-50
Yuba	5.5
Kaas	50
Geprosesseerde sojaproteïen (vir vispasta)	30
Miso	33
Shoyu	50
Natto	22

EKONOMIESE EN LANDBOUKUNDIGE ASPEKTE VAN DIE OLIESADENYWERHEID
ECONOMIC AND AGRICULTURAL ASPECTS OF THE OILSEEDS INDUSTRY

N.P.J. Kriek

Oliesadebeheerraad - Oilseeds Control Board

SAMEVATTING

Oliesade, dit wil sê grondbone en sonneblomsaad, is aanvanklik op klein skaal verbou - grondbone, die belangrikste van die twee produkte, hoofsaaklik vir eetdoeleindes. ŉ Nywerheid vir die uitpers van olie is plaaslik gevestig voordat voldoende oliesade vir persdoeleindes geproduseer is en die bedryf moes vir sy grondstowwe staatmaak op invoer, hoofsaaklik uit Indië. Na die Tweede Wêreldoorlog is die verbouing van oliesade en die aanplanting van veral grondbone in nuwe gebiede aangemoedig. Die toename in produksie was fenomenaal met die gevolg dat oliesade nie meer ingevoer word nie; inteendeel - Suid-Afrika is ŉ netto-uitvoerder van oliesade, waaronder handuitgesoekte grondbone van uitstekende gehalte. Oliesade verteenwoordig ŉ belangrike en selfs onontbeerlike deel van die Suid-Afrikaanse ekonomie. In sommige gebiede is grondbone die belangrikste kontantgewas wat verbou word. Grondbone is egter besonder vatbaar vir verskeie plantsiektes en ook onderhewig aan swambesmetting, en gevolglik het grondboonprodusente met vele moeilikhede te kampe.

SYNOPSIS

Oilseeds, i.e. groundnuts and sunflower seed, were initially planted on a small scale. Groundnuts, the more important of the two products, were cultivated mainly for eating. An oil expressing industry was established locally before sufficient oilseeds were produced for crushing purposes and the industry had to rely on imports, mainly from India, for its raw materials. After World War II, the production of oilseeds and especially of groundnuts in new areas were encouraged. The increase in production was phenomenal and today oilseeds need no longer be imported. On the contrary, South Africa is now a net exporter of oilseeds including hand-picked selected groundnuts of excellent quality. Oilseeds constitute an important and even indispensable part of the South African economy. Groundnuts are the most important cash crop which can be cultivated in certain areas. They are however, very vulnerable to various plant diseases and are also subject to mould infestation, hence groundnut producers have to contend with many difficulties.

Tot ongeveer die jaar 1900 is grondbone op klein skaal langs die Natalse kus geproduseer, slegs vir eie verbruik as eetbone. Daarna word grondbone in ander gebiede geplant en word dit op die Springbokvlakte op kommersiële skaal verbou om in die plaaslike vraag na eetgrondbone te voorsien en vir gebruik as rantsoene vir Bantoes in die myne werksaam. Die eerste fabriek vir die verwerking van grondbone vir menslike verbruik, in die vorm van gebakte en gesoute grondbone, is in 1923 te Duiwelskloof opgerig deur ene William Alderton. ŉ Jaar later word die onderneming verskuif na Potgietersrus waar Kap. Cant, wat tans nog by die prosessering van grondbone betrokke is, by die firma aansluit. Etlike jare later, gedurende 1928, het die firma Alderton Beperk, ŉ verwerkingsfabriek vir grondbone aan die Witwatersrand begin. Die besigheid op Potgietersrus, het egter nog as ŉ selfstandige onderneming voortgegaan. Die besighede, Alderton Ltd op Randfontein en Alderton (Potgietersrus) (Edms.) Bpk. - hoewel hulle aan verskillende eienaars behoort - is twee vertakkinge van die grondboonbakkery wat op heel klein skaal onder ŉ maroelaboom begin is.

Uniek van die oliesadenywerheid is die feit dat ŉ vervaardigingsnywerheid vir die ekstraksie van plantaardige olies in die Republiek opgerig is nog voordat die verbouing van oliesade vir oliepersdoeleindes op enige noemenswaardige skaal onderneem is. Die ontstaan van die oliepersnywerheid dateer terug na die beginjare van die Eerste Wêreldoorlog toe die eerste fabriek vir die persing van oliesade, soos grondbone en sonneblomsaad, deur Lever Bros. S.A. (Pty) Ltd in Durban opgerig is.

Vanweë die feit dat grondbone vir persdoeleindes van Indië en ander tropiese lande teen laer pryse as die plaaslike ekonomiese produksiepryspeil ingevoer kon word en omdat die plaaslike produksie van grondbone hoofsaaklik op die voorsiening van eetvariëteite toegespits was, was die persnywerheid hoofsaaklik afhanklik van oorsese lande vir genoegsame grondstofvoorrade en het grondboneproduksie gevolglik stadige vordering gemaak. Die gevolg was dat die produksie van oliesade in Suid-Afrika nie tred gehou het met die sneltoenemende behoeftes van die groeiende oliepersnywerheid nie.

Die moeilikhede ondervind met die bemarking van oliesaadoeste, veral grondbone, gedurende die twintiger- en depressie jare, het produsente genoodsaak om ŉ oplossing in georganiseerde en gesamentlike bemarking te soek.

Aanvanklik het koöperatiewe organisasies en twee privaat handelaars in die Noord-Transvaal, toendertyd die enigste belangrike grondboneproduserende streek, die hantering en bemarking waargeneem. Die organisasies tesame met verteenwoordigers van ander produsente en kopers van oliesade, het in 1934 die Grondboneprodusente Adviserende Komitee gestig om amptelike erkenning en ondersteuning te kry. Die Komitee het in oorleg met die Departemente Landbou en Handel en Nywerheid verkooppryse van surplus grondbone aan die plaaslike persnywerheid bepaal.

Ten einde die nywerheid gedurende die depressiejare 1930/35 te help, het die Regering nie alleen die invoerregte op sade en plantaardige olies verhoog nie, maar verorden dat geen permitte vir die tolvrye invoer van grondbone aan persers toegestaan sou word alvorens bewys gelewer is dat die beskikbare kwota plaaslike grondbone opgeneem is nie.

Hierop het ŉ vinnige uitbreiding van die oliepersnywerheid gevolg en na beraming was die nywerheid teen 1938 in staat om in die totale binnelandse benodigdhede aan eetbare olies te voorsien.

Grondboneverbouing het egter geen onmiddellike reaksie op die beskermende maatreëls getoon nie maar, hoewel wisselvallig, het grondbonelewerings vir persdoeleindes, nogtans toegeneem van 2,200 ton in 1935 tot 5,438 ton in 1939. Dit was egter 14.6% en 16.5% onderskeidelik, van die hoeveelhede grondbone gedurende daardie jare gepers.

Gedurende Wêreldoorlog II het die plaaslike oliesaadnywerheid verdere aanmoediging ontvang en is die weg gebaan vir verdere uitbreiding. Produksie van oliesade het egter geen toename getoon nie en was die 1945/46 oes inteendeel selfs benede die 1938/39 peil. Op hierdie stadium is regeringsbeheer onder oorlogsmaatreëls ingestel ten einde ŉ eweredige verspreiding van landbougrondstowwe, insluitende grondbone, te verseker en is die Direktoraat van Voedselvoorrade in 1946 gemagtig om die distribusie van grondbone en later ook die van sonneblomsaad, oor te neem.

Dit het om verskeie redes duidelik geword dat die toevoer van grondbone uit Indië en die Verre Ooste, mettertyd sou verdwyn en vanweë die algemene tekort aan olie-draende grondstowwe en vette, het die Regering van die Republiek besluit om ernstige aandag aan die vraagstuk te skenk en is ŉ veldtog vir die verhoogde produksie van grondbone en sonneblomsaad in die Republiek geloods.

Die skema was besonder suksesvol en grondbone is nou ook in ander gebiede, bv. Noordwes-Vrystaat, Vaalharts en Wes-Transvaal geproduseer.

Dit het ŉ aansienlike toename in produksie teweeggebring. Met die vermeerderde produksie is aangedring op ŉ eenkanaal-bemarkingskema en is die Oliesadebeheerraad in 1952 kragtens die bepalings van die Bemarkingswet 1937 (Wet 26 van 1937), soos gewysig, ingestel en sedertdien was die ontwikkeling van die oliesadebedryf fenomenaal, soos uit onderstaande tabel duidelik blyk:-

PRODUKSIE VAN GRONDBONE EN SONNEBLOMSAAD IN DIE REPUBLIEK VAN SUID-AFRIKA

1946/47 - 1963/64 : 2,000 LB. EENHEDE

BEMARKINGSEISOEN	GRONDBONE (op gedopte basis)	SONNEBLOMSAAD
1946/47	8,300	nie beskikbaar nie
1947/48	21,000	9,600
1948/49	56,000	40,950
1949/50	53,000	28,000
1950/51	67,000	29,800
1951/52	80,000 *	50,850
1952/53	79,600 *	53,473 *
1953/54	96,900 *	53,927 *
1954/55	141,728 *	56,377 *
1955/56	137,377 *	57,794 *
1956/57	157,073 *	70,344 *
1957/58	127,428 *	82,187 *
1958/59	98,244 *	75,746 *
1959/60	133,436 *	109,283 *
1960/61	146,859 *	98,850 *
1961/62	188,093 *	122,616 *
1962/63	131,307 *	107,281 *
1963/64	192,000 **	107,000 **

* Werklike ontvangste van agente van die Raad.

** Skatting.

Benewens die ongeveer 14,000 ton grondbone wat jaarliks hul weg vind na die plaaslike eethandel en ongeveer 9,000 ton wat as saad aan produsente verskaf word, bied die binnelandse persbedryf die grootste plaaslike afset vir grondbone. Namate produksie gedurende die afgelope dekade groot uitbreiding ondervind het, het ook die oliepers- en verwante bedrywe geweldige ontwikkeling en groei ondergaan en vorm hierdie bedrywe vandag 'n belangrike en selfs onontbeerlike onderdeel van die Suid-Afrikaanse ekonomie. Tans is die land geheel en al selfvoorsienend wat betref sy behoeftes aan oliesade, beide vir eet- en persdoeleindes.

Die sonneblomsaadoes - behalwe vir onbeduidende uitvoere - word in sy geheel deur persers opgeneem terwyl groot hoeveelhede grondbone, soos in onderstaande tabel aangedui, jaarliks deur oliepersers verwerk word - eerstens om te voorsien in die steeds groeiende binnelandse behoeftes aan eetbare kookolies, bakvette en margarien en tweedens, om te voldoen aan die steeds toenemende vraag na proteïndraende oliekoek en - meel as een van die belangrikste bestanddele van gebalanseerde voermengsels vir vee, varke en pluimvee. Die jaarlikse binnelandse verbruik van eetolies beloop tans bykans 50,000 ton en hierbenewens word nog enigiets van 10,000 ton tot 20,000 ton eetbare olie deur oliepersers na verskillende dele van die wêreld uitgevoer.

Sedert die ontstaan van die Raad is 'n bestendige en winsgewende mark opgebou vir handuitgesoekte grondbone in die Verenigde Koninkryk, die Vasteland van Europa, Kanada en Nieu-Seeland. Die geweldige populariteit van Suid-Afrikaanse eetgrondbone in hierdie oorsese marke kan hoofsaaklik toegeskryf word aan die besondere smaak en geurigheid van ons produk asook die hoë kwaliteit en gesondheidstandaarde wat deurgaans ten opsigte van uitvoere gehandhaaf is.

Onderstaande tabel toon die afset van grondbone, sowel plaaslik as uitvoere, gedurende die afgelope aantal seisoene:-

TOTALE AFSET VAN GRONDBONE EN SONNEBLOMSAAD IN DIE PLAASLIKE- EN UITVOERMARKTE : JAARLIKS 1953/54 - 1963/64 (2,000 LB. EENHEDE).

SEISOEN	PLAASLIK Grond-bone			UITVOER Grond-bone			TOTAAL
	Grond-bone	Sonneblom-saad	Totaal	Grond-bone	Sonneblom-saad	Totaal	
1953/54	36,017	53,430	89,447	59,552	-	59,552	148,999
1954/55	49,654	46,862	96,516	84,165	9,037	93,202	189,718
1955/56	43,997	55,985	99,982	92,941	1,086	94,027	194,009
1956/57	43,424	65,983	109,407	112,608	4,010	116,618	226,025
1957/58	41,211	74,507	115,718	80,522	7,589	88,111	203,829
1958/59	41,667	71,610	113,277	64,352	3,669	68,021	181,298
1959/60	41,381	102,897	144,278	90,013	5,981	95,994	240,272
1960/61	50,852	91,627	142,479	96,393	6,917	103,310	245,789
1961/62	52,754	107,975	160,729	128,004	13,877	141,881	302,610
1962/63	69,361	101,074	170,435	68,396	5,937	74,333	244,768
1963/64	67,447	103,617	171,064	122,600	3,552	126,152	297,216

NOTAS: (i) Syfers weergegee op 'n basis van uitgedopte grondbone.

(ii) Oordragte is ingesluit by die seisoen waarin dit werklik verkoop is.

(iii) Saadverkope volgens die permitstelsel is nie ingesluit nie.

Gedurende die 1963/64 uitvoerseisoen is by wyse van eet- en persgrondbone-uitvoere R9,180,800 aan buitelandse valuta verdien.

Hoewel sonneblomsaad in sekere gebiede, veral die Oostelike Transvaalse Hoëveld, reeds goed gevestig is, word die produk in baie dele nog as ŉ vangoes (catch crop) beskou wat net geplant word as ander oeste soos mielies reeds goed gevestig is en klimaatstoestande gunstig is vir laat aanplantings van sonneblomsaad, of as die reëns baie laat kom en ander gewasse nie meer geplant kan word nie.

In teenstelling hiermee, is grondboneproduksie, die belangrikste van die twee gewasse, reeds goed gevestig, veral in die Noord en Noord-Westelike Transvaalse Bosveld, Wes-Transvaal, Noordwes-Vrystaat, Noord Kaapland - veral Vaalharts-, Vryburg- en Mafeking-distrikte.

In die Noord-Westelike Vrystaat, Wes-Transvaal en Vaalharts gebiede skakel grondboneverbouing goed in by die wisselboustelsel wat toegepas word. In die Transvaalse Bosveld- en die Molopo-gebied van Noord-Kaapland, wat by uitstek beeswêreld is, is grondbone die belangrikste kontantgewas wat, afhangende van die reënval, suksesvol verbou kan word. Die grondboontjiepitte word verkoop terwyl die lowwe as uiters waardevolle veevoer gebruik word. Feit is dat produsente in die gebiede meer waarde heg aan die hooi as aan die grondboontjiepit self.

Wat die landboukundige aspek betref, dien daarop gelet te word dat grondboneverbouing nie ŉ maklike taak is nie. Vanaf ploegtyd moet sorgvuldig te werk gegaan word - die lande moet goed voorberei word, saad goed behandel en op die regte tyd geplant word. Grondboontjielande moet gereeld geskoffel word aangesien die gewas nie saam met onkruid groei en ŉ goeie oes lewer nie. Die gewas is besonder vatbaar vir verskeie plantsiektes soos rosette, blaarvlek en stam-, neut- en wortelvrot, wat aansienlike skade kan veroorsaak. Rosette was die oorsaak dat die 1958/59 grondbone-oes, wat volgens aanplantings aansienlik meer moes wees, slegs 98,000 ton was.

Waar die Suid-Afrikaanse grondboneprodusent nie toegerus is om, soos in die V S A en Australië gedoen word, grondbone meganies uit die grond te haal en te droog nie, word heelwat moeilikhede veral met die droging ondervind. Baie arbeid is nodig om grondbone uit te haal en in hopies op die lande te pak. Indien die hopies nie op die regte manier en goed gepak word nie, word die produk erg beskadig wanneer swaar reëns laat in die seisoen val.

ŉ Probleem wat grondboneprodusente gedurende die afgelope twee seisoene hoofbrekens besorg het, is skimmelbesmetting en die gevolglike vergiftiging van die pitte. Toe die probleem die nywerheid gedurende 1963 oorval het, het ons betreklik min van die ontwikkeling van skimmelbesmetting geweet. Aanvanklik is vermoed dat besmetting net ontstaan nadat die plante uit die grond gehaal en op die lande in hopies gepak is. Gedurende die huidige seisoen is intensiewe ondersoek ingestel. Volgens Sellschop, J.P.F. in ŉ artikel „Vanwaar Aflatoksien", vind skimmelbesmetting plaas wanneer -

(1) die peule en pitte, nog voordat die plant uitgehaal word, deur die klein swamkweker termiete beskadig word;

(2) die plante deur swaar droogte getref word;

(3) die peule in die hope deur die bolwurm ruspe beskadig en uitgevreet word; en

(4) die peule in die grond as gevolg van wisselende vogtigheids- en droogtetoestande oopbars.

Die Departement Landbou-tegniese Dienste doen daadwerklike stappe om produsente te oorreed om deur die toepassing van verbeterde verbouings- en drogingsmetodes skimmelbesmetting te voorkom. Baie kan hierdeur bereik word om skimmelbesmetting te verminder - in jare met gunstige klimaatsomstandighede, behoort feitlik geen moeilikheid met skimmelbesmetting ondervind te word nie. Waar droogtetoestande en termietbeskadiging egter in gedrang kom, kan daar nie op verbouingsmetodes staat gemaak word om skimmelbesmetting en vergiftiging te voorkom nie. Verwag kan word dat daar jare sal wees dat die nywerheid met vergiftigde grondbone belas sal wees en dit is myns insiens gebiedend noodsaaklik dat intensiewe navorsing gedoen moet word om metodes en middele te vind om nie alleen aflatoksien nie, maar ook ander gifstowwe deur skimmels veroorsaak, uit sowel die olie as die perskoek te verwyder. Die Navorsingsgroep van die Nasionale Voedingnavorsingsinstituut het reeds belangrike vordering in die rigting gemaak, maar daar is nog baie werk wat gedoen moet word. Dit sal voorwaar ŉ prestasie wees as ons in die nabye toekoms kan sê dat aflatoksienbesmetting van grondbone, sover dit die persnywerheid betref, nie meer ŉ probleem is nie, want daardeur sal ŉ belangrike belemmering in die bemarking van die produk weggeruim wees.

RESEARCH SERVICES AVAILABLE AT THE NATIONAL NUTRITION RESEARCH INSTITUTE

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SYNOPSIS

Although the National Nutrition Research Institute was established primarily to do research on national nutrition problems, it must also serve industry.

The organisation of the National Nutrition Research Institute and the activities and facilities of its eight divisions are described. The Institute's fields of research include food technology, food analysis, biochemistry, physiology, toxicology, microbiology, the evaluation of nutritional status and studies in clinical nutrition.

The facilities which could be of value to the food industry, particularly those of the Food Technology Division, are described and the conditions under which research is undertaken for industry, defined.

SAMEVATTING

Hoewel die Nasionale Voedingnavorsingsinstituut hoofsaaklik gestig is met die oog op navorsing oor voedingsprobleme van nasionale aard, moet hy ook die nywerheid bystaan.

Die organisasie van die Nasionale Voedingnavorsingsinstituut asook die aktiwiteite en fasiliteite van sy agt afdelings word beskryf. Die Instituut se navorsingswerk behels voedseltegnologie, voedselontleding, biochemie, fisiologie, toksikologie. mikrobiologie, voedingspeilbepaling en studies oor kliniese voeding.

Die fasiliteite wat vir die voedselbedryf van waarde kan wees. veral dié van die Afdeling Voedseltegnologie, word beskryf om die voorwaardes waarop navorsing vir die nywerheid onderneem word, omskryf.

INTRODUCTION

The Council for Scientific and Industrial Research was established by the Scientific Research Council Act No 33 of 1945. The objects of the Council as set out in the Act include the following:

1. To promote the utilization of the natural resources of the Republic.

2. To undertake or aid scientific research in relation to such matters as the Minister may refer to it for investigation.

3. To undertake testing, investigation and researches, in such manner as it may deem advisable, with the object of improving the technical processes and methods used in industry, of discovering processes and methods which may promote the expansion of existing or the development of new industries or the better utilization of waste products.

4. To foster, recognize and aid the establishment of associations of persons engaged in industry for the purpose of carrying out scientific industrial research, and to co-operate with and, subject to conditions approved by the Minister, make grants to such recognized or established associations.

5. To establish and control facilities for the collection and dissemination of information relating to scientific and technical matters.

These objects clearly indicate the importance attached to industrial research by those responsible for the establishment of the C S I R. Right from its inception the C S I R has endeavoured to foster and promote industrial research so as to fulfil this section of its functions.

The National Nutrition Research Institute was established in 1954 primarily to carry out research into the problems of malnutrition existing in this country in order to elucidate and find means of combating them. The majority of the Institute's investigations would naturally be in connection with health problems, but it was realised that to fulfil its function, the Institute would also have to interest itself in food science. A food technology division was consequently established and built up over the years and it is mainly through this division that the Institute can perform its function of doing research for industry.

FACILITIES AVAILABLE AT OR THROUGH THE N N R I

The National Nutrition Research Institute (N N R I) at present consists of the following eight research divisions:

The N N R I maintains two divisions at the Pretoria General Hospital. The Nutrition Clinic for Adults is concerned with an investigation into pellagra and liver diseases and their relationship to diet. The research projects of this Division are purely clinical and non-industrial.

The Nutrition Clinic for Children, although mainly concerning itself with clinical investigations of nutritional diseases of children, also undertakes the study of the quality and efficacy of infant foods on children, after these foods or diets have been thoroughly studied in experimental animals. Such studies are time-consuming and costly and have to be very carefully considered as the well-being of young patients is involved. Although industrial food products have in the past been studied by this clinic on behalf of industry, and, if warranted, could again be undertaken. such commitments are not undertaken unless they are considered to be of national importance.

The Division of Physiology is very well equipped for the evaluation of the nutritive value of foods using results obtained from the experimental feeding of animals as criteria. The Division is particularly well-equipped and can claim to be a specialist laboratory for the evaluation of protein quality. This Division has served many industries interested in the development and production of high-protein foods, by assessing the quality of their products and by suggesting improvements in the formulations on the basis of the evaluation.

Government departments and some local authorities involved in feeding schemes realise the value of chemical and biological evaluation of such high-protein foods and largely base their specifications and purchases on such comprehensive analyses and evaluations.

The Division of Physiological Chemistry is another division that operates in a field which normally would not be linked with industrial research. This Division studies the biochemistry of the body fluids for the purpose of assessing the nutritional status of man and of elucidating the relationship between diet, metabolism and disease.

The Division of Field Studies is entirely devoted at present to the study of the nutritional status of the South African population. It frequently enlists the aid of other divisions in its work. The Division is occasionally involved in the assessment of the acceptability of particular food formulations —for commercial purposes, however, such acceptability assessments or market studies can, as a rule, be carried out more satisfactorily by private firms and the Institute would not normally undertake such tasks for industry.

The Division of Toxicology is a new branch of the Institute which has long felt the need for such facilities in order to be able to study the safety of new food products and also the effects of toxins and anti-nutrients, occurring in foodstuffs, on the health of man.

The Division is headed by a pathologist, is well-equipped for pathological investigations, has facilities for experiments on animals and will soon also have at its disposal a laboratory for the chemical study of these bio-factors and their physiological effects.

Facilities for toxicological investigations are very limited in South Africa and the Division will fill a long-felt need. It will not be surprising if it is found necessary to expand the Division rapidly in the next few years.

One of the main projects of the Division is the study of the toxicology of myco-toxins, the extremely poisonous metabolites of moulds which under certain conditions develop on legumes and cereals and which in recent years emerged as a serious threat to the oilseeds industry of South Africa and of other countries.

Although industry itself may not make extensive direct use of this laboratory, the research undertaken in it will probably prove to be of great future value to the industry.

Facilities for the analysis of foods is available in the Food Chemistry Division of the N N R I. Much of the analytical work done in the Division is in connection with research projects of other divisions or with the main project of the divisions viz. the study of the composition of South African foods and the compilation of food-composition tables.

Routine analytical services are preferably not undertaken by a research organization such as the N N R I and it is the policy of the C S I R to avoid, as far as possible, rendering services which would compete with those offered by private consultants. Analytical services are also available at the S.A. Bureau of Standards. Nevertheless the Division often undertakes analyses of food products for industry when the industry concerned wishes to learn the nutritive value of a food product or its efficacy for special purposes.

It is the Division of Food Technology, however, which, by its very nature, can be of the greatest service to industry. Since its inception it has gradually accumulated a wide variety of small-scale processing plant so that today most industrial processes can be carried out or simulated on a small scale in the Division's processing laboratory.

The Division's staff of 17 scientists, technicians and laboratory assistants also place at industry's disposal a wide range of knowledge and experience.

The Division is engaged in a wide range of research projects. These consist entirely of research with industrial application or of investigation under contract undertaken on behalf of an industry or a firm.

The research services available to the food industry are, however, not limited to those available in the N N R I. The C S I R has numerous institutes, departments and divisions, the specialist services of which can be enlisted by N N R I when problems which fall outside its scope are presented by the food industry. Constructional or factory design problems for example could be referred to the National Building Research Institute; effluent problems to the National Institute for Water Research; engineering problems to the National Mechanical Engineering Research Institute and fundamental chemical investigations or chemical engineering problems to the National Chemical Research Laboratory. The N N R I can also call on the facilities and very extensive and well-equipped workshops of the Technical Services Department when the design of new processing equipment and the construction of prototypes are involved.

The C S I R Bantu Beer Research Unit deals with all matters pertaining to Bantu beer brewing while the C S I R Microbiology Research Group offers excellent facilities for the study of microbiological problems in food processing.

As quoted earlier, one of the objects of the C S I R is to collect and disseminate scientific and technical information. In order to fulfil this function the C S I R has built up a very good scientific and technical library, the facilities of which are available to industry. The coverage of the books and periodicals in the field of food science and technology is particularly extensive.

Mention should also be made of the Industrial Economics Division of the C S I R's Information and Research Services which can undertake economic investigations and operational research for industry.

UTILIZATION OF RESEARCH SERVICES BY INDUSTRY

From the foregoing it should be evident that the research and technical services which the C S I R can offer the Food Industry are extensive and diverse.

On taking cognisance of the wide range of facilities available at the C S I R the industrialist will undoubtedly ask himself: „How can I make use of or benefit from these facilities?"

Individual agreements

Firstly there is the individual manufacturer who has a problem which he is not technically equipped to deal with himself. For him the best procedure would be to write to, or preferably to visit. the N N R I in order to discuss the problem. Often an answer or a partial answer to the problem can be found by studying the literature; more often the information may not be available or particular conditions may apply and research on the subject is necessary. Whatever the service required, if the Institute can undertake it, it will submit to the enquirer a programme and also an estimate of the probable costs and time required for the service. If agreement is reached a contract is entered into, the work is carried out and a report is issued to the sponsor on completion of the task. If the project is of long duration interim reports may also be issued if required.

The type of agreement entered into between the research sponsor and the N N R I may vary according to circumstances. Often, especially when process or product development is involved, it is impossible to estimate the duration or cost of a project in advance. Clearly, also, ultimate success can never be guaranteed. In such cases the N N R I has often agreed to undertake a task within agreed limitation of expenditure. Reports are then issued to and discussions held with the sponsor at regular intervals in order to review the progress of the investigation. The sponsor then has the option to terminate the project if the results indicate that to bring the project to a successful conclusion would entail too great an expenditure. It should be made quite clear that when a research project is undertaken on behalf of industry the object is to serve industry, not to obtain financial gain for the Institute. The C S I R is not a profit-making organization and the charges to the sponsor cover only the costs involved. The sponsor may also be required to bear the costs of particularly expensive equipment and materials. It should be emphasized, however, that the charges only cover costs and in cases where such a project is considered to be of great national importance part of the cost of the project may even be borne by the Institute.

The manufacturer should fully disclose the purpose for which research is required when such services are sought from the C S I R. Often, to enable the research worker to comprehend the problem fully, the manufacturer has to disclose processing details. This can be done with the assurance that the manufacturer will be strictly protected and confidential information supplied will not be abused.

NOTES