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REPORT

drawn up on behalf of the Committee on Agriculture, Fisheries and Food

on the effects of the use of biotechnology on the European farming industry

Rapporteur : Mr F. W. GRAEFE ZU BARINGDORF

A Series: Reports - B series: Motions for Resolutions, Oral Questions, Written Declarations, etc. - C Series: Documents received from other Institutions (e.g. Consultations)

At its sitting of 9 December 1985 the European Parliament referred the motion for a resolution on the use of agricultural products in biotechnology (Doc. B 2-1087/85) tabled by Mr Tolman and Mr Eyraud on behalf of the Committee on Agriculture, Fisheries and Food, pursuant to Rule 47 of the Rules of Procedure, to the Committee on Agriculture, Fisheries and Food as the committee responsible, and to the Committee on Energy, Research and Technology for an opinion.

At its meeting of 23 January 1986 the Committee on Agriculture, Fisheries and Food decided to draw up a report; it appointed Mr Graefe zu Baringdorf rapporteur at its meeting of 5 February 1986.

At its sitting of 17 February 1986 the European Parliament referred the motion for a resolution tabled by Mr Pisoni and others on new uses for agricultural products and, in particular, the use of cereals for ethanol production (Doc. B 2-1351/85), pursuant to Rule 47 of the Rules of Procedure, to the Committee on Agriculture, Fisheries and Food as the committee responsible, and to the Committee on Budgets and the Committee on Energy, Research and Technology for an opinion. At its meeting of 19 March 1986 the Committee on Agriculture, Fisheries and Food decided to incorporate this motion for a resolution into the report by Mr Graefe zu Baringdorf.

At its meetings of 25 and 26 September, 13 and 14 October and 18 and 19 November 1986 the committee considered the draft report. At the last meeting the committee adopted the motion for a resolution as a whole by 20 votes to 15, with 4 abstentions.

The following took part in the vote : Mr TOLMAN, chairman; Mr GRAEFE ZU BARINGDORF, vice-chairman and rapporteur; Mr ABENS (deputizing for Mr Eyraud), Mrs ANDRE (deputizing for Mrs S. Martin), Mr BORGO, Miss BROOKES (deputizing for Mr Battersby), Mrs CASTLE, Mr CHRISTENSEN, Mr CLINTON, Mr COLINO SALAMANCA, Mrs CRAWLEY, Mr DEBATISSE, Mr DEVEZE, Mr DURAN I LLEIDA, Mr EBEL (deputizing for Mr Bocklet), Mr ELLES (deputizing for Mr Howell), Mr EPHREMIDIS (deputizing for Mr Adamou), Mr GATTI, Mr HAPPART, Mr LACERDA DE QUEIROZ (deputizing for Mr Garcia), Mr McCARTIN (deputizing for Mr Dalsass), Mr MAHER, Mr MERTENS, Mr MORRIS, Mr MUSSO, Mr PAPAKYRIAZIS (deputizing for Mr Sutra), Mr F. PISONI, Mr RAFTERY (deputizing for Mr Marck), Mr ROMEOS, Mrs ROTHE, Mr SIERRA BARDAJI, Mr SIMMONDS, Mr SPATH (deputizing for Mr Fruh), Mr STAVROU, Mr THAREAU, Mr VAZQUEZ FOUZ, Mr VEGA Y ESCANDON (deputizing for Mr N. Pisoni), Mr VERNIMMEN and Mr WOLTJER.

Neither the Committee on Budgets nor the Committee on Energy, Research and Technology will be delivering an opinion.

The report was tabled on 21 November 1986.

The deadline for tabling amendments to this report will be indicated in the draft agenda of the meeting at which it will be debated.

C O N T E N T S

The Committee on Agriculture, Fisheries and Food hereby submits to the European Parliament the following motion for a resolution, together with explanatory statement:

A

MOTION FOR A RESOLUTION

on the effects of the use of biotechnology on the European farming industry

The European Parliament,

- having regard to the motion for a resolution tabled on behalf of the Committee on Agriculture, Fisheries and Food by Mr Tolman and Mr Eyraud, pursuant to Rule 47 of the Rules of Procedure, on the use of agricultural products in biotechnology (Doc. B 2-1087/85),

- having regard to the motion for a resolution tabled by Mr F. Pisoni and others, pursuant to Rule 47 of the Rules of Procedure, on new uses for agricultural products and, in particular, the use of cereals for ethanol production (Doc. B 2-1351/85),

- having regard to the report by Mrs SQUARCIALUPI (Doc. A 2-154/85), on the genetic variety of cultivated plants and trees,

- having regard to the report by Mr LINKOHR on bioethanol (Doc. A 2-64/86),

- having regard to the Commission discussion paper entitled: Biotechnology in the Community: stimulating agro-industrial development (COM(86) 221 final),

- having regard to the new Community Framework Programme of technological research and development (COM(86) 129 final),

- having regard to the Commission reports on the Biomolecular Engineering Programme (BEP) and the Commission RAP Biotechnology,

- having regard to the US Congress OTA report on the impact of the new technologies on the structure of American agriculture,

- having regard to the EEC FAST programme: The End of Farm Workers - the new farm workers (XII/108/86),

- having regard to the report by the Committee on Agriculture, Fisheries and Food (Doc. A 2-159/86),

A. in view of the extensive efforts and the levels of expenditure brought to bear at Community level for the promotion of biotechnology in order to modernize agriculture and industry,

B. whereas these efforts are necessary so that agroculture and the agro-industrial sector can maintain their position and their competitiveness on the world market,

C. whereas biotechnologies, if used judiciously, can help reduce production costs and open new markets, thus improving the economic situation of farmers,

D. whereas multinationals are spending huge sums of money on biotechnology research, and it is important that the Community and national governments invest more in this area to avoid a situation where multinationals might gain a near monopoly of the knowledge available in this new technology,

E. whereas the commercial application of biotechnology may lead to an acceleration of rationalization of production in certain sectors of agriculture but will also lead to the development of new opportunities and new markets for farm products,

F. whereas there will continue to be a reduction in the numbers employed on the land, but new possibilities can be created producing products which are in deficit such as proteins, timber, fibre, specialized vegetable oils etc., with the aid of biotechnology,

G. whereas the likely increases in production will probably create further surpluses, but these technologies will also open up new markets for agricultural products, for example in the chemical and pharmaceutical industries and the agro-industry, which are far from negligible in the long term,

H. whereas traditional intensive agriculture posed many dangers to the environment, but biotechnology could assist in reducing the hazards by increasing the efficiency of nitrogen fixation and resistance to diseases and pests thus helping to reduce inputs of fertiliser, fungicides, insecticides and pesticides. Likewise it could contribute to the safe disposal of farm wastes by converting animal waste and other organic substances to methane gas to be used as energy on the farm,

I. whereas serious studies must continue into energy production from biomass,

J. whereas genetic variety in crops and livestock has decreased over the centuries, and biotechnology and gene banks can contribute to increasing and conserving genetic variety,

K. whereas the application of biotechnology, like all new technologies, entails certain risks, and therefore it is very important that there should be adequate controls, preferably harmonized on a Community-wide basis,

L. whereas the development of biotechnologies will not necessarily lead to a solution of the problems of famine in the Third World, but may on the contrary widen the gulf between rich and poor, between large-scale farms and subsistence farming, between cash crop production and the supply of basic foodstuffs,

M. whereas genetic plasma comes mainly from Third World countries,

1. Feels that, in the present context, biotechnology must promote an agricultural policy geared to quality, with high added value, rather than further increasing yields and quantities produced:

2. Wishes to maintain family farming as the basis of our agriculture, the main task of which is to provide people with healthy food and to provide the agro-industries with suitable raw material for processing, without damaging the environment;

2.1 A purely biotechnological approach must be rejected; biotechnology must instead be integrated within already existing technologies;

2.2 In food processing, the primary aim must be to produce food that is safe and nutritious. Genetic engineering is already contributing in this sector particularly in the production of fermented products such as cheese, youghurts, soured milk drinks, beers, etc. ...;

2.3 The links between agriculture and industry, both upstream and downstream, should be strengthened with the object of supplying the consumer with competitively priced high quality food, while maintaining the viability of as many family farms as possible;

2.4 For our agriculture to stay competitive it will be essential to invest more in the continuous breeding of plants and animals, preferably, though not exclusively in Government-controlled research centres;

2.5 Producer, processor and consumer co-operatives should be encouraged, likewise small and medium-sized industries should be encouraged in this sector;

3. Calls for all the ecological consequences to be taken into account in the use and application of biotechnology;

4. Supports the cooperation in the field of breeding between scientists, breeders, working farmers, environmentalists and conservationists designed to preserve a broad genetic potential;

5. Argues that the aim of breeding particular animal species and cultivating particular plant varieties must take account of improvements in performance and natural characteristics;

6. Successful plant breeding relies on the creation of diversity and this process can be accelerated using biotechnology;

7. Stresses that gene banks help to maintain genetic variety by complementing measures designed to encourage the protection of natural ecological zones;

8. Calls for gene banks to be made subject to public supervision and the protection of intellectual property by means of adequate patent safeguards;

9. Recognizes the risks involved in the introduction of genetically manipulated organisms into the environment and calls on the Commission to assess the problem;

10. Calls for comprehensive testing of genetically engineered organisms before releasing them in any part of the world. Calls on the Commission to introduce standards for testing;

11. Supports the efforts of Third World countries to use appropriate technology to develop their agriculture and their economies and to reduce their dependence on multi-nationals;

12. Calls for prices for agricultural products to be fixed at a level which will help to give a reasonable income in farming thus helping to safeguard family farming in the Community;

13. Feels, nevertheless, that the prospects for industrial markets for agricultural products must be analysed, as they represent :
   - a further way of disposing of surpluses,
   - a far from negligible source of indigenous raw materials from Community industry;

14. Calls on the Commission to produce a forecast, along the lines of the US Congress OTA report, of the likely structural and social consequences of the promotion and application of biotechnology and genetic technology in the European farming industry;

15. Instructs its President to forward this resolution to the Council and the Commission.

B

EXPLANATORY STATEMENT

1. OUTLINE OF THE PROBLEM

Biotechnology in Community agriculture

In the light of the present objectives of the Common Agricultural Policy the commercial application of biotechnology in European agriculture will accelerate the process of rationalization and subordinate more and more of the natural conditions of agricultural production to agro-industrial production procedures.

With the aid of biotechnologies yields can be increased, production processes in general speeded up, but also substitutes produced which replace other agricultural products. Just as in the 1970s the USA drastically reduced its sugar imports by means of the biotechnological conversion of maize starch into fructose syrup, so the Community could cut down its animal feed imports by using waste products from this sugar substitution (maize gluten). Biotechnology already possesses the techniques needed to make Community protein production independent of US imports.

The EEC Commission is promoting the use of biotechnology in agriculture and in upstream and downstream industries with the aim of speeding up structural change in order to remain competitive on world markets. It is thus pursuing a policy of adapting to agro-industrial developments in the USA and Japan. In concrete terms this means the promotion of the vertical integration of large agro-industrial farms and the deliberate destruction of small-scale farming.

In the light of the investments which have already been made in the biotechnology sector, state promotion of the continuing process of concentration in the bio-business and of increased worldwide competition, all of which necessitate the rapid application and spread of biotechnology, licensing procedures and risk studies are becoming increasingly farcical. Against this background the work of the EEC Commission in assessing the risks inherent in biotechnology seems to be a meaningless exercise.

The alternative lies in the retention and development of a small-scale farming industry. The economic system must be adapted to regional needs as a precondition for its long-term development and viability. Adapted native breeds and varieties which can cope with the special demands of climate and soil stabilize the ecological conditions of agricultural production and help keep man and the environment healthy.

2. STRUCTURAL CHANGE THROUGH BIOTECHNOLOGY
Stimulating agro-industrial development

Present agricultural policy is encouraging the application of biotechnology in the Community with the aim of building up a competitive and profitable biotechnology industry. In this it follows the logic of a growth-oriented economic strategy, which is determined by world market forces, and which necessitates the increasing concentration and integration of individual economic sectors (capital goods industry, agro-chemicals, agro-production, processing).

In the context of the reform of European agricultural policy the Commission is pressing for an integration of agriculture and industry and has plans for 'stimulating agro-industrial development'. In a discussion paper of the same name of April 1986 (COM(86) 221 final) which was drawn up as a supplement to the Green Paper, the Commission explains the objectives of this integration policy and the measures contained in it.

According to this document the application of biotechnology increases the value of agricultural products, speeds up growth in productivity and aims at a reduction in the cost of agricultural production. In addition new uses are foreseen for agricultural products, above all in the non-food sector, and also the substitution of agricultural and oil imports.

According to Commission statements and also a US Congress report, more valuable agricultural products[1], or to put it more precisely profits generated by the application of biotechnology are expected in industries upstream and downstream of agriculture. This is not surprising, since the application of biotechnology changes the characteristics of plants and animals in the laboratory in the pre-production phase, and also has an impact in downstream industries during the breaking down and processing of agricultural products by means of micro-organisms and enzymes.

The speeding up of growth in productivity[2] thus also has its origins in these industries and therefore integrates agriculture more and more into industrial production processes.

The reduction in the costs of agricultural production[3] is the result of rationalizations which are brought about in the main by the standardization of raw materials and the vertical integration of agricultural production into upstream and downstream industries. In the face of falling raw material prices, potential profits through rationalization will only be achieved in agro-industrial complexes.

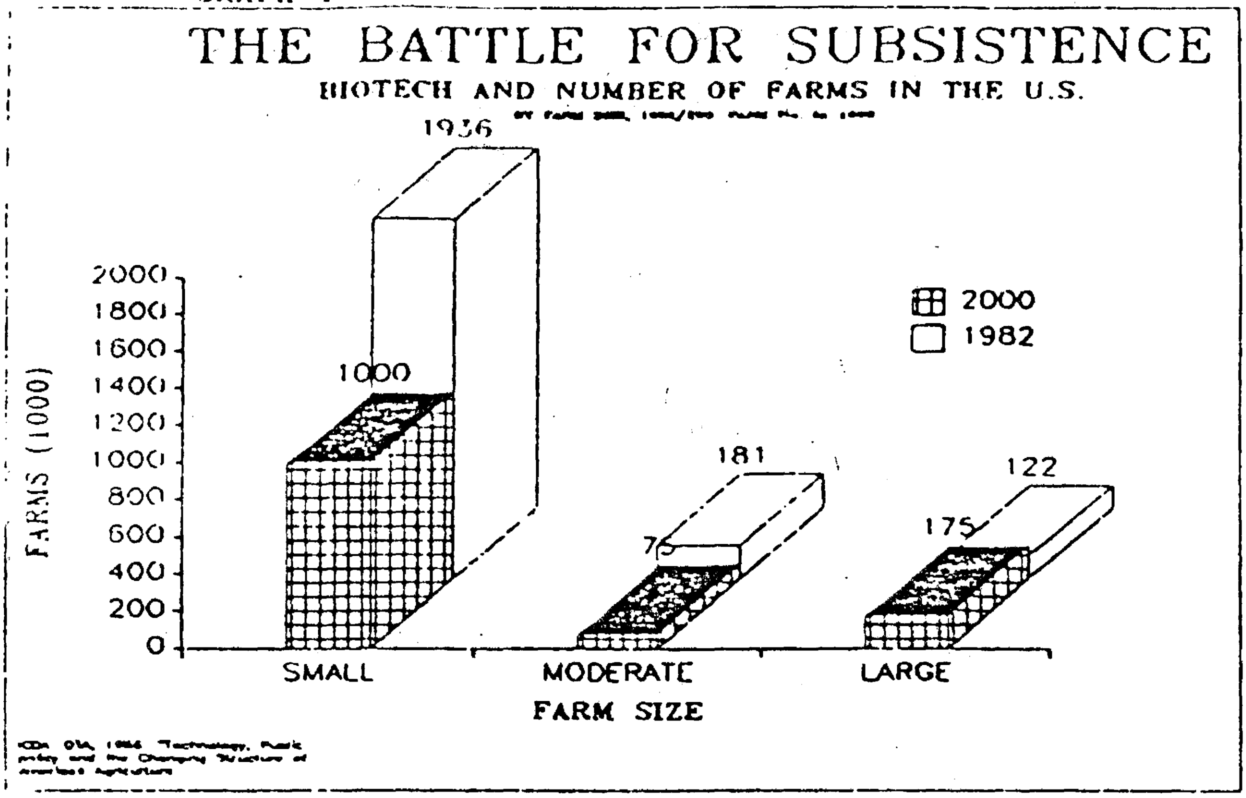
A US Congress report (Office of Technology Assessment OTA) gives clear indications about prospects in the biotechnological age. It predicts that by the year 2000 the application of biotechnology and computer technology in the United States will lead to the number of farms dropping by half from the present figure of around 2 million. Only agro-industrial farms with an income above $ 70 000 a year and part-time farms will survive. Small and medium-sized full-time farms, which were previously seen as the backbone of American agriculture, will disappear completely (cf the following graphs 1 and 2).

It is conspicuous that the Commission is agreed on the need to create a biotechnology industry, but that very little attention is paid to the social consequences of the biotechnological revolution. One searches in vain in the report on 'stimulating agro-industrial development' for statements on the consequences of the structural change for employment and regional development.

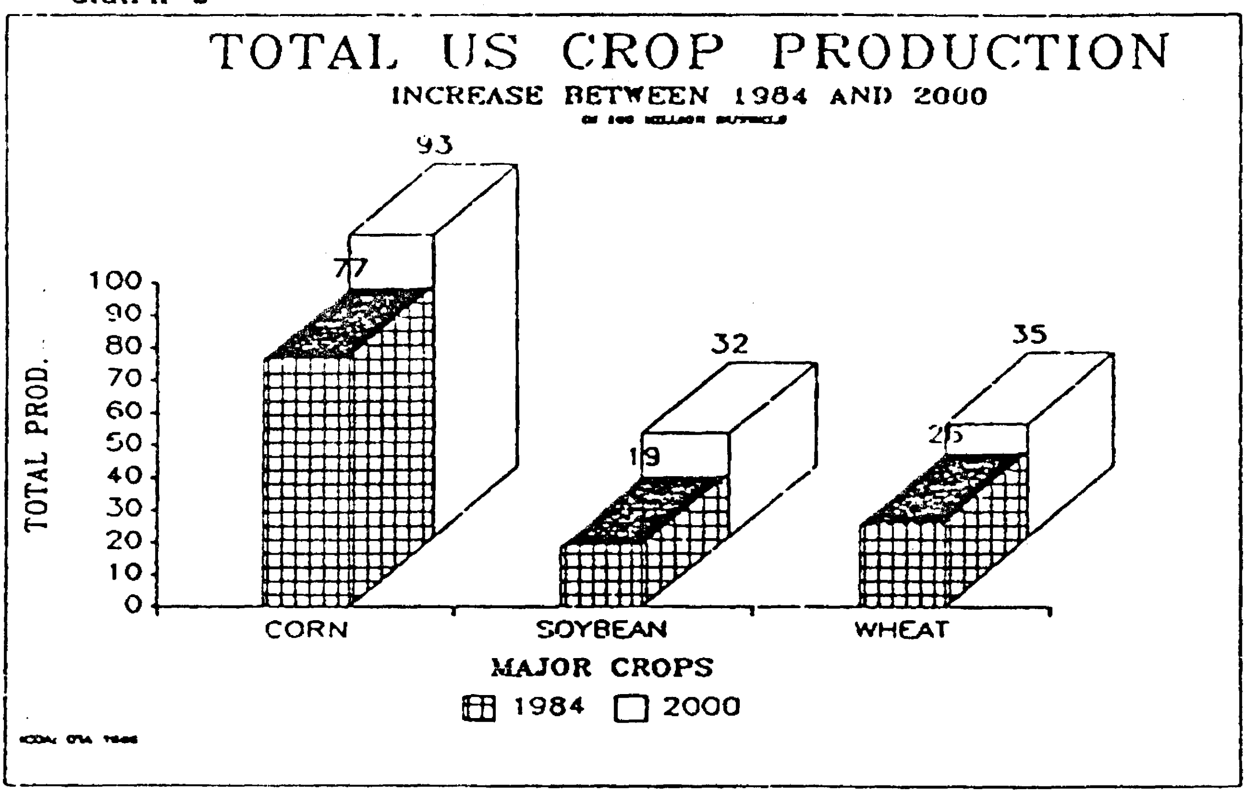
In the Green Paper the Commission prevented its restrictive price policy for agricultural products as a measure necessary to reduce surpluses. In the light of the later paper on 'stimulating agro-industrial development' it emerges that this argument was designed to mislead the public. In fact this policy has two aims: cheaper raw materials for the agricultural industry and agricultural exports, and a speeding up of the industrialization of agriculture.

GRAPHIKEN 1 und 2

GRAPH 1



GRAPH 2



Source : ICDA Seedling July 1986

3. BIOTECHNOLOGY AND GENETIC TECHNOLOGY IN ANIMAL PRODUCTION

Modern technological agriculture is pressing for animals to be produced in line with industrial requirements. The aim is not the individual animal but rather the greatest possible uniformity of stock, so that standardized husbandry, feeding and processing systems can be used. The animals are no longer integrated components of agricultural production, but are produced under artificial conditions using imported concentrated feeds rather than feedstuffs grown on the farm. In addition to the problem of liquid manure, developments in animal production have contributed to single crop farming (maize) and soil erosion. Breeding, husbandry and feeding techniques have led to an increase in production which is linked to low resistance and susceptibility to disease.

The use of reproductive, genetic and computer technologies in modern medium-sized and large farms is designed to increase the productivity of the individual animal. In Holland a yield of 10 000 litres of milk per cow per year is expected, in France an increase from 21 to over 30 piglets per sow per year, in the FRG 40 embryos per embryo-transfer cow per year.

Structural change and reproductive techniques

In 1986 in the Federal Republic 93% of all cattle farms, i.e. 5.8 million cows, are dependent on artificial insemination. The necessary prerequisite for this widespread use of artificial insemination is cryoconservation, the freezing of sperm in liquid nitrogen. For the 5.8 million cows there are only 5 000 inseminating bulls. The semen of the bulls is so rich in sperm that on average 400 semen samples can be obtained per ejaculation and around 40 000 per bull per year. Only 2% of the inseminating bulls are selected for the production of the next generation (cf German Cattle Breeders Association, 1970-1985).

The high frequency and number of inseminations by top quality bulls especially, brings with it the danger of the spread of undesirable characteristics and hereditary defects. The import and export of deep-frozen sperm creates the conditions for the worldwide spread of such genes in high performance breeding.

In the 1970s the very small number of bulls licensed for reproduction was still balanced by relative diversity on the female side, relative because the cows for their part were already daughters and grand-daughters of the bulls in question.

Embryo transplanting has now become a practical reproductive technique. The cows receive hormone injections so that a maximum number of fertile eggs are formed. After the superovulation the cows are artificially inseminated. The ensuing transfer of the embryos does not merely double the genetic impoverishment, but rather increases it many times over. Through micromanipulations carried out on the embryo, for example the production of twins, the number of descendants of <u>one</u> genetic mother is further increased: what we are dealing with here is cloning; in this process genetically identical clones are produced by means of division at the two-cell stage. The degree of relationship, even of those animals at the top of the chain, is continually increasing. Meanwhile, the genetic value of individual animals is so highly regarded that they are cloned, i.e. multiplied.

Genetic manipulation

With the introduction of genetic technology the field of breeding is left behind. In breeding two genomes are mixed together, whole genetic units are exchanged. In this process the respective functions of most genes are still unknown. A gene is not passed on individually but rather as a functional element in a whole genome. This functional link and its interactions cannot be analysed. By means of genetic technology, individual genes will now be identified and localized (genome analysis), so that a genome can then deliberately be inserted or removed (gene manipulation).

By means of gene transfer genetic technology is designed to

1. have a direct effect on increases in productivity and thus lead to the better fulfilment of breeding objectives and

2. reduce, by means of resistances, consequences inherent in present breeding, husbandry and feeding conditions, such as susceptibility to disease and stress.

Since there are serious difficulties involved in the genetic manipulation of animal cells, bacteria have been manipulated to produce bovine growth hormone. In order to achieve this, the growth hormone gene from cattle embryo cells has been isolated and inserted into the genome of bacteria.

From 1988 in the EEC (in Great Britain from 1991) a ban will apply to all uses of hormones other than for therapeutic purposes. Groups representing the drugs industry and the animal production industry have reacted promptly: 'growth hormone is not a hormone but a peptide'. Thus by means of a new definition, the growth hormone is declared to be a non-hormone in order to circumvent the hormone ban.

Another way of increasing milk production will involve the genetic manipulation of rumen micro-organisms. In this way the processing of feed is to be improved by circumventing food requirements specific to ruminants. However the particular feature of these requirements is that they are so modest. The fact of being able to make milk out of grass means that there is no competition for food with man.

In this connection the question of safety must immediately be raised. Rumen bacteria are elements in an open system. The effects of their genetic manipulation can no more be assessed and controlled than those, of for example, the release of genetically manipulated bacteria into the soil.

Genetic Diversity and Homogeneity

Genetic diversity is the result of incalculably long development and adaptation processes in animals in varying environments. Native breeds and varieties are elements in an ecosystem which they help to shape and by which they are marked. The latter process demands the adaptability of the population as a whole, and of the individual animal.

Many old breeds of domestic animal have already died out. The unique combination of genotype and phenotype has been lost forever. Many other domestic breeds are threatened with the same fate. In 1973 the Rare Breeds Survival Trust was founded in Great Britain with the aim of preserving domestic breeds threatened with extinction, for example the British White and Belted Galloways. Among German cattle the Murnauwerdenfelser the Hinterwalder and the Vorderwalder are particularly threatened. The Murnauwerdenfelser is the lightest and smallest German breed of cattle, the only one which can graze on the steep slopes in the Black Forest. The survival of many species of orchid depends on their grazing habits. Native species must be kept in their natural habitat. As deep frozen embryos or in sperm banks they cannot evolve and adapt, and similarly the ecosystem cannot survive without them as a necessary element.

4. BIOTECHNOLOGY AND GENETIC TECHNOLOGY IN PLANT PRODUCTION (see Table 1)

The use of chemical, breeding and technological rationalization methods in developing an industrialized agriculture has also led to radical changes in the plant sector. The absolute priority given to business efficiency has meant the selection of the relatively most suitable species, a reduction in crop rotation, in some cases to the level of a single crop system, and the reparcelling of land to create large crop areas.

Large areas of our countryside have lost their entire ecological structure, our soils are threatened with erosion. Consistent selection of varieties and use of fertilizer and pesticides to increase and stabilize yields is leading to the systematic reduction in the number of cultivated plants, threatening the diversity of species, even among weeds, and creating problems with pesticide and fertilizer residues in food, soil and groundwater.

Although the number of varieties offered in breeders' catalogues is continually rising, in practice genetic impoverishment is increasing:

USA	1982	4 potato varieties take up	72%	of	cultivated	land
		2 pea varieties "	96%	"	"	"
Holland*	1983	1 sugarbeet variety "	74%	"	"	"
1983		2 winter wheat varieties	88%	"	"	"
		1 potato variety "	38%	"	"	"
		4 forage maize varieties	81%	"	"	"
FRG	1979	9 wheat varieties "	73%	"	"	"
FRG	1984	6 " "	76%	"	"	"

South-East Asia: 1 rice variety (IR36) takes up 60% of cultivated land

* Descriptive crop catalogue 1983, No. 58

TABELLE 1

Biotechnologie		Pflanzenzüchtung	
Molekularbiologie (Gentechnologie)	Zellbiologie	Erstellung von Variation	Sortenentwicklung
Anwendung von **biochemischen Methoden** zur ● Identifizierung von Genen ● Konstruktion von Vektoren („Transportmitteln") ● Übertragung von Genen	Methoden für die **Regeneration** zu funktionsfähigen Pflanzen aus ● Protoplasten ● Einzelzellen ● Gewebe	Entwicklung von **Basismaterial** durch ● Einkreuzung von natürlichen Genressourcen ● künstliche Mutationsauslösung ● Rekombination der besten Genotypen ● **Einsatz von Material und Methoden aus biotechnologischer Forschung**	Entwicklung von **Sorten** durch ● Klonzüchtung (z. B. Kartoffeln) ● Selbstungszüchtung (z. B. Weizen) ● Panmixiezüchtung (z. B. Roggen) ● Hybridzüchtung (z. B. Mais, Zuckerrüben)

There is one well-known example of the negative effects of genetic uniformity. The maize fungal disease 'Helminthosporium maydes' took on epidemic proportions in 1970 because 85% of the land under maize in the United States had been sown with the same hybrid seed in a single crop system. As a result the American seed industry had to replace almost 80% of its sales with other seeds. In the United States the price of maize seed rose within a year from 20 to 48 dollars per bushel (according to Global 2000).

Genetic technology

The introduction of genetic technology is designed to bring about:

- faster breeding
- specific changes in plant charcteristics
- simpler and cheaper breeding techniques.

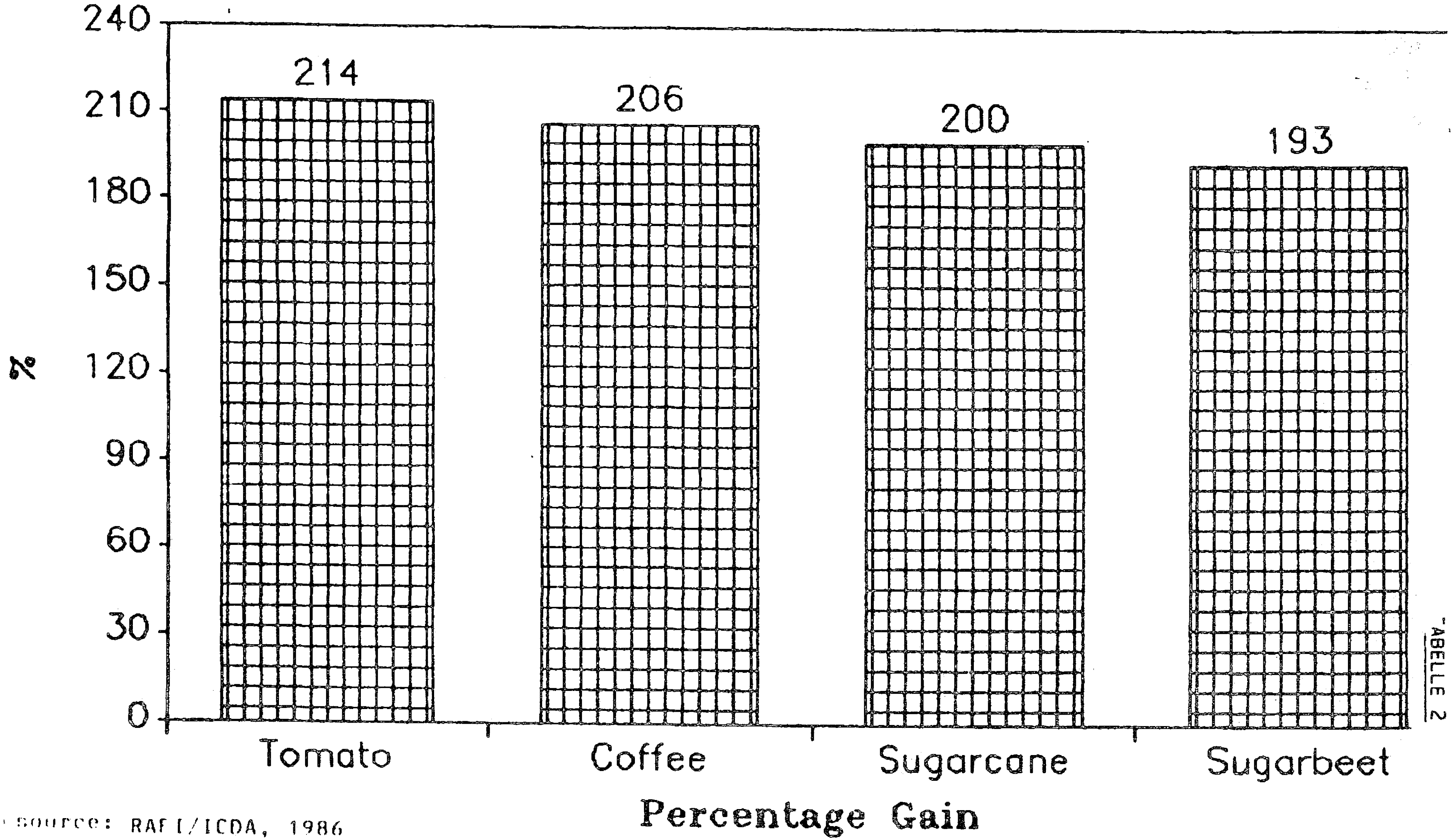
The use of regeneration techniques greatly reduces the time needed to breed a new variety. Conventional, resistance breeding often only bears fruit after 20 years and thus cannot counteract quickly enough the pressure of disease in intensive plant production. Whereas it previously took 10 to 15 years to breed a new variety, by means of new cell culture techniques this period can be reduced to as little as three years. If by means of this cell culture technique a complete plant can be produced from a single cell with the desired genetic information, further desired characteristics will be added to high-yield varieties by means of genetic technology (cf Table 2).

In the area of herbicide resistance genetic technology has already led to the creation of cultivatable varieties. The American chemical multinational Monsanto has produced a plant variety resistant to its total herbicide Roundup (Glyphosate) and Ciba-Geigy a variety resistant to Antrazin. Previously the amount of herbicide applied depended on the sensitivity of the cultivated plant. The more herbicide was applied the more likely the plant was to react, leading to a fall in yield.

Agricultural Biotechnology:

SPEED-UP IN BREEDING TIME

Percentage Increase in Breeding Pace



Source: RAFI/ICDA, 1986

RAFI (biotech)

-15 a -

PE 107 429/fin.

TABELLE 2

The introduction of herbicide resistant plant varieties means that the amount of herbicide applied can be calculated according to the resistance of the most obstinate weed. When a herbicide resistant plant variety is licensed the toxicity of the herbicide to which it is resistant is not taken into account. The extension of the area of application of total herbicides through the licensing of herbicide resistant plant varieties increases the problems caused by their toxicity.

No attention is paid to increasing accumulations of herbicides in soil and the possible residues in the food chain, which creates the risk of metabolites or other mutagenic products being formed (cf controversy over the herbicide Paraquat).

From the point of view of the industry, herbicide-resistant varieties are above all developed for economic reasons, since the development costs of a new herbicide are up to 20 times higher than those for a new variety (AKBu SiB 1986, page 52).

Outdoor tests with genetically manipulated organisms

As resistances can be built up more easily by using bacteria than by means of the resistance breeding of plants, the gene firm AGS in America has taken this step in order to limit frost damage in strawberry crops. This involves the use of genetically manipulated bacteria, the so-called ice bacteria. This bacteria produces a protein which causes ice crystals to form at temperatures of -1.5 to -5°C. Water without crystal centres can be cooled to up to -40°C without it freezing. Genetic technologists have now developed a sort of plant antifreeze by suppressing the ability of the bacteria to form this protein through removal of the relevant gene. The gene firm which developed these genetically manipulated bacteria called them Frostban and had them patented. All crops exposed to frost could be sprayed with this chemical and frost damage eliminated.

Despite a ban imposed by the US Environment Department, the gene technology firm carried out outdoor tests with Frostban. Popular protests have so far delayed the official release of manipulated organisms. However, many applications have been made for official authorization of such tests, which is putting the Environment Department under increasing pressure.

Ethanol from renewable raw materials

The slogan 'renewable raw materials' has fuelled a discussion recently (see report by Mr LINKOHR). What is meant is that plants such as beet, potatoes, cereals, maize, manioc and sugar cane should be fermented to produce agro-alcohol or ethanol. Supporters of this technology also hope that it will solve some problems facing the EEC: reduction of surpluses, improvement of the economic situation of agriculture, the securing of jobs in agriculture and industry and reduced environmental pollution.

Reduction of surpluses: the position regarding surpluses is conditioned by the need for rationalization and growth in production in order to offset the effect of continually falling producer prices on incomes. The result is an increasing intensification of production through the extension and exploitation of the genetic potential of plants and the increased use of agro-chemicals.

Experts estimate the possible growth in agricultural production at between 2 and 5% annually (according to crop). The likely scope (5% addition) of ethanol production could at best compensate for increases in the surplus potential for a few years. The surpluses are not reduced at the point of production, but a proportion of them is simply exploited or converted. If this logic is pursued, permanent surpluses become a prerequisite for bio-ethanol production.

Improving the economic situation of agriculture: the demand for low raw material prices for bioethanol production will increase the price pressure on all agricultural products. The raising of the yield potential of plants with the help of biotechnology and genetic technology and the intensified use of agro-chemicals to raise and stabilize yields will also exert constraints on the method of producing foodstuff raw materials. The effects of rationalization, i.e. the reduction in costs, will not benefit agricultural producers, but rather will be creamed off by price pressure from the processing industry. More and more land will be turned into marginal areas of agricultural production and so-called structurally weak areas and farms will be created and forced out of agricultural production. As a result the rate of job losses in the farming industry will be drastically increased.

Reduced environmental pollution: bioethanol offers ecological advantages as a fuel additive. As a replacement for lead it can increase the anti-knock quality of the fuel mixture and reduce pollutant emission. Pollution with nitrous oxides, carbon monoxides and hydrocarbons is also slightly reduced. However the emission of aldehydes, which can be toxic, increases. The ecological dangers lie in large-scale cultivation. Since the products are not intended for human consumption, either in natural or in processed form, they do not need to be free of agro-chemical residues. As a result there is no longer any obstacle to the intensive use of agro-chemicals. Soils which are too highly contaminated with heavy metal emissions to allow food production to take place (around 7% of agricultural land in the FRG) could be used for raw material production without the sources of these emissions having to be eliminated. The trend towards single cropping is threatening the diversity of species and draining soil fertility. But a particular threat to the environment is posed by the vast residues left after the conversion of biomass into ethanol, the harmful effects of which cannot be eliminated even after further processing of the waste products.

5. BIO-BUSINESS

Since the 1970s around 900 seed firms[1] have been taken over world-wide by the agro-chemical multi-nationals, thus enabling them to coordinate seed and chemical production and to market them as an agricultural input package. The involvement of other breeding firms in the research and marketing programm has been secured by means of contract (see table 3). The result of this multi-national seed-chemical link has already made itself felt in agriculture. All the major seed suppliers now market combinations of seeds, disinfectants, herbicides and pesticides which form an almost indivisible package.

[1] Pat Roy Mooney, 1985, unpublished

Since the development of genetic techniques has become commercially interesting, the multi-national concerns have secured an interest in this area as well. It was a buyers market, because after the investment boom the hoped-for rapid amortization failed to materialize, the shares of the small gene firms fell as a result, and bankruptcy could often only be avoided by means of a timely sale. Genetic technology know-how could be obtained cheaply in this way (diagrams 1-4 and tables 4 and 5).

TABELLE 3: The global seedsmen *

Rank	Private enterprise	Home state	Parent industry	Total sales (US $ millions)	Seed sales (US $ millions)	Seed firms* Direct	Seed firms* Indirect	Number of crops	Number of var	Number of states
A	Royal Dutch/Shell	Anglo/Dutch	Petrol	82.291	650	68	3	55	83	76
	Pioneer Hi-Bred	USA	Seed	557	557	27	2	6	55	16
	Sandoz	Switzerland	Chemical	2.946	319	34	—	12	172	13
	Cardo	Sweden	Agro-Ind.	440	285	25	5	18	108	7
	Dekalb-Pfizer	USA	Seed/Chem.	—	187	29	1	8	142	20
	Ciba-Geigy	Switzerland	Chemical	7.061	107	19	7	9	76	14
B	Upjohn	USA	Chemical	1.828	139	10	1	13	52	7
	Cargill	USA	Agro-Ind.	15.000	—	11	—	6	47	5
	Suiker Unie	Netherlands	Agro-Ind.	353	100	15	1	12	72	7
	Svalöf	Sweden	Seed	—	—	7	3	16	62	3
	Clays-Luck**	France	Seed	155	155	5	—	—	—	6
	Kleinwanzelbener Saat.	F.R.Germany	Seed	80	80	26	1	14	125	11
	Cebeco-Handelsraad	Netherlands	Agro-Ind.	—	—	7	—	13	85	7
	Florimond-Desprez	France	Seed	—	—	1	4	10	44	3
	Limagrain	France	Seed	130	130	22	—	8	41	8
	UNCAC	France	Agro-Ind.	—	—	6	—	12	32	2
	De Danske Sukkerfabrikker	Denmark	Agro-Ind.	400	—	10	—	6	46	8

* Direct = a subsidiary.
Indirect = a company of which the senior enterprise has a contractual relationship which may or may not include equity interest.
** There are some indications that a significant share of the Clays Luck equity is now in the hands of public and private French corporations.

source: Development dialogue 1-2 1983 Uppsala, Sweden
The law of the seed, page 96

Document 1

Erfolg kann man säen: BRUTUS.

BRUTUS (FAO 270) - der Mais für Körner-, Silo- und Corn-Cob-Mix-Nutzung. Mit hervorragender Futterqualität durch relativ geringen Spindelanteil und hohe Nährstoffkonzentration.

Große Ertragssicherheit erreicht BRUTUS durch:

- starke Kältetoleranz in der Jugend
- geringe Anfälligkeit gegen Stengelfäule
- sehr gute Standfestigkeit, auch bei der Reife
- robuste Gesundheit
- problemlose Ernte
- hohe Erträge

Sie erhalten BRUTUS über den Handel und über die Genossenschaften.

Shell Agrar

7/83 Württembergisches Wochenblatt für Landwirtschaft

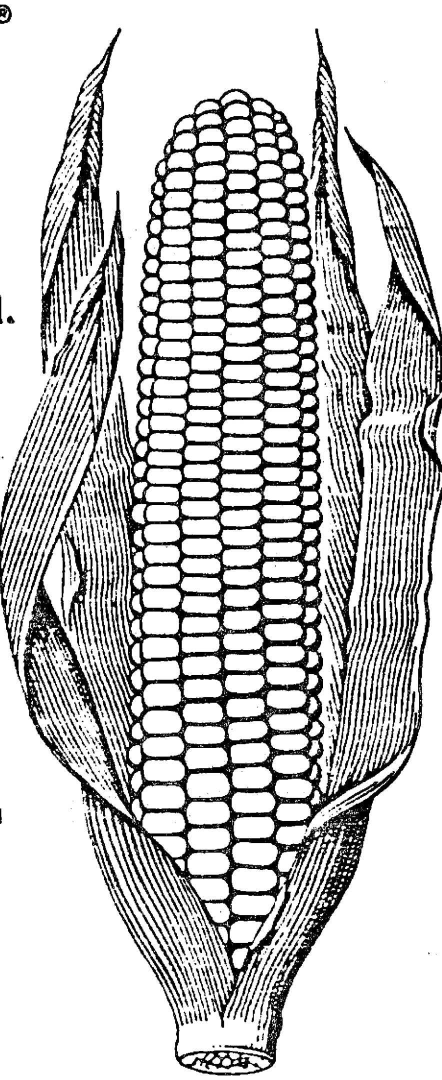
LENTAGRAN®

im Mais. Dem ist kein Kraut gewachsen.

LENTAGRAN - das Mais-Herbizid für den Nachauflauf erfaßt Problem-Unkräuter und Hühnerhirse

Mit der Tankmischung LENTAGRAN + ATRAZIN Fl. Shell bekämpfen Sie Problemunkräuter einschließlich ATRAZIN-resistenter Unkräuter wie z. B. Klettenlabkraut, Amarant- und Meldearten, Ackerstiefmütterchen u.a.

Die Tankmischung LENTAGRAN + ATRAZIN Flüssig Shell zeichnet sich durch sehr gute Maisverträglichkeit aus. Selbst bei extremen Temperaturschwankungen (Hitze-, Kälteperioden) treten keine Blattverbrennungen oder Wachstumsstörungen beim Mais auf. Sie ist in allen Entwicklungsstadien der Kultur voll verträglich. Sorteneinschränkungen bestehen nicht.



AUFWANDMENGE UND ANWENDUNG:

Mit 1,5 kg/ha LENTAGRAN + 1,5 kg/ha ATRAZIN Flüssig Shell gegen kleine Unkräuter und Ungräser.

Mit 2 kg/ha LENTAGRAN + 1,5 kg/ha ATRAZIN Flüssig Shell bei größeren widerstandsfähigeren Unkräutern.

Mit 3,0 kg/ha LENTAGRAN + 2,0 kg/ha ATRAZIN Flüssig Shell gegen Problemunkräuter und Hühnerhirse.

UNSER WEITERES PROGRAMM FÜR EINE GESUNDE MAISKULTUR:

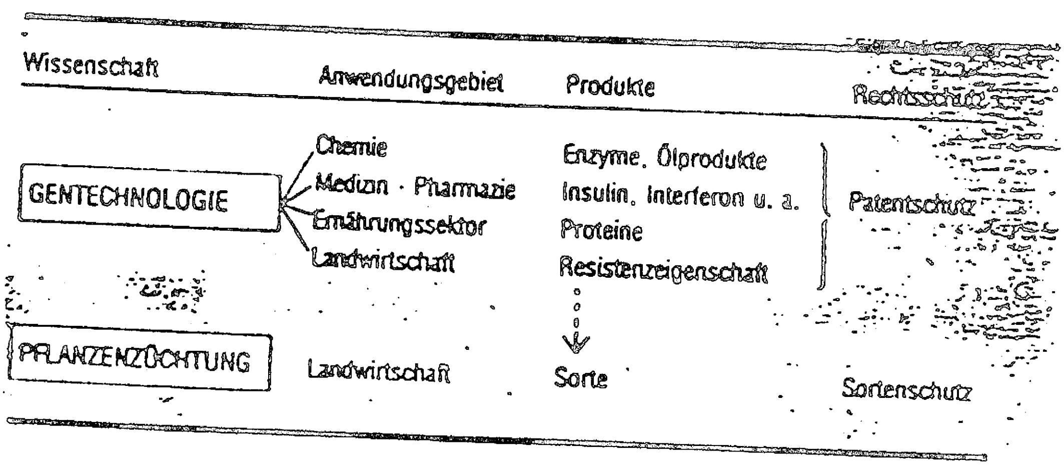
- Maissorte BRUTUS (FAO 270), der Tip für Körner-, Silo- und Corn-Cob-Mix-Nutzung. Standfest bis zur Reife, robuste Gesundheit, geringer Spindelanteil, problemlose Ernte, große Ertragssicherheit.
- AQUINOL 80, das Herbizid mit der bewährten Hirsewirkung für den Vorauflauf mit dem günstigen Abbauverhalten.
- BIRLANE FLUID, das spezielle Insektizid gegen die Fritfliege.

Shell Agrar

16/83 Württembergisches Wochenblatt für Landwirtschaft

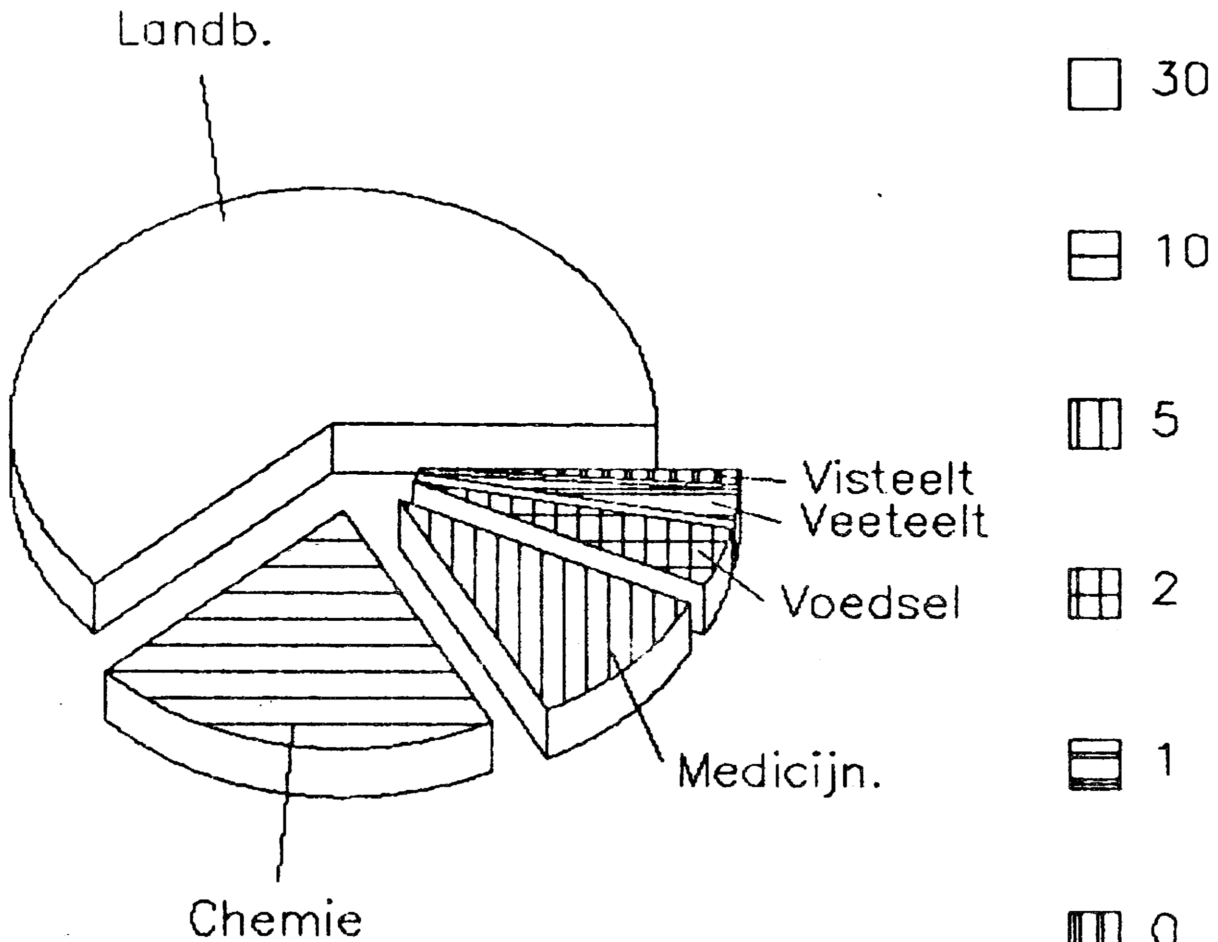
Document 2. The Shell game

SCHAUBILD 3


Wissenschaft
Anwendungsgebiet
Produkte
Rechtsschutz
GENTECHNOLOGIE
Chemie
Medizin · Pharmazie
Ernährungssektor
Landwirtschaft
Enzyme, Ölprodukte
Insulin, Interferon u. a.
Proteine
Resistenzeigenschaft
Patentschutz
PFLANZENZÜCHTUNG
Landwirtschaft
Sorte
Sortenschutz

POTENTIELE BIOTECHNOLOGIE MARKT

PER SEKTOR
IN MILJARDEN US$



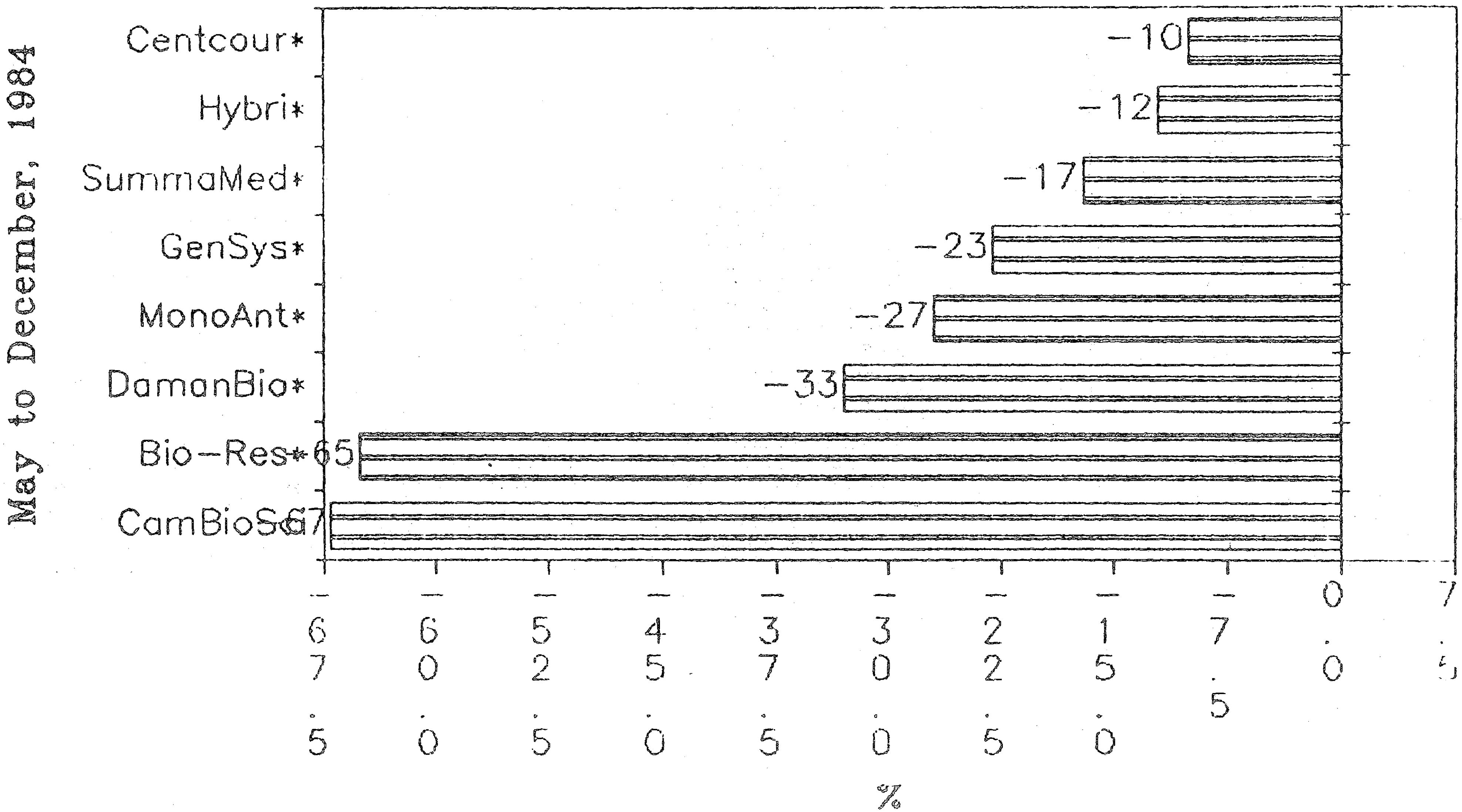
source:
BRON: ATAS BULLETING, VOL. 1
SONDAHL et. al.

Schaubild 4

Agricultural Biotechnology:

ANTIBODY FIRMS & STOCK PRICES

Small Biotech Firms Face Decline (3)



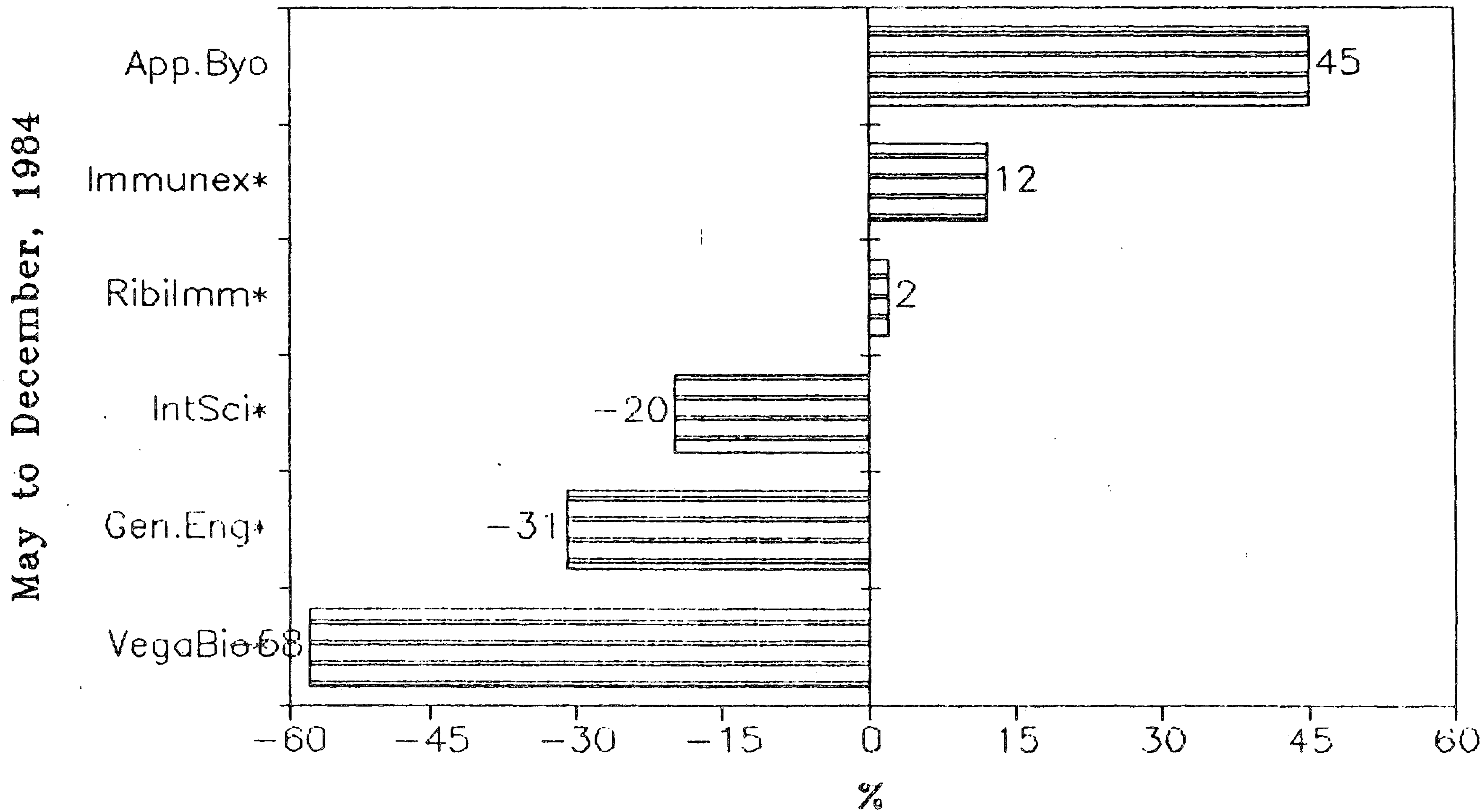
source:
RAFI (biotech)
Source: UNIDO Genetic Engineering &

TABELLE 4

Agricultural Biotechnology:

OTHER PRODUCT FIRMS & STOCKS

Small Biotech Firms Face Decline (4)



Source
RAFI (biotech)

TABELLE 5

The extent to which the direct commercial exploitation interests of the agro-industry have reduced the room for manoeuvre in agricultural research is exemplified by herbicide resistance research. The cheapest, quickest and most profitable course of action is to adapt the company plant variety to the company herbicide (see table 6 - PHARMA PESTICIDES AND SEEDS).

Just as the total herbicides will soon make short work of wild plants, so the multi-national concerns are well on the way to achieving a full rationalization of the structure of seed production. A study of the 'restructuring of the world seed industry'[1] through the application of genetic techniques in breeding, which was financed by 25 multi-national concerns, comes to the conclusion that if the present trend continues until the year 2000 no more than twelve seed and chemical giants will control the seed market. This same study also contains a timetable for genetic technological research in plant production which bases its predictions on the commercial use of genetically manipulated seeds for the majority of cultivated plants (see table 7).

Since genetic technology has begun to have an influence on breeding, the multi-national concerns in Europe and the Third World have been pushing for the introduction of patent rights in line with US practice. In their opinion the protection of plant types, which allows further development by other breeders, should be replaced by patent law which gives the applicant an exclusive monopoly.

In the USA in 1985 alone 1 078 new patents were registered giving substances and organisms produced with the aid of biotechnology copyright protection. Only 21 of these were registered by universities, the vast majority were taken out by chemical, seed and pharmaceutical concerns.

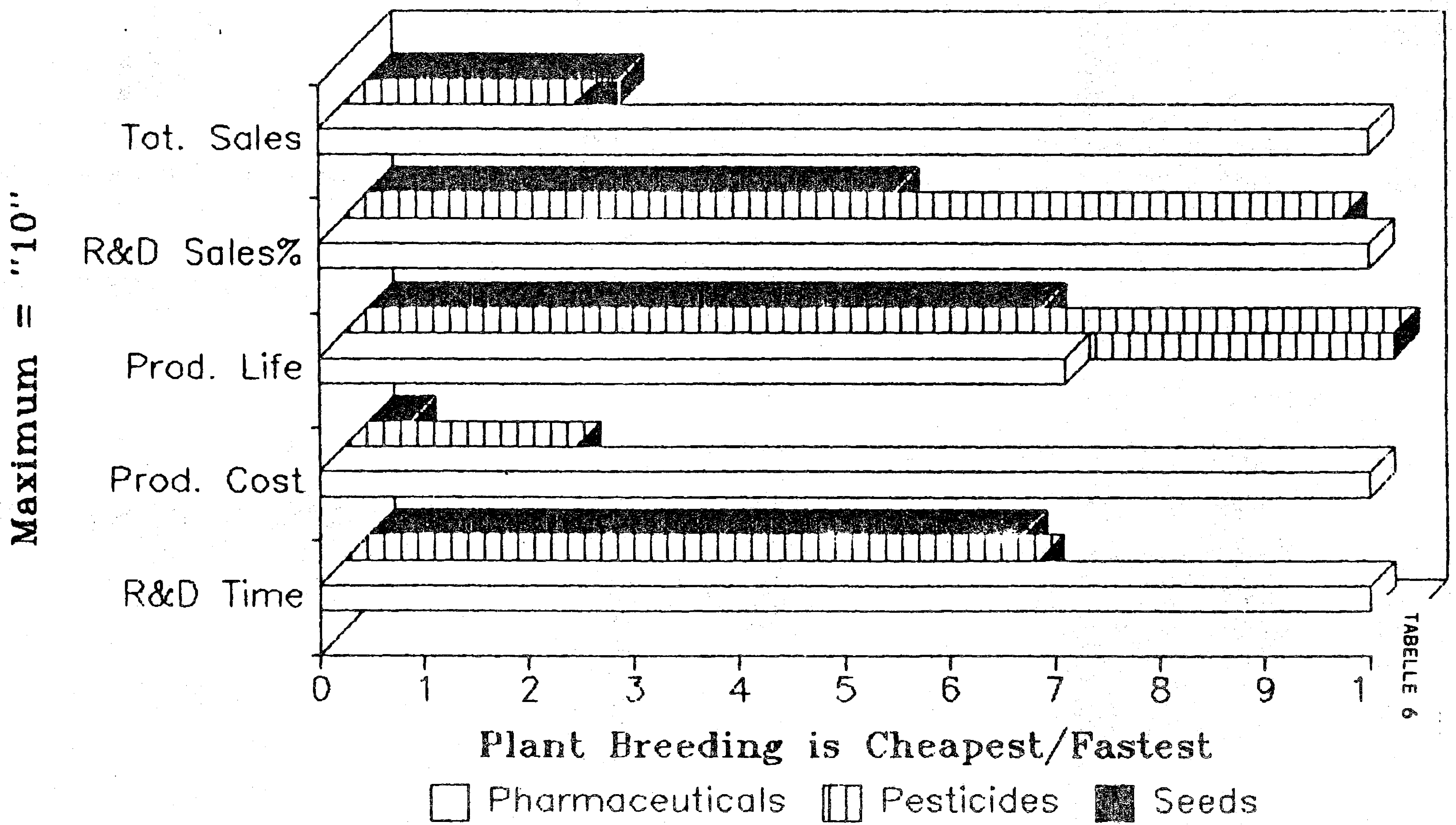
Apart from the fact that such a patent law could further consolidate the dominant market position of the multi-national concerns and further increase the dependency of governments, agricultural producers and consumers, it could not be expected to lead to a qualitative improvement in research and in the products marketed (see in this connection diagram 3).

1 George H. Kidd, L. William Teweles + Co.: The new plant genetics: restructuring the global seed industry, Pinne UK, 1985

Agricultureal Biotechnology:

PHARMA. PESTICIDES & SEEDS

Comparing Opportunity Costs



source
RAFI/IGRP (chemcomp/chemcom2)

TABELLE 7

GENETIC RESEARCH TIMETABLE FOR KEY CROPS

		Identification, Duplication and Modification of Agriculturally Important Genes	Routine Growth of plant tissue in Laboratory Culture Conditions	Growth of First Genetically Transformed Whole Plant	First Plants Altered by New Technology Available to Breeder for Commercial Production	Growth of Transformed Plants on a Routine Basis
Major Cereals	Corn	now (zein, early maturity genes)	now	early 1990s	now	mid-1990s
	Wheat	1985-1987	now	early 1990s	1984-1986	mid-1990s
	Rice	1985-1987	now	late 1980s	now	early 1990s
	Barley	now (hordein, powdery mildew resistance genes)	now	1986-1988	1985-1987	early 1990s
	Sorghum	1987-1989	1984-1986	early 1990s	1988-1990	mid-1990s
Oil Seeds	Soybean	now (nitrogen fixation genes)	now	early 1990s	1988-1990	mid-1990s
	Oil Palm	1988-1990	now	late 1990s	now	after 2000
	Sunflower	1985-1987	1984-1986	now	1984-1986	1986-1988
	Oilseed Rape	1984-1986	now	late 1980s	now	early 1990s
Forages	Alfalfa	1986-1988	now	1985-1987	now	early 1990s
	Red Clover	now (nitrogen fixation genes)	now	early 1990s	now	mid-1990s
Vegetables	Tomatoes	1984-1986	now	1983-1985	now	1986-1988
	Lettuce	1985-1987	now	late 1980s	1983-1985	early 1990s
	Cucumber	1986-1988	1983-1985	mid-1990s	1985-1987	late 1990s
	Onion	1986-1988	1984-1986	early 1990s	1984-1986	mid-1990s
	Potato	now	now	1983-1985	now	1986-1988
	Carrott	1983-1985	now	1983-1985	now	1986-1988
	Beans	now (phaseolin)	1984-1986	1986-1988	1985-1987	early 1990s
	Peas	now (vicilin, legumin)	1984-1986	mid-1990s	1985-1987	late 1990s
	Brassicas	1983-1985	now	late 1980s	now	early 1990s
Grasses	Kentucky Bluegrass	late 1980s	1985-1987	mid-1990s	1986-1988	late 1990s
	Orchardgrass	late 1980s	1985-1987	mid-1990s	1986-1988	late 1990s
Woody Plants	Fruit, Nut and ornamental trees	mid-1990s	1986-1988	late 1990s	early 1990s	after 2000
	Forest trees	mid-1990s	now	late 1990s	early 1990s	after 2000
Speciality Crops	Sugarbeets	1985-1987	now	early 1990s	1987-1989	mid-1990s
	Sugarcane	1987-1989	now	early 1990s	now	mid-1990s
	Cotton	1985-1987	now	early 1990s	1983-1985	mid-1990s
	Tobacco	now	now	1983-1985	now	1986-1988

Source: L. William Teweles & Co

PE 107 429/fin.

6. RESEARCH OBJECTIVES

The Commission is encouraging research and development in the field of biotechnology and genetic technology in the context of the economic integration of the Member States and an improvement in the competitiveness of the Community as a whole vis-à-vis the United States and Japan.

The biomolecular engineering programme (BEP), which from 1982 to 1986 was supported to the tune of 15 m ECU and which will continue to be financed, as the objective of eliminating bottlenecks which prevent the application of modern biochemistry and molecular genetics in certain sectors of the food industry and agriculture. In the first four years this programme has already produced useful results, which are described by the Commission as pioneering and encouraging.

Laboratories in the Federal Republic of Germany, Ireland, the Netherlands and Great Britain have jointly developed starter cultures for the processing of milk from technologically manipulated streptoccoci, which have already reached the patenting stage. The development of genetically produced vaccines for farm animals and the development of a system for transferring agro- bacteria to cultivated plants are seen as major successes of this research programme.

But it is the limited perspective in which the whole research concept and therefore also the assessment criteria, are set, which allows its work to be seen as positive in an overall sense. Every gene transfer or gene decoding, which is commercially viable, therefore seems to be an advance in itself. As a result, the reports from the individual programme sectors, insofar as they are made linguistically accessible to the layman, read like announcements of successes. In reality they are nothing more than declarations of faith in technological progress.

7. RISKS

Until now in most Member States of the Community risk studies and safety regulations in the sector of biotechnology and genetic technology have only covered research institutes and laboratories. They are designed to prevent the accidental release of manipulated organisms into the environment.

The question of the risks inherent in the commercial application of biotechnology and genetic technology has only been seriously opposed by scientists and politicians since private firms expressed the wish to release genetically manipulated organisms into the environment (cf ice-minus bacteria).

According to a comprehensive study by the Ecological Research Centre in Cornell, USA, no reliable methods yet exist to assess the risk of releasing manipulated organisms into the environment*. On the other hand a large number of applications for the authorization of outdoor tests are pending in the USA and Europe. In the light of the extensive investments which have been made in the biotechnology sector, the pressure for commercial application in agriculture is steadily increasing. The dangers associated with its general application and authorization in agriculture can be summarized as follows:

1. Knowledge about the manipulated organisms and their behaviour in the environment is still fragmentary. However, once they have been released into the environment it is no longer possible to call them back. They will interact with the environment, evolve further, possibly even pass on their genetic characteristics to others. 'Errors in creation' on the part of the genetic technicians, which could still have been corrected in the laboratory, require much more drastic countermeasures once they have reached the environment, if indeed human influence can be exercised at all at that stage.

2. Through the use of biotechnology and genetic technology the number of mutations in biological systems can be increased. The speed at which new organisms are introduced in this way is far in excess of natural evolution and therefore creates ecological imbalances, which may give rise to a situation in which the control of the manipulated organisms by natural competitors is no longer possible.

3. Experiences with the introduction of non-manipulated organisms into foreign ecosystems have already made it clear that the effects cannot be predicted with any certainty. There are examples of immigrations which have passed off relatively harmlessly, but newly introduced varieties can equally cause extensive damage. The introduction of the Colorado beetle and of galinsoga led to considerable falls in yields in agriculture, the introduction of the water hyacinth into Africa and Asia has led to waterways being choked and has greatly altered the spectrum of species.

4. As manipulated organisms become more and more widespread in agricultural production, so man must increasingly take on the regulating function of the natural environment. The rationalized farming industry provides enough clues for forward projections to be made: nitrate problems in groundwater, pesticide resistances, soil erosion.

   If natural self-regulation processes are destroyed the short-term gains from increases in yield may quickly be offset by the resulting ecological costs.

---

* Jack Doyle, 1986

8. GENETIC EROSION

The increasing importance of genetic technology in agricultural development has brought clearly to light a central contradiction in modern agricultural production: modern growth oriented agriculture lives off its own assets, but it is increasingly destroying the natural bases of its own production[2].

With modern breeding being solely geared to maximum yields and the standardization of plants and animals with a view to a uniform supply of agricultural products the genetic diversity of cultivated plants and farm animal breeds is being systematically decimated[3].

The abandonment of small, regionally based breeding stations means the 'discontinuation' of the production of a large number of regional varieties and local breeds. The major seed concerns concentrate their breeding efforts on a small number of varieties, mostly hybrids, which can be exploited more profitably in large numbers than a broad spectrum of regionally adapted varieties. But national governments and the Commission are also to blame for the loss of a large number of regional varieties. When lists of certified seeds were being drawn up, 'unproductive' varieties were deliberately sifted out. When drawing up a European seed catalogue in 1980 the Commission ensured, in cooperation with the major seed businesses, that of the 1 547 registered vegetable varieties a mere 23 appeared on the list. Allegedly the varieties sifted out were synonyms. However, Pat Mooney from the ICDA Seed Network estimates that synonyms made up at most 38% of the varieties registered (see diagram 5: The common catalogue).

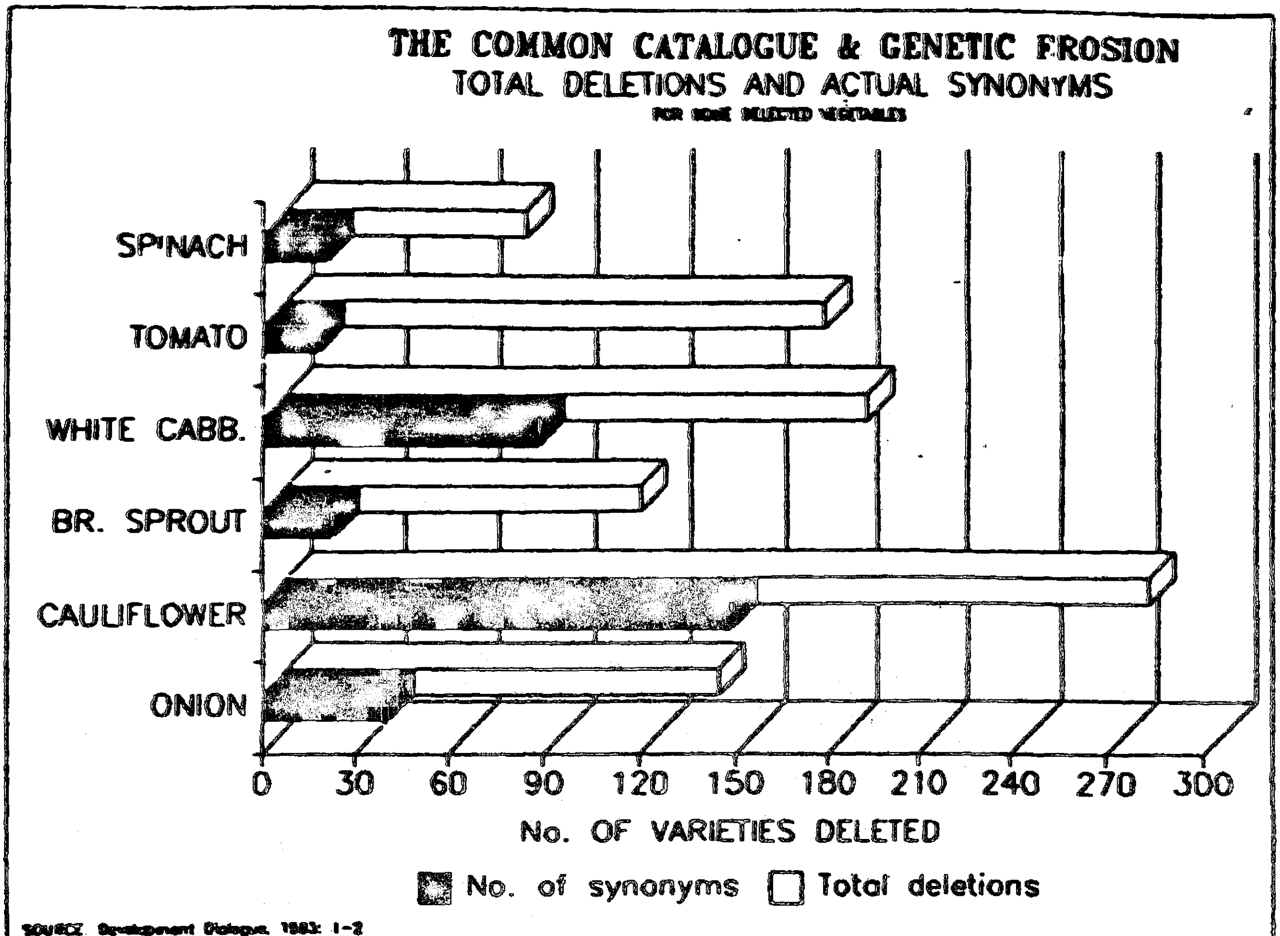
The drawback to this productivity-based agricultural strategy can above all be seen in the vulnerability of the whole agricultural sector to pests and diseases. The specifically regional resistances lost in the wake of the standardization of variety and breed characteristics must be compensated for by the ever increasing use of chemicals and drugs, which in turn has a destabilizing effect on the ecosystem of which agricultural production is a part. More and more often, pest resistances to the current pesticides are appearing as well as new diseases, and this leads to even more intensive use of agro-chemicals.

Against this background the use of genetic technology now offers itself as integrative 'solution from within'. According to its proponents and sponsors the genetic manipulation of plants and animals, but also of microorganisms, will enable an ideal combination of useful characteristics to be created which, largely independent of environmental influences, will be able to meet demands for exploitable foodstuffs and raw materials.

---

[2]Compare the report by Mrs Vera Squarcialupi, Doc A 2-154/85, and Edward Wolf in: State of the World; 1985 Worldwatch Institute

[3]Examples: of the 8 to 10 000 apple varieties which still existed in Europe at the turn of the century only a few hundred survive today, of which in turn only around a dozen are cultivated and marketed on a large scale. In Greece 95% of the local wheat varieties have disappeared during this century.



Source: ICDA Seedling

April 1986

The necessary basis for this is as varied as possible a reservoir of genes which are available for genetic breeding as required. The setting up of gene banks to conserve reproductive materials seemingly fulfils the desire for the preservation of natural resources for agricultural production, but in reality the systematic storage of seeds, sperm etc. only disguises temporarily masks the continuing over-exploitation of nature. Without the continuing adaptation to the particular environmental conditions of varying regions, the centrally stored genetic material will no longer be viable or adaptable after lengthy periods in storage[4].

The establishment of gene banks encourages an irresponsible attitude to natural resources. Secure in the knowledge that genes are safely preserved, we can continue to treat the environment as we always have done. However, like all central security systems gene banks are extremely vulnerable. There are many examples of the complete loss of seeds through technical errors in storage, power cuts etc.[5].

9. CONSEQUENCES FOR THE THIRD WORLD

Economic dependency, malnutrition and hunger - the main problems of the developing countries - cannot be solved by means of technology. This has been clearly shown with the green revolution. The export of machines, chemicals and high-yield seeds has favoured large farms, ruined countless small farmers and added to city slums. The export production of developing countries has grown at the expense of agricultural self-sufficiency and has increased economic dependence on the world market. Debts are blocking development. Technology has not got to the root of the hunger problem, but has widened the gulf between rich and poor.

In this context it is irresponsible to claim that the application of biotechnology and genetic technology could help the developing countries escape this situation. On the contrary the chances of the new technologies being adapted to people's needs have been reduced. The unequal property and distribution conditions in the developing countries have now been exacerbated by the concentration of economic power in the hands of multi-national concerns. If during the green revolution the majority of research and development, of hybrid seeds for example, was public, today genetic technology know-how is in private hands and is 'protected' by patents. Research therefore tends to be much more strongly geared towards exploitation and marketing. The developing countries thus have less opportunity to influence their own agricultural development.

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[4]cf. statements by Professor Weniger, TH Berlin
Professor Plarre, TU Berlin

[5]Quote from William C. Brown, former President of the famous Seed firm Pioneer High Breed International: 'More seed is lost as a result of badly run gene banks than from the field which the collectors have not yet visited'.

Let us take the example of the oil palm, probably the most important oil-producing plant grown in developing countries. The multinational concern Unilever has achieved an important breakthrough in this production sector: the breeding and propagation of palm oil plants in cell cultures. As a result it is now possible to clone the most productive varieties, i.e. to produce as many oil palm seedlings as required with identical genes and characteristics. The new propagation technique has brought the concern several advantages simultaneously:

- an immense speeding up and simplification of the selection and propagation of plants (30 times as fast)

- an increase in yield from the normal 3.5 to 11 tonnes per hectare

- the consistently homogenous quality of the oil produced

- various possibilities for the rationalization of production by using identical plants

- an almost unlimited market for palm oil seedlings in Asia, Africa and Latin America through the patenting of the technique

- cost benefits for its own processing industries.

Unilever is the world's largest margarine producer, but also produces a wide range of cosmetics, foodstuffs and detergents. Unilever itself owns palm oil, coconut, rubber, cocoa and copra plantations in West and Central Africa, Colombia and Malaysia. The company controls a third of the world market in oils and fats.

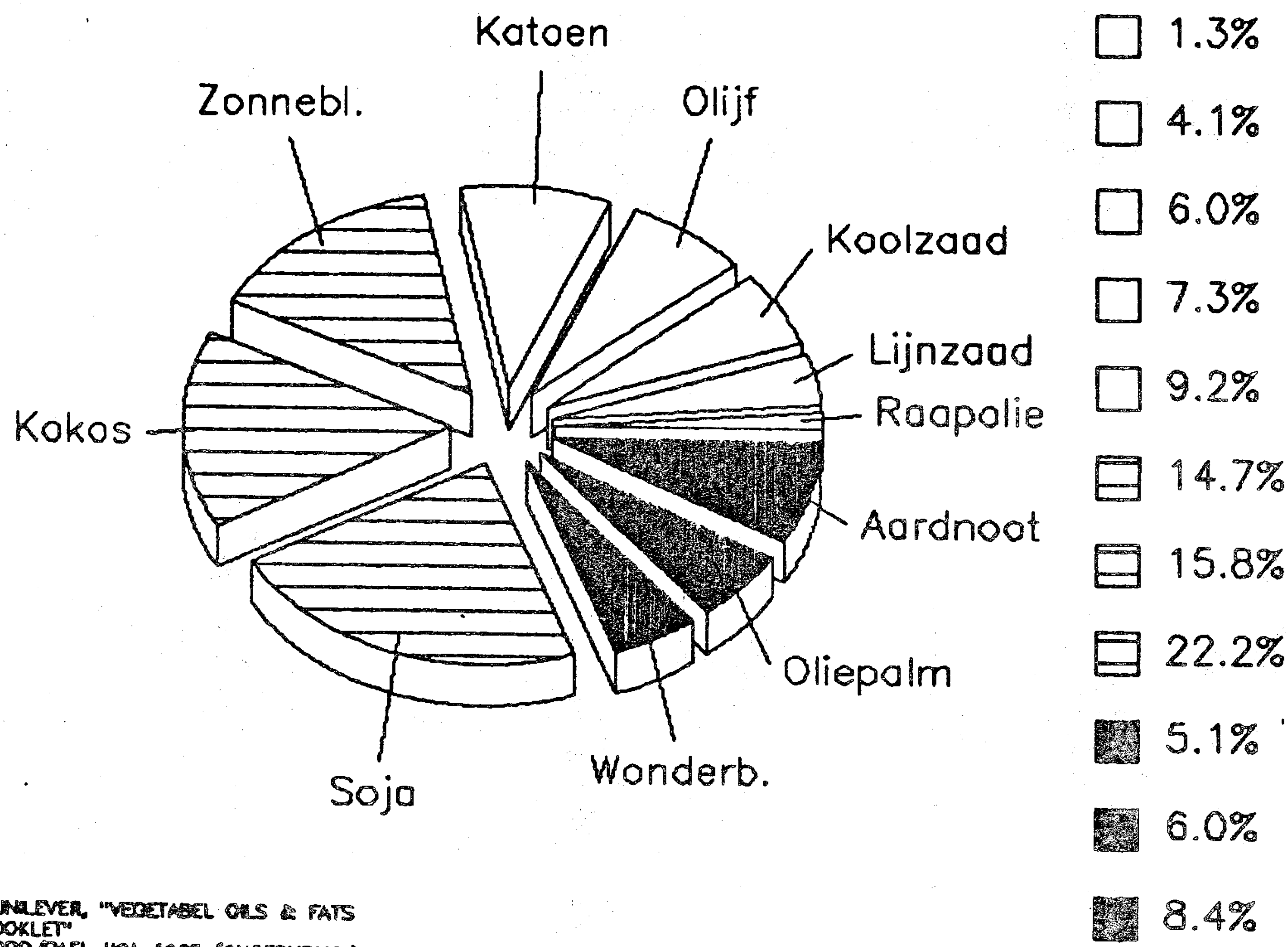
The developing countries tend above all to experience the drawbacks to technological progress. Initially the small producers, who cannot finance the switch to the new high-yield varieties, are ruined by falling prices, and with them countless agricultural workers, for whom there is no more work. But the fall in prices may also reduce whole countries to bankruptcy, as has already happened in the case of various raw materials. Other oil crops will also be affected because the margarine and food producers can alter the proportion of the various fats in their products (example for the coconut palm: UNILEVER; see diagrams 6 and 7).

Owing to the systematic application of these technologies the developing countries are finding themselves in an almost impossible situation: on the one hand they must try to modernize their export production by introducing the new technology so as to be able to keep pace with their competitors (as they are consistently being urged to do by the International Monetary Fund), on the other through the application of genetic technology the industrialized countries are already finding substitutes for their export products. In any case the resulting over-production leads to a worldwide drop in prices and falling export earnings. Even the fact that the developing countries are a 'supply area' for genetic material (70% of gene resources occur naturally there) in no way strengthens their economic position.

PLANTAARDIGE OLIËN

HUIDIGE EXPORT VERDELING

PER GEWAS, IN %

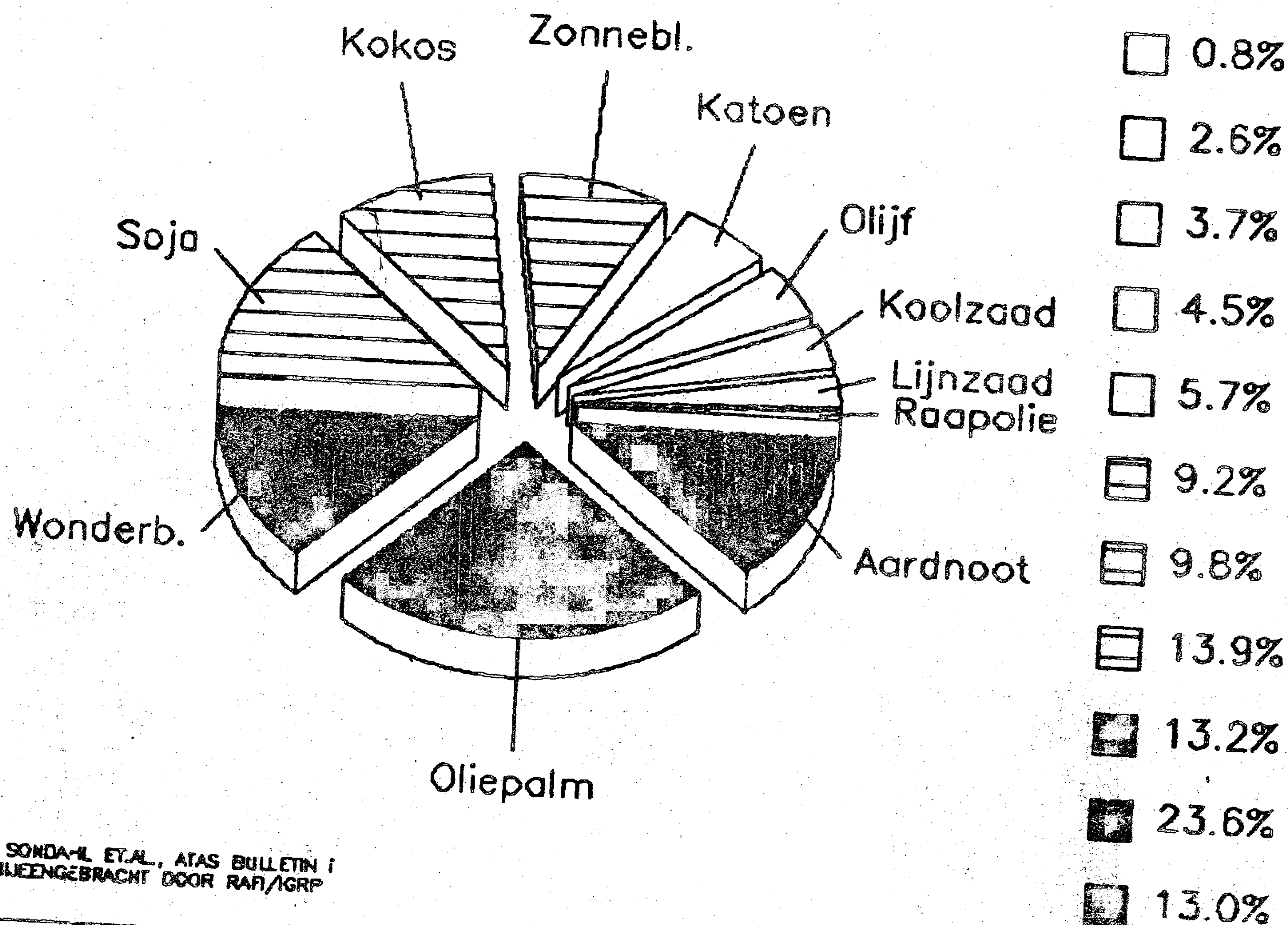


BRON: UNILEVER, "VEGETABEL OILS & FATS DATA BOOKLET"
NAAR: IGRP/RAFI, USA 1985 (ONGEPUBLIC.)

Schaubild 6

EXPORT-VERDELING DOOR BIOTECHNOLOGIE

(GESCHAT, IN %)



BRON: SONDAHL ET.AL., ATAS BULLETIN I
DATA BIJEENGEBRACHT DOOR RAFI/IGRP

10. CONCLUSIONS AND ALTERNATIVES

The rejection of the development and application of biotechnology and genetic technology in agriculture is based on an analysis of the structural, economic and social conditions and the contexts in which they are developing.

Modern agriculture is going through a crisis of over-production and self-destruction. The biotechnological and genetic technological approach to overcoming this crisis by means of altering the basic molecular information of life, simply takes us further along the road to disaster. It reduces the perspective to that of the electron microscope and ignores the interactions between the various ecological and social systems.

Alternatives cannot be expected at the purely technological level. They emerge from initiatives and movements such as the opposition of small farmers to the Common Agricultural Policy, consumer initiatives in favour of healthier food, agricultural workers who form trades unions in order to fight for land and jobs, critical scientists, who take an interest in alternative directions of research such as ecological farming, biological farms which demonstrate through their practical work that agricultural production and nature conservation are inseparable, 'Third World groups', which recognize in the exploitation of the Third World the destruction of the bases of our own existence.

The people who become involved in these movements have something to set against rationalized agriculture and the biotechnological revolution: the ability to understand the negative effects of modern agriculture, both in their causes and their inter-relations, and the conviction that they themselves can change things.

The political efforts of the small farmers' opposition has meant that the advocates of growth in European agricultural policy can no longer simply categorize growth farms as 'efficient' and small farms as 'failures'. The disappearance of the small farmer is no longer being accepted as a matter of course, but instead joint action is being undertaken to counter it.

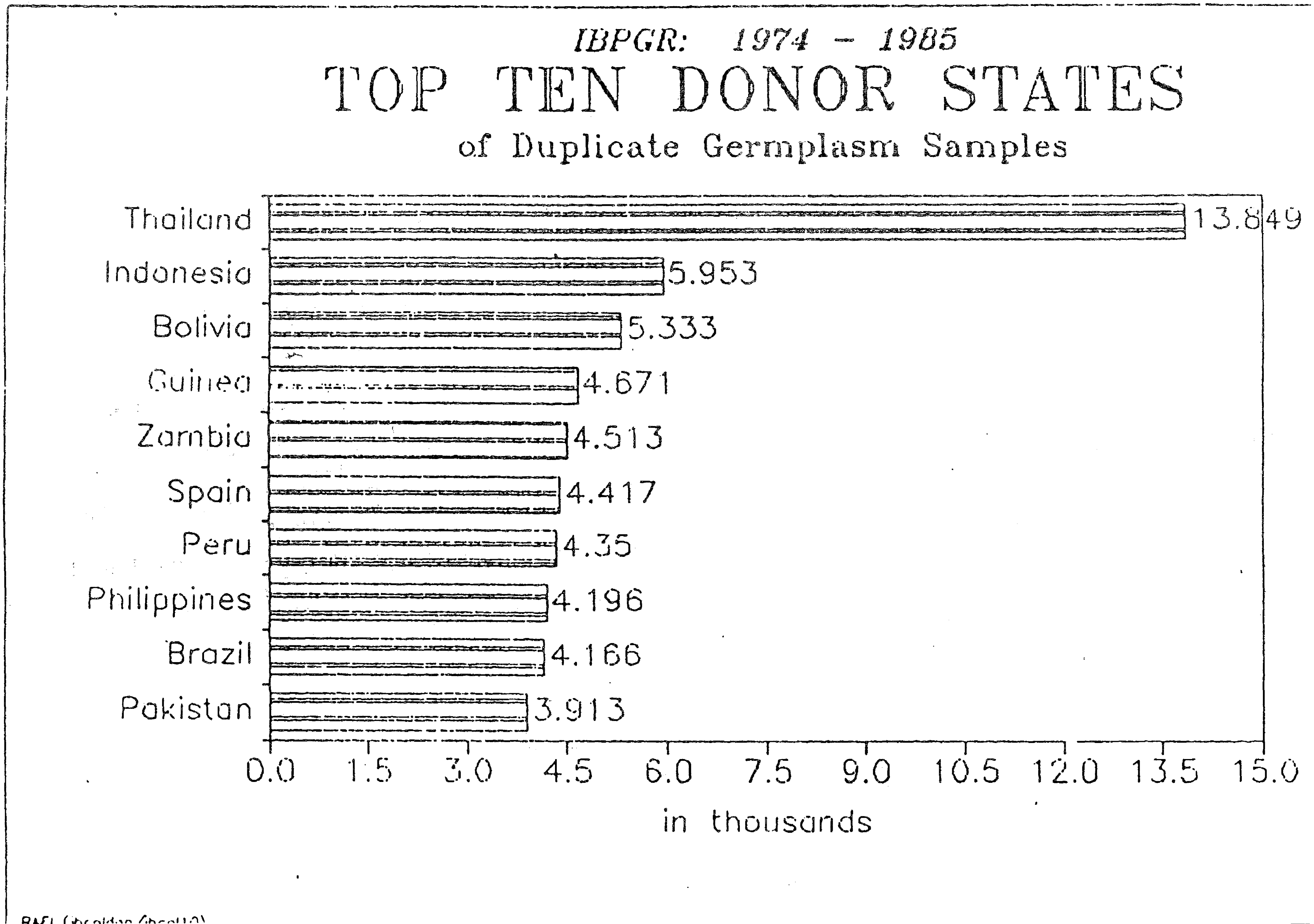
It is a matter of preserving the small farming (or cooperative) system, which is adapted to the economic and ecological peculiarities of a particular region. It is a matter of the preservation and improvement of a cyclical economy, which can conserve energy and raw material sources and maintains agricultural resources in a fertile and healthy state for future generations. It is a matter of producers and consumers reminding each other of their duty, of healthy food, more direct marketing, for example through producer-consumer cooperatives, so that industrial processing and conservation can be reduced. It is a matter of rewarding farmers adequately for their work of farmers in order to protect and create worthwhile jobs on the land and so initiate the natural interplay between agricultural production and environmental protection. Finally it is a matter of reducing the dependency of the Third World on the Community, of giving the developing countries more assistance in building up economic self-sufficiency and trade relations; it is a matter of making food aid superfluous, by dint of the Community reducing the pressure to export surpluses, cutting feed imports and giving the developing countries suitable assistance in increasing production designed to meet their own needs.

The promotion and commercial application of biotechnology and genetic technology runs diametrically counter to all these objectives. It leads to a worsening of the problems of the Common Agricultural Policy.

RESEARCH ON THE FACTORY FARM:

PLANT KIND	PLANT PRODUCT	COUNTRY OF ORIGIN	RESEARCH ENTERPRISE	US$ VALUE PER KILO
Lithosper-mum	Shikonin	Korea, China	Mitsui (Japan)	$4,500
Pyrethrum	Pyrethins	Tanzania. Ecuador, India	Univ. of Minnesota (USA)	$300
Papaver	Codeine Opium	Turkey		$650
Sapota	Chicle	Central America	Lotte (Japan)	
Catharanthus	Vincristine		Can. Nat. Research	$5,000
Jasminum	Jasmine			$5,000
Digitialis	Digitoxin-digoxin		U. of Tub-ingen (FRG) Boehringer	$3,000
Cinchona	Quinine	Indonesia	Plant Sci. Ltd (UK)	
Cocoa coccus	Cocoa Butter	Brazil Ghana	Cornell U. Hershey Nestle	$891 mil lion market
Thaumato-coccus	Thaumatin	Liberia Ghana Malaysia	Tate and Lyle (UK)	
Rauwlfia	Reserpine			$80 mil-lion market

[redacted]

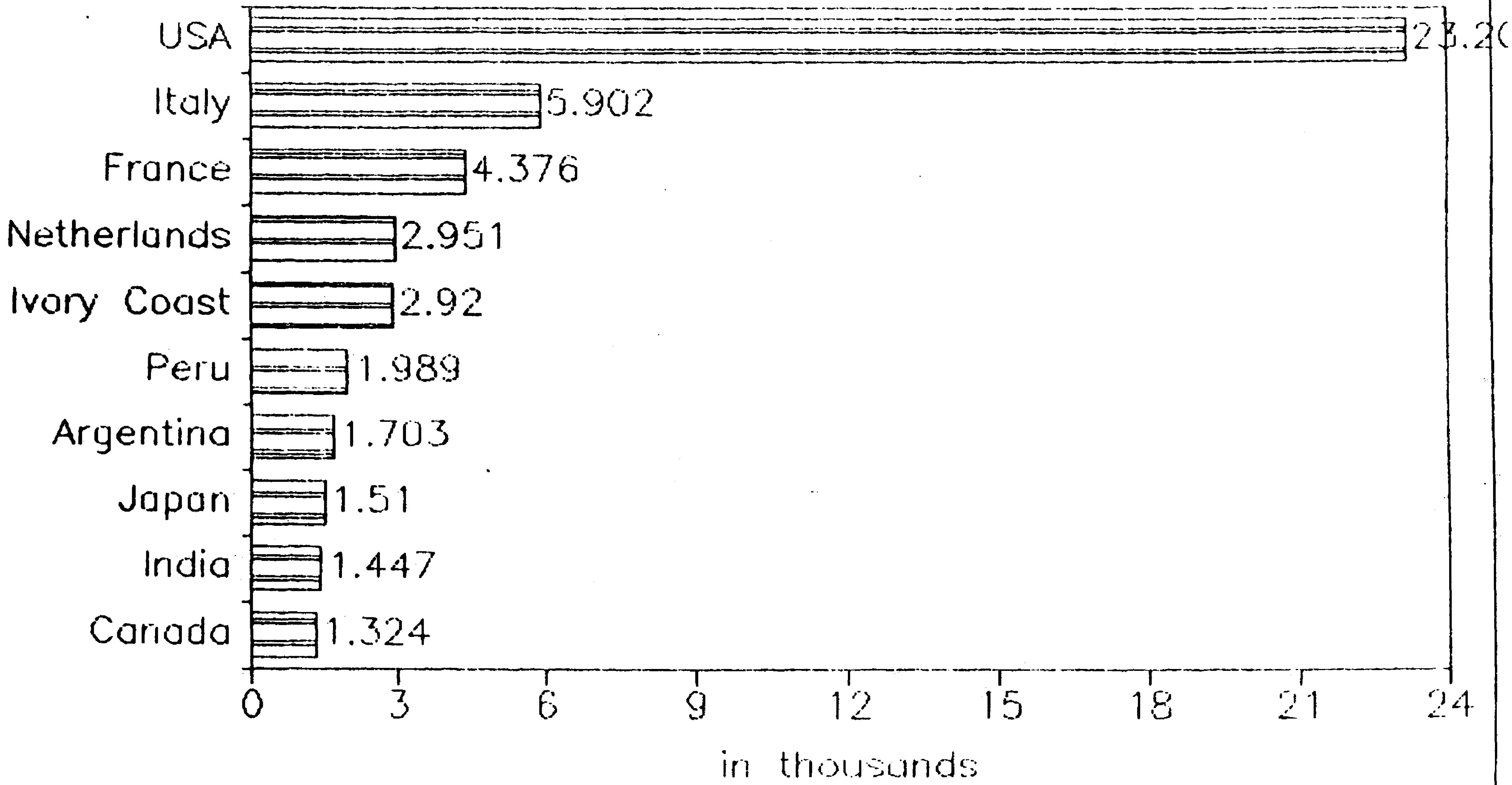


PE 107.429/fin.

IBPGR: 1974 – 1985

TOP TEN RECIPIENT STATES

of Duplicate Germplasm Samples



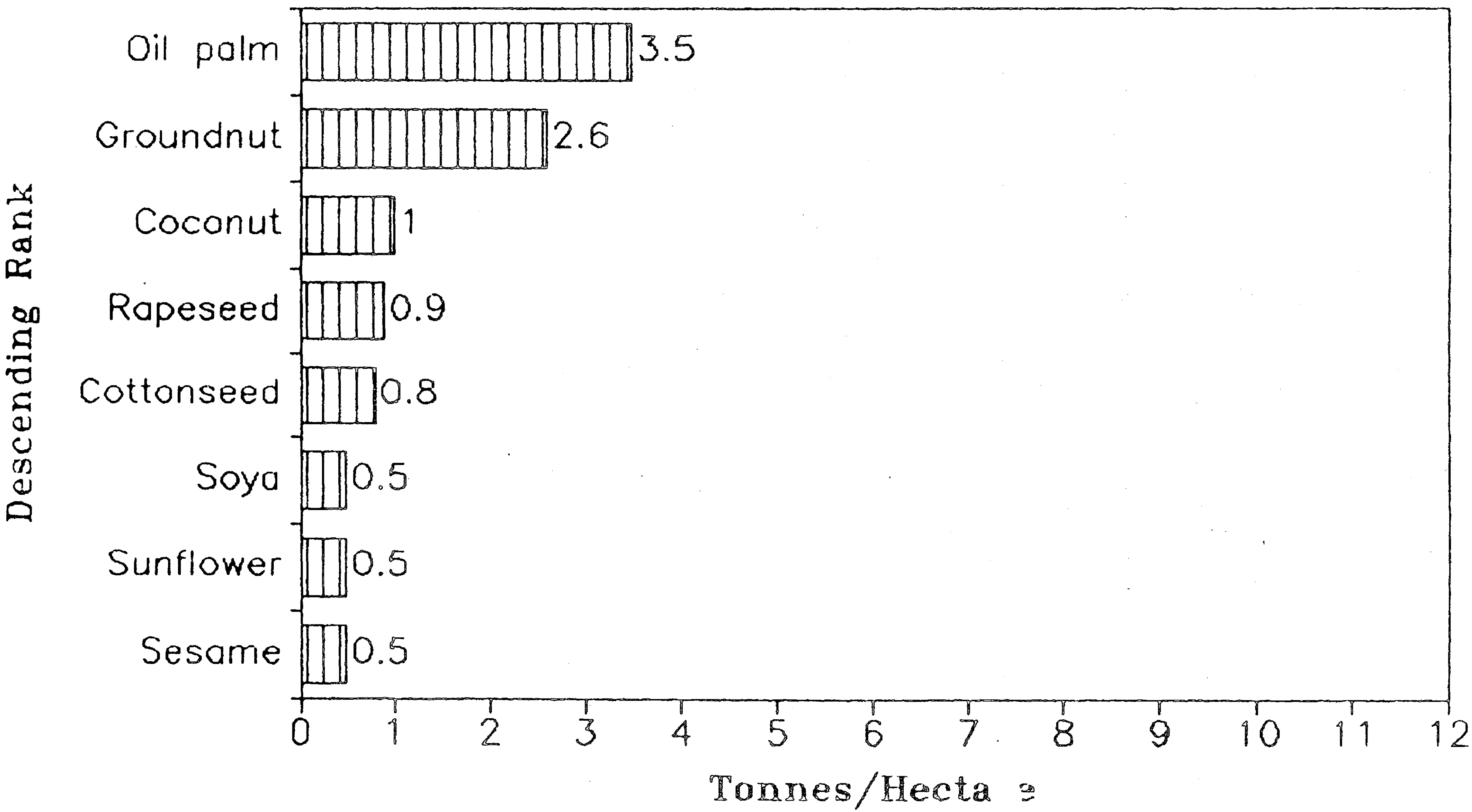
RAFI (ibcoldan/ibcal10)

TABELLE 10

Agricultural Biotechnology:

CURRENT OILSEED PRODUCTION

Comparison in Tonnes per Hectare



RAFI (oilseed/oilseed)

TABELLE 11

Agricultural Biotechnology:

FUTURE OILSEED YIELDS

Impact of Cloned Oil Palm

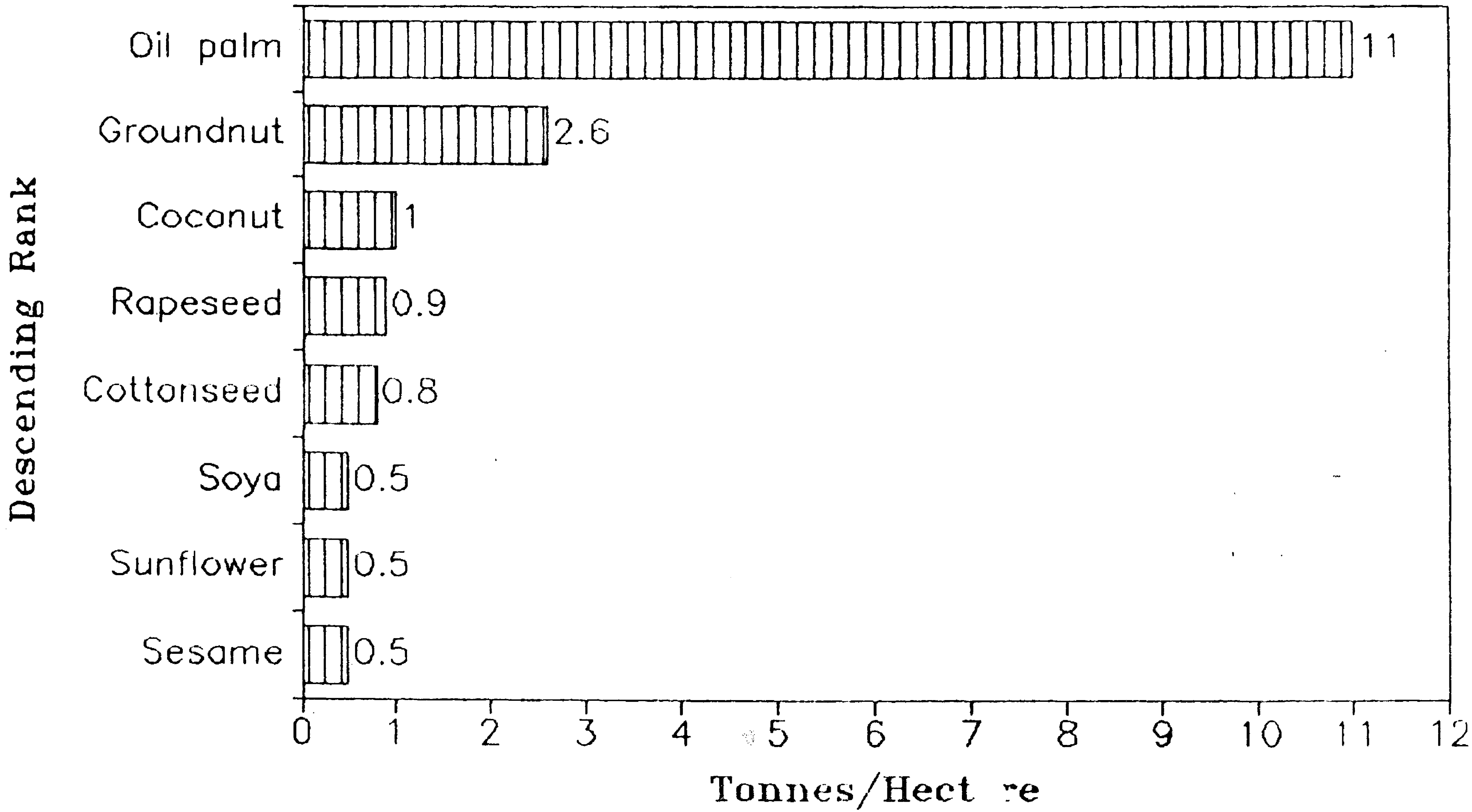


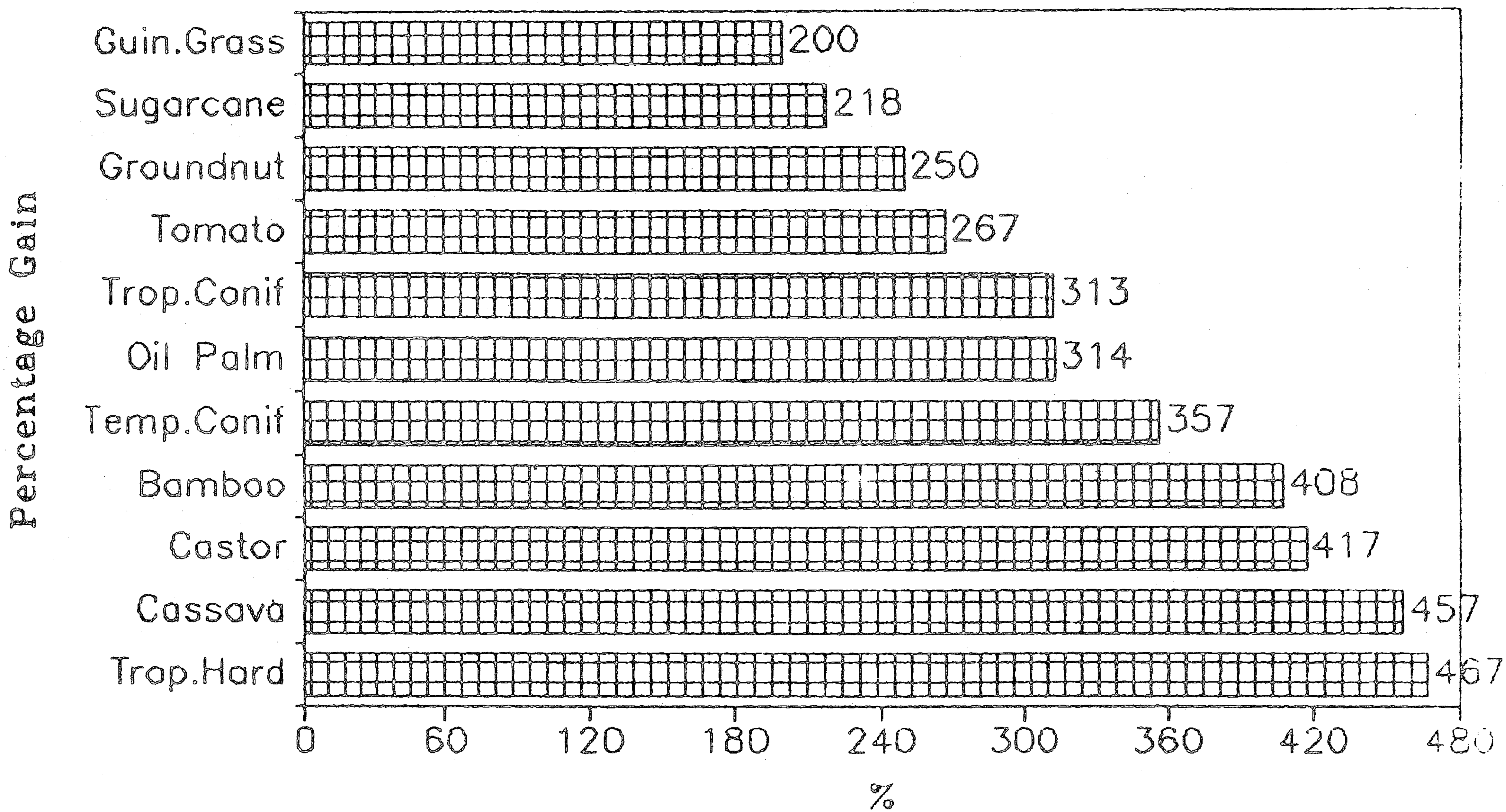
TABELLE 12

RAFI (oilseed/oilseed)

Agricultural Biotechnology:

CROP YIELD IMPACT

Potential Gain in Tonnes Per Hectare

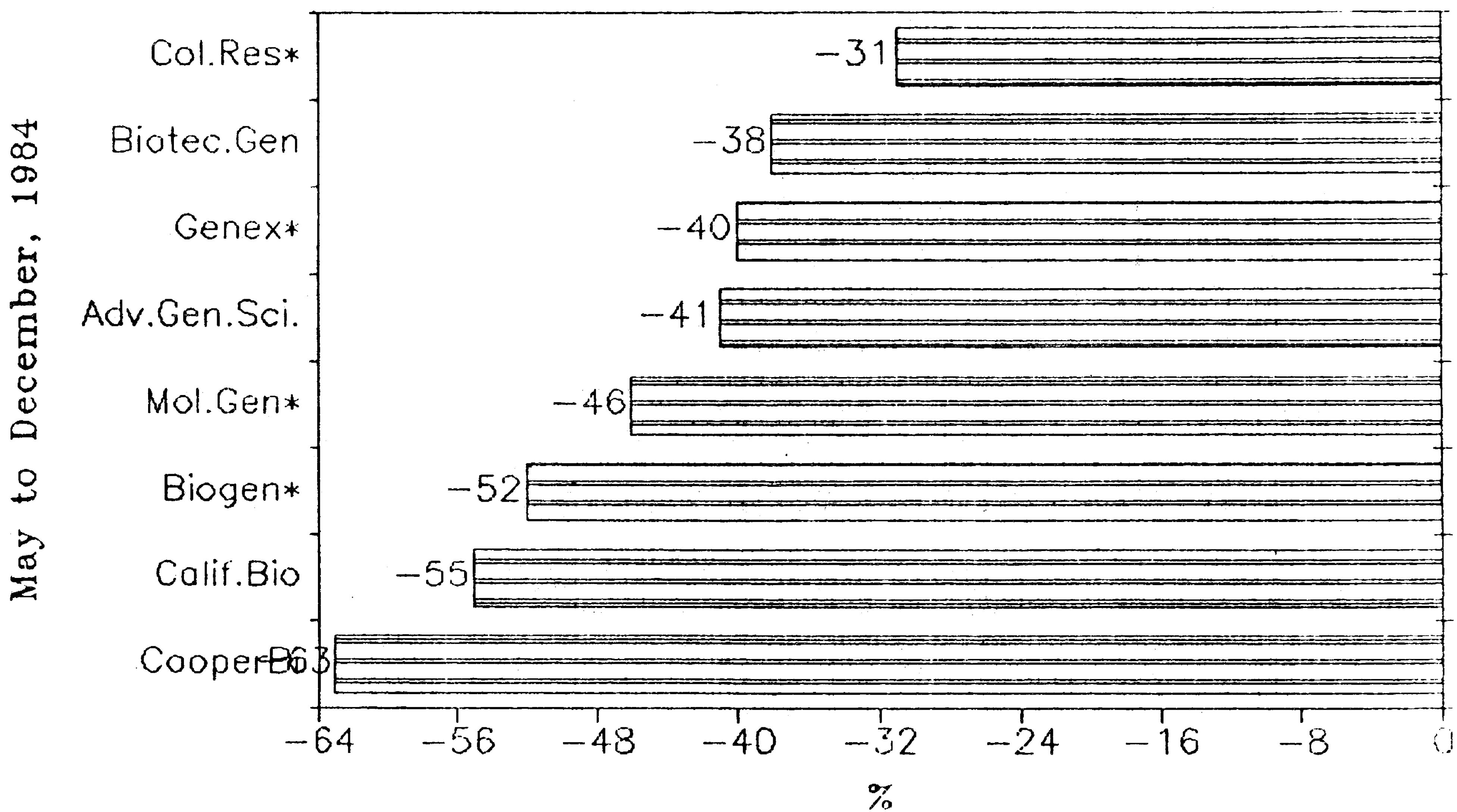


RAFI (biotech)

Agricultural Biotechnology:

rDNA FIRMS & STOCK PRICES

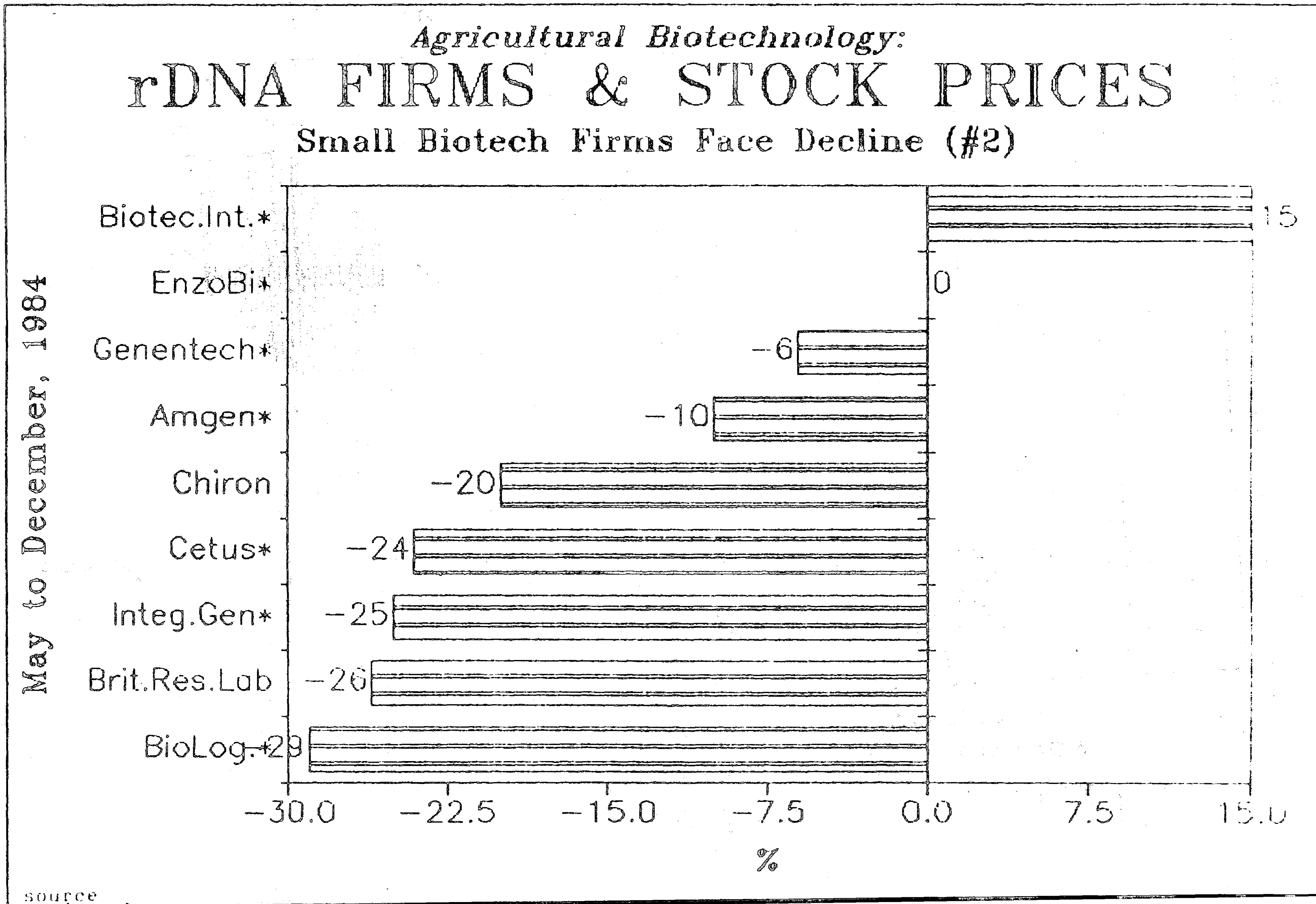
Small Biotech Firms iFace Decline (1)



Source RAFI (biotech) UNIDO, Genetic engeneering

Source: UNIDO, Genetic Engineering ...

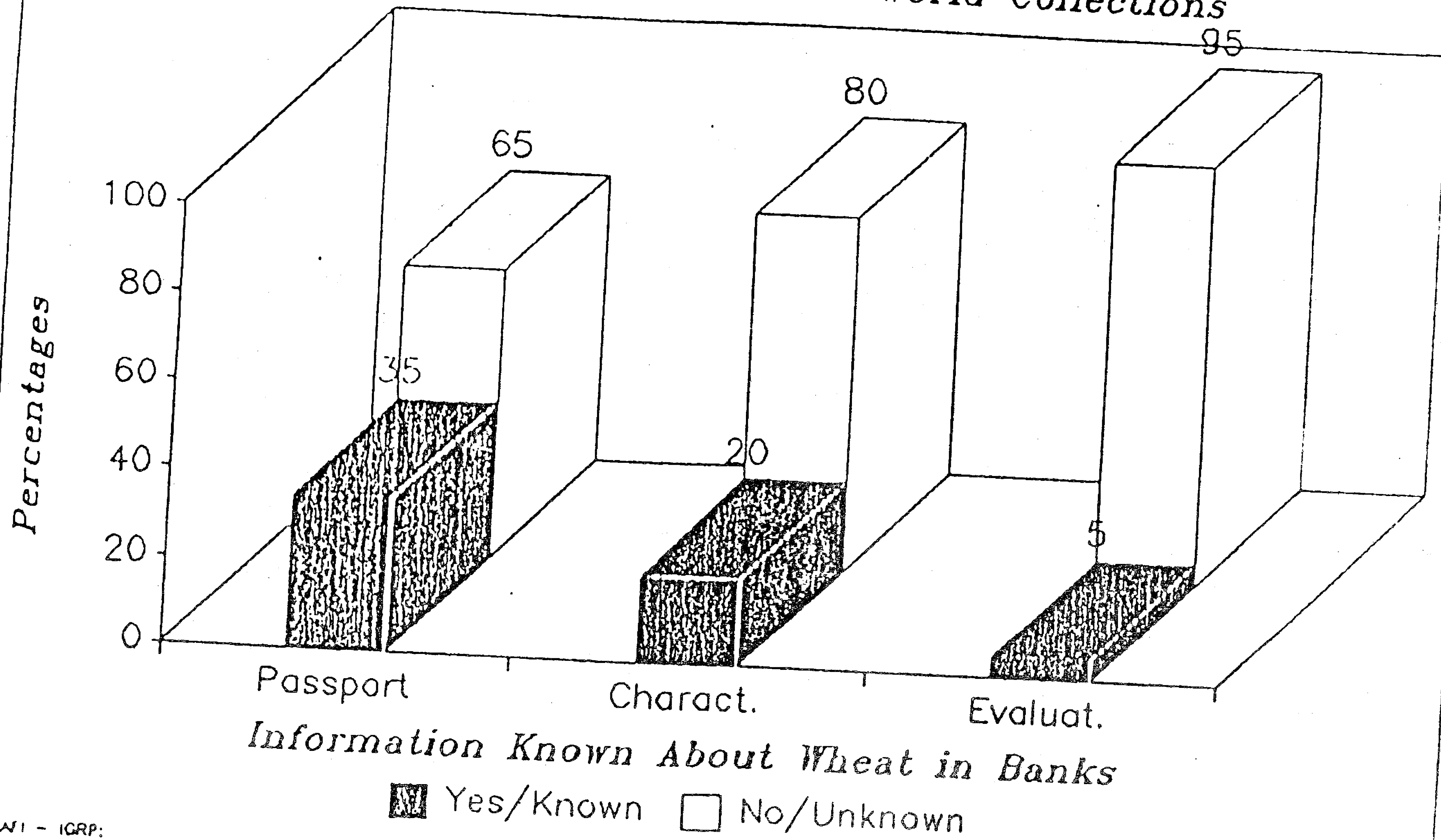
TABELLE 15



PE 107 429/fin.

GROUNDS FOR SECURITY?

IBPGR Information on Accessions of Wheat in World Collections



RAFI - IGRP:
Evaluation of The Global Conservation Strategy = (1wheat/183)

IBPGR: 1974 - 1985

NO CALL FOR THE WILD?

Percent Wild Species in Collections

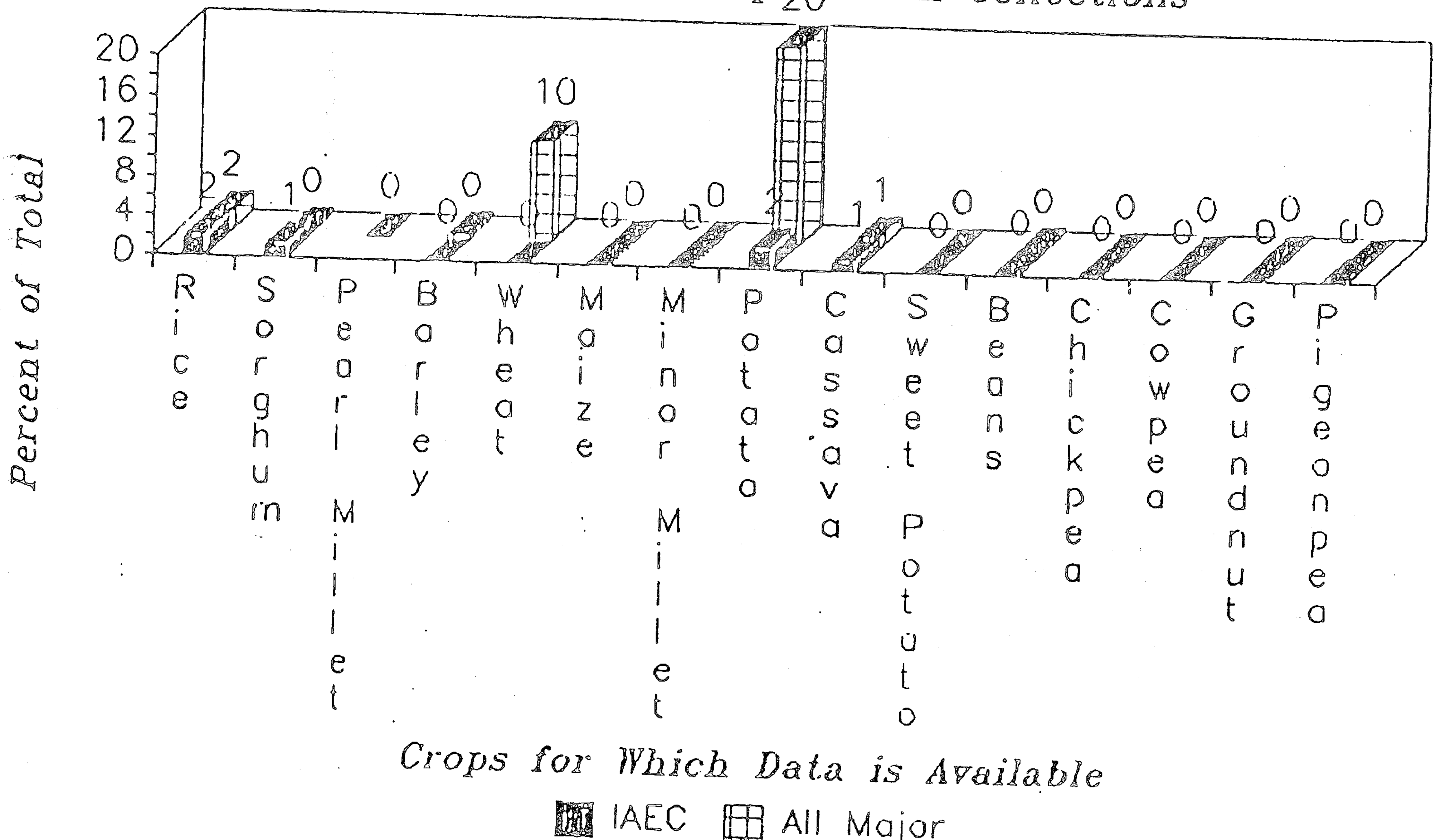


SCHAUBILD 9

SOURCE: [illegible]/RAFI
Evaluation of the Global Conservation Strategy – ([illegible]/[illegible]/17A)

APPENDIX

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DOCUMENT B 2-1087/85

MOTION FOR A RESOLUTION

tabled by Mr TOLMAN, chairman and Mr EYRAUD, first vice-chairman,

on behalf of the Committee on Agriculture, Fisheries and Food

pursuant to Rule 47 of the Rules of Procedure

on the use of agricultural products in biotechnology

The European Parliament,

A. having regard to the need to step up efforts to increase outlets for agricultural products other than for use as food,

B. having regard to the Community's efforts to develop biotechnology in the very near future,

C. having regard to the excellent opportunities for using a large number of agricultural products in biotechnology,

D. whereas the use of agricultual products in biotechnology may have consequences for the future of European agriculture,

E. whereas biotechnology has been included in the Eureka project,

1. Calls on the Commission to submit a study on the impact of the use of biotechnology on European agriculture;

2. Invites its competent committee to draw up a report on the subject;

3. Instructs its President to forward this resolution to the President of the Council.

DOCUMENT B 2-1351/85

MOTION FOR A RESOLUTION

tabled by Mr F. PISONI, Mr CHIABRANDO, Mr COSTANZO, Mr N. PISONI, Mr BORGO, Mr GAIBISSO, Mr GIUMMARRA and Mr LIGIOS

pursuant to Rule 47 of the Rules of Procedure

on new uses for agricultural products and, in particular, the use of cereals for ethanol production

The European Parliament,

A. having regard to the Commission Green Paper on perspectives for the Common Agricultural Policy,

B. having regard to the Commission Memorandum on the adjustment of the market organization for cereals,

C. having regard to the agreement reached by the Energy Council on [illegible] November 1985 concerning the savings in crude oil which can be made through the use of substitute fuels,

D. having regard to the Commission guidelines on new uses for agricultural products and, in particular, the use of Community cereal surpluses for ethanol production,

E. whereas ethanol production calls for costly structures and would require fixed quantities of cereals, irrespective of harvest yields,

F. whereas the oil industry can provide lead-free petrol at a moderate price well below that of ethanol,

G. whereas it is impossible to envisage EAGGF financial support for fixed, and in any event substantial, quantities,

H. whereas, in order to compete with other products serving as lead substitutes in petrol, ethanol production would require substantial financial aid from the Community,

I. having regard to the need to use biotechnology in agriculture, not least for the industrial processing of agricultural products,

L. having regard to the need to protect the role of family farms when planning new uses for agricultural products,

M. whereas the present cereal surpluses are being achieved at the expense of quality,

1. Proposes that a detailed study be carried out on ways of producing ethanol of agricultural origin, in the short- and medium-term and at competitive prices and that a thorough assessment be made of the cost of such production to the Community budget;

2. Stresses that, if the ethanol option were to be adopted:

   a. existing structures must be used, adjustments being made to them at a limited cost, and any Community aid must be reserved for producers who belong to associations,

   b. where specific industrial structures are necessary, large sums should not be spent on setting them up,

   c. the cost of the operation should not, in any case, be borne by farmers,

   d. the adjustments made to each structure should under no circumstances make agriculture dependent on the industrial sector;

3. Proposes, in addition, that research into and the development of biotechnologies should be carried out, once their economic feasibility has been established, using only Community agricultural products or rejects or surplus products also of Community origin, which cannot otherwise be used;

4. Considers, however, that the solution to the problem of cereal surpluses should be sought primarily at market level by promoting higher-quality products;

5. Calls on the Committee on Agriculture, Fisheries and Food to hold a public hearing on the subject;

6. Instructs its President to forward this resolution to the Commission and Council.