

PAPER PRESENTED AT THE INTERNATIONAL
WORKSHOP IN INTEGRATED PEST CONTROL
FOR GRAIN LEGUMES. CICP, EMBRAPA ,
FAO, IITA AND INTSOY. April 3-9 ,
1983 in Goiânia, Brazil.

PUBLIC SECTOR AND PESTICIDE INDUSTRY
PERCEPTION OF THE ROLE OF PESTICIDES
IN INTEGRATED PEST CONTROL PROGRAMS.

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AGRICULTURAL RESEARCH

The resources for agricultural research have shown a considerable growth in the last years, especially centered in the federal departments.

Silva, Fonseca and Martins made use of the technical literature published in the period between 1927 and 1977 as an indicator of results of the researches and as a tentative classification standard. These scientists stated that 68% of that literature regards factor saving technologies and 65% of it refers mainly to increasing soil productivity: (land saving technologies such as fertilization, plant breeding, irrigation and drainage, cultural practices, pests and diseases). Only 3% of the literature was related to increasing work productivity (labor saving technologies, such as farm machinery and herbicides), as we can see on Table 1, to follow.

If we compare the number of scientific articles published about pests/diseases/herbicides to the quantity of articles published about other subjects, we will get the figures shown on Table 2, to follow. A simple look at the data on Table 2 shows two very meaningful situations for agricultural research:

- Most research concerned to plant protection (pests/diseases/herbicides) which was more than all the other factor saving researches put together in certain periods; in the 30's and 40's the research on plant protection represented 56.5% and 57.9% respectively, of all the agricultural land and labor saving research in the country.
- A rapid growth of plant protection research started in the 40's and coincided with the appearance of the first synthetic organic agrochemicals such as BHC, DDT, Chlorinated camphene, ethyl parathion and 2,4-D.

Until 1939, most agricultural research on a scientific basis was performed by government departments almost only in the State of São Paulo. From the 70's on, the participation of the other States as a whole surpassed the number of those performed in the State of São Paulo, as we can see on Table 3, to follow.

TABLE 1 - NUMBER OF SCIENTIFIC ARTICLES ON AGRICULTURAL LAND AND LABOR
SAVING RESEARCH, PERFORMANCE IN BRAZIL (1927-1977)

(SAVING RESEARCH LAND)	P E R I O D						TOTAL
	27-29	30-39	40-49	50-59	60-69	70-79	
FERTILIZATION	31	32	66	126	357	422	1.024
PLANT BREEDING	7	29	67	107	113	300	623
IRRIGATION/DRAINAGE	4	3	6	10	18	72	113
PESTS/DISEASES	36	191	418	367	540	786	2.336
SUB-TOTAL	90	332	698	734	1.192	1.857	4.903
LABOR SAVING							
FARM MACHINERY	4	6	27	14	5	17	83
HERBICIDES (')	-	-	4	17	66	92	179
SUB-TOTAL	4	6	31	31	71	109	262
T O T A L	94	338	729	765	1.263	1.966	5.165

(') - THE FIRST RESEARCHES WITH HERBICIDES COINCIDE WITH THEIR APPEARANCE IN THE COUNTRY

SOURCE: III PBDC. AÇÃO PROGRAMADA EM CIENCIA E TECNOLOGIA 3. PRODUÇÃO VEGETAL. SEPLAN. CNPq. 1982.

TABLE 2 - NUMBER OF SCIENTIFIC ARTICLES ON AGRICULTURAL RESEARCH PUBLISHED ABOUT PESTS/DISEASES/HERBICIDES AND OTHER SAVING TECHNOLOGIES

NATURE OF THE RESEARCH	P E R I O D S						TOTAL
	27-29	30-39	40-49	50-59	60-69	70-79	
PESTS/DISEASES/HERBICIDES	36	191	422	384	606	878	2.527
OTHER TECHNOLOGIES	58	147	307	381	657	1.088	2.648
T O T A L	94	338	729	765	1.263	1.966	5.165

SOURCE: III PBDCT. AÇÃO PROGRAMADA EM CIENCIA E TECNOLOGIA 3. PRODUÇÃO VEGETAL. SEPLAN. CNPq. 1982.

TABLE 3 - NUMBER OF SCIENTIFIC ARTICLES ON AGRICULTURAL RESEARCHES IN BRAZIL,
BY REGION AND BY PERIODS.

REGION	P E R I O D S						TOTAL
	27-29	30-39	40-49	50-59	60-69	70-79	
I	-	-	-	-	-	34	34
II	-	-	19	57	28	102	206
III	-	6	12	67	111	413	609
IV	-	-	17	108	91	518	734
V	-	10	307	104	140	674	1.235
SUB-TOTAL	-	16	355	336	370	1.741	1.818
SÃO PAULO	157	503	692	822	1.438	1.078	4.690
T O T A L	157	519	1.047	1.158	1.808	1.819	7.508

REGION I - STATES OF: MATO GROSSO, GOIÁS, DISTRITO FEDERAL

REGION II - STATES OF: PARÁ, AMAZONAS

REGION III - STATES OF: BAHIA, SERGIPE, ALAGOAS, PERNAMBUCO, PARATIBA, CEARÁ,
PIAUI, MARANHÃO

REGION IV - STATES OF: RIO GRANDE DO SUL, PARANÁ, SANTA CATARINA

REGION V - STATES OF: MINAS GERAIS, RIO DE JANEIRO, ESPÍRITO SANTO

SOURCE: IIII PBDCT. AÇÃO PROGRAMADA EM CIÊNCIA E TECNOLOGIA 3. PRODUÇÃO VEGETAL.

SEPLAN. CNPq. 1982.

Therefore, we can verify that the increase in number of scientific articles about agricultural researches after the 70's coincides with settlement of EMBRAPA in 1973.

There are no scientific data about the evolution of specific researches about pests/diseases/herbicides. However, using the criteria adopted by Silva, Fonseca and Martins, previously mentioned, we might admit that 68% of scientific articles about agricultural researches refers to factor saving technologies (land and labor). Considering the average of 50% of these researches (see Table 2) refers to pests/diseases/herbicides, we may admit that 34% (50% of 68%) of the figures on Table 2, that is, one third, refers directly or indirectly to plant protection research.

THE PESTICIDE INDUSTRY

We have already realized that in the 40's two expansions started together: that of scientific research about pests/diseases/herbicides and that of the introduction of the first synthetic organic pesticides (BHC, DDT, Chlorinated camphene, ethyl - parathion and 2,4-D). Let us see a brief history of the contribution of the agrochemical industry to reach the present stage of researches and use of technology developed along these 40 years of plant protection.

Until the beginning of the 40's the main pests and diseases in the economically important crops were controlled with products based on lead and calcium arsenate, Paris green, copper sulphate, quick-lime and sulphur, among others. Though they were not specifically pesticides, they had certain properties and characteristics suitable for controlling some plant pests and diseases.

In that same decade the agriculture in the south and center of the country was threatened by three important pests:

- the invasion of migrating grasshoppers in the south of the country;
- the violent intensification of the attack of coffee berry borers in the coffee plantation in the State of São Paulo, which was at that time the main coffee producing state in Brazil; and
- the intensification of the attack of pests in cotton crops in the State of São Paulo.

At that time, coffee and cotton, as well as cacao, were the main Brazilian economic

supports, and any damage to those crops would be an economic disaster for the country.

The extermination of the migrating grasshopper was supervised by the plant protection Division of the Ministry of Agriculture. The researches about the biology of the coffee berry borer and cotton pests were performed by specialists from the São Paulo Biological Institute. These two achievements brought euphoria into the agricultural, agronomical and rural areas.

That was the success of the techniques to fight the insidious enemies with the new synthetic organic insecticides that were emerging.

After these initial successes the local agrochemical industry started its expansion due to the explosive growth of Brazilian agriculture and of the high investments in technology made by international industries to meet the technological expansion of the post-war world.

The introduction of new pesticides, new application techniques, new equipment and the emergence of new crop protection problems, pressed the agrochemical industries to structure their selling departments, which were unable by themselves to assure acceptance of these new products and of these new application technologies.

For this reason it became absolutely necessary for agrochemical industries to set up Product Development and Technical Assistance Departments. They had to employ skilled professionals specialized in evaluating the biological activity of these new compounds in the Brazilian environment. These experts were also able to disseminate the recently generated know-how among farmers.

A considerable part of introductory works for new products and new application techniques extension and technical assistance is developed by the industries in close cooperation with official bodies.

Being the agrochemical industry the first generator of technical information of a biological, physical, chemical, medical, toxicological and ecological nature about the compounds that it synthesizes, formulates and distributes, it accumulates a lot of informations which are made available to the Health, Agricultural and Environmental authorities. These data will be the starting point for more detailed studies, so as to reach a correct and complete judgement of their performance.

THE NEED FOR CHANGES

A series of factors have caused the great changes in course in the Brazilian agrochemical industry: the explosive growth of soybean crop, the growing technology on cotton-growing, the presence of coffee leaf rust, the expansion of the use of herbicides in soybean, sugar-cane and rice crops, pastures, etc, the increased use of fungicides in wheat, cacao, rice, potatoes, tomatoes and vegetable crops in general were some of the causes of these changes. The energy crisis caused by the huge rise of prices in oil and its by-products, and the consequent need to reduce imports of technical products, were equally important. These happenings pressed the research of alternative energy sources leading to the institution of PRO-ALCOOL to stimulate the expansion of sugar-cane acreage, a notorious crop high-consuming herbicides.

The origins of the industrial intensification are to be found in the industrial strategy of II-PND (National Development Plan) which stated that "with regard to basic inputs, Brazil will adopt a policy to guarantee the supplies, aiming a self sufficiency whenever possible".

That is the reason why PNDA (National Program of Pesticides) approved in 1975, has gone on with the measures developed by the federal government in relation to basic inputs, according to the directives of the II PND.

As a result of the PNDA, the industrial sector as well as the technical and scientific sectors of agrochemical industries have been expanded. Several major companies set up Research Centers in the country, especially in the State of São Paulo. Some existing Centers were expanded in order to supply technical and scientific support to areas related to residues, toxicology, formulations, application techniques, environmental pollution control (of liquid and gaseous effluents), biological evaluation, parasitology, phytopathology, weed science, plant physiology, etc. Their purpose was to generate expertise under the regional conditions of the environment, not only to supply government departments with regional information about the performance of their products, but also to assure the health of food and safety for consumers of agricultural products from pesticide-treated crops as well as to comply with legal requirements.

The Research Centers and the Research and Development Managers of these companies, by means of their specialists, keep a permanent relationship of the highest technical standard with professionals from government departments. This assures a

constant flow of technical information in order to improve more and more the technology needed to keep plant protection in Brazil at the highest level.

A re-examination of Table 3, presented at the beginning of this presentation, shows that, except for the State of São Paulo, the agricultural research had a great increase in the 40's and kept stable up to the 60's.

Therefore it is quite obvious to admit that most cooperative research amongst the agrochemical industry and official research bodies concentrates in the State of São Paulo, in whose capital are located the most important companies head offices and their agricultural department.

The agrochemical industry started its expansion in the 50's and has been expanding up to the beginning of the 80's at high rates - which has not happened with the official researches outside the State of São Paulo until the early 70's. Taking that into consideration, we may admit that expansion in the use of agrochemicals has been performed also with the participation of technical assistance and with the effort of the industries themselves. The dynamics of this process requires a permanent relationship among the agrochemical industries and the official department of the respective areas, in order to activate regulations to update procedures, to review priorities, etc. This will guarantee the use of pesticides with the maximum possible social benefit.

In the technical and plant protection area professionals from official institutions and from the agrochemical industry join societies of a specialized nature, such as the Brazilian Society of Herbicide and Weeds (SBHED), and many others.

This same cooperative sense is found in meetings of plant protection experts, in specific Brazilian meetings in Special Crop Comissions, etc.

For matters of regulations considered as administrative routine, the government and the industry set up Working Groups in order to update the legislation and review specific matters.

The Center of Integration for Industries and Schools has made it easier to connect the Plant Protection Departments of Agronomy Schools and the Development Departments of agrochemical industries, supporting trainees supervised by professors of the respective specialization areas.

Universities, official state or federal research institutions and agrochemical industries jointly proceed for the benefit of the community, through their experts. Several problems led official departments to take decisions as great and comprehensive as these problems: the agricultural frontier expanded; there was not

an official agricultural research institution covering the whole country with independent administration; the use of pesticides increased and especially their misuse, in spite of intense, long and objective campaigns toward proper use. That created problems of pest resistance resurgence of pests and diseases, intoxication of operators, undesirable contamination of the environment and so on.

In the 70's and up to this decade the Federal Government, pressed by those circumstances, took measures of a great importance to solve the problems caused by those facts:

1. Settlement of the Brazilian Enterprise for Agricultural Research EMBRAPA, in 1973.
2. Settlement in 1975 of the Brazilian Enterprise for Technical Assistance and Rural Extension - EMBRATER.
3. Creation in 1975 of the National Pesticide Program.
4. Inforcement of a new plant protection legislation, based on powers endowed by the decree nº 24, 114, dated Apr. 21, 1934.

EMBRAPA

The Brazilian Enterprise for Agricultural Research, EMBRAPA, was established with basis on the law nº 5,851, dated Dec. 7th, 1973. It is a public enterprise, bound to the Ministry of Agriculture, with a juridical entity of private law, with its own estate, administrative and financial autonomy.

In order to effectively contribute to solve the Brazilian economic problems, EMBRAPA concentrates its efforts in several important areas. The area closely related to the subject of this presentation is the rationalization of the use of inputs.

Rationalization of the Use of Inputs

In the last two decades Brazilian agriculture has presented a reasonable growth in its total production. However, the use of inputs has grown at a rather higher rate, which rises considerably the relative participation of the inputs in the total production cost of agricultural products.

The development of a technology suitable for rationalizing agrochemicals by means of a more reasonable and proper use will have a profound effect on agricultural

costs, on importation expenditure, on the bio-ecological balance and on the preservation of the environment.

Guided by these principles, EMBRAPA develops nation-wide researches on plant protection with the purpose of developing and extending integrated control systems for pests, diseases and weeds. EMBRAPA emphasizes researches for biological control and plant breeding in order to obtain pathogenic-resistant plants, making it possible to reduce the use of pesticides.

The researches related to these objectives generated until 1980 the following benefits:

Integrated management of soybean pests	Cr\$ 2,771,720,000.00
Biological control of wheat aphids	Cr\$ 2,890,416,000.00
TOTAL	Cr\$ 5,662,156,000.00

Source: Taxas de Retorno dos Investimentos da EMBRAPA
EMBRAPA, DID, Brasília, 1980

For the continuation of these researches, EMBRAPA's Agricultural Research National Program forecast for 1981, 1,166 projects of research lines related to Plant Protection, Entomology, Phytopathology and Crop management, distributed as follows:

Plant Protection	158 projects
Entomology	275 projects
Crop Management	310 projects
Phytopathology	423 projects
TOTAL	1,166 projects

The number of works presented in the recent VIII Brazilian Entomology Congress is another very significant standard to evaluate the predominance of researches focusing the integrated management of pests and biological control.

The figures in the following Table clearly show the preference of researchers for this kind of research:

NATURE OF THE WORKS	Nº OF WORKS
Chemical Control	72
Biological Control	42
Integrated Control	43
Subtotals	<hr/> 72 85

Source: Sumários do VIII Congresso Brasileiro de Entomologia

P N D A

The National Pesticide Program, approved in 1975, has, among others, the following technical goals:

- nationwide amplification of the studies and actions about the toxicity of pesticides on man and animals, as well the effect of residues and their biological consequences;
- organization of laboratories to control the effects of pesticides on food;
- systematic monitoring of economically important pests and diseases and their resistance to pesticides;
- determination of damages caused by insects in economically important crops;
- establishment of national especifications for characterizing pesticides, aiming at quality control;
- creation of the National Research Center of Plant Protection products;
- intensification and amplification of proper use of pesticides, aiming at environment protection;
- studies to stimulate the National Industry to produce locally raw materials needed for expanding the domestic supply of agrochemicals.

REGULATION

The Federal Health and Agriculture Departament have organized in the course of the last years a structure of regulations in order to eliminate/reduce the indiscriminate use of pesticides, specially those considered as of high risk for the environment, for man, for various forms of life that compose the hydric and edaphic environment:

- they forbade the use of certain groups of pesticides considered as of high risk;
- they restricted or forbade the use of some organo-chlorinated products;
- they established rigid rules for packaging and presentation of pesticides;
- they established rules and obligation of registering for plant protection operating companies;
- they established rules for registering companies that commercialize agrochemicals;
- they established regulations for classifying pesticides for free, controlled and restricted sales.

With this coordinated action, the official departments of research, extension and regulation have created conditions for the sucessful implantation of the Integrated Pest Maanagement.

INTEGRATED PEST MANAGEMENT

Several facts have had a decisive influence on the implantation of Integrated Pest Management. These points are important for promoting the proper use of agrochemicals, which industries are trying to establish so far. These facts are:

- The great expansion of agricultural research in general and plant protection research especially as a result of the settlement of EMBRAPA, the settlement of new Agronomic Research Institutes, the creation of new Agronomy Schools, the re-equipping of the existing official research institutes in order to investigate more widely and deeply the consequences of improper use of agrochemicals.
- A better official technical assistance cover, through the Brazilian Enterprise for Technical Assistance and Rural Extension - EMBRATER, and private technical assistance. This assistance is supplied by a net work of agricultural cooperative associations spread all over the agriculturally important areas of the country, with a great power of influence on farmers.
- An active exchange of technical information and human resources for training in countries of a high technological agricultural development.
- Campaigns for proper use, financially supported by agrochemical industries, at all levels and in all important agricultural areas of the country.
- Awareness at all levels developed by these campaigns about the risks of improper use and benefits of proper use of pesticides for the operators, for the society and for the environment.
- Resistance of certain pests in crops of considerable economic importance, leading to higher rates and higher number of applications, which will rise considerably the final cost of agricultural products.
- The disproportional rise of prices of pesticides, thus creating the need for using them with parsimony.
- The rise of financial costs of agricultural products also caused by the reduction or elimination of subsidies offered to agriculture.
- Less and less attractive condition to commercialize agricultural exportation products, due to a transient world retraction of importation of primary products.
- The implantation of agronomic prescriptions and restrictive regulation that have limited the free trade and use of pesticides.

The National Research Center of Agrochemicals represents one of the technical goals of the National Pesticide Program, created on Oct. 21, 1983, through the deliberation

nº 13/82 of EMBRAPA's Executive Board of Directors. One of its main objectives is stimulating the implantation of Integrated Pest Management Programs, comprehending National Product Centers, Official Research Institutes, Plant Protection Departments of Agronomy Schools, Agrochemical Industries, and even international agricultural research institutions.

The goal to attain is generating know-how about managing pests/diseases/weeds under Brazilian regional conditions.

This will create expertise to fight those harmful agents so as to reach a better agricultural productivity with safety for the society and for the environment, promoting social welfare.

The cooperative attitude shown in the historic past and summarized in this presentation, which has characterized the evolution of the techniques adopted for the advance of plant protection research, certainly proves that all official and private institutions involved in this complex survival problem will render their indispensable contribution.

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