

SUGAR BEET RESEARCH AND DEVELOPMENT: A PREREQUISITE FOR A SUSTAINABLE BEET-SUGAR INDUSTRY.

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International organisations have been playing an important role for a very long time and have been fostering the information transfer between countries. Although difficult to measure, it might well be that the communication network in sugar beet, which is unique in the agricultural world, has consistently contributed to the success of our sector by transferring new techniques to competitors and the social bonds it created. In the following I'm going to expose in more details the European research structure around sugar beet, the history of sugar beet research and of the International Institute for Sugar beet research, and importance of research for the continuation of the sugar industry with special emphasis on sustainable development of beet and sugar production.

1. HISTORY OF SUGAR BEET RESEARCH AND THE ROLE OF INTERNATIONAL ORGANISATIONS

The I.I.R.B. is a non-governmental international organisation aiming to support the cooperation between experts in the field of sugar beet research through the promotion of the scientific and technical aspects of sugar beet growing. With its 72 years of activity, the I.I.R.B. is amongst the oldest international organisations in the world.

In our overview we will start with an analysis of the historical and socio-economical background that led to the foundation of the institute. Furthermore the actual structure and functioning as well as the scientific activities and available means are presented.

1.1 HISTORICAL BACKGROUND

As is often the case, the idea of founding an international organisation coincided with a beet-growing sector in full crisis and various participants deemed it absolutely essential to develop the technical aspects of growing if this crop was to still have a future. It is therefore important to see the foundation of the I.I.R.B. in the light of the socio-economical realities that prevailed at the beginning of the century in large parts of western and central Europe.

The First World War generated, especially for sugar beet growing, catastrophic conditions, with stagnating or even lost productions. As a consequence, cane

sugar became more competitive and threatened to the European sugar sector. Furthermore, beet growing was extremely labour intensive and insect invasions such as the mangold fly still decreased the already low yields. This situation led in 1926 in Belgium to the foundation of the "National Committee for the investigation of the Sugar Beet" the precursor of today's I.R.B.A.B. located in Tienen (B). In 1930 the Dutch Institute for sugar beet growing was founded. Despite the efforts consented by these institutes, the yields remained low with a root yield of ± 28 t/ha and white sugar yield of 4-5 t/ha. The economical depression of 1928 affected also the sugar industry and it was at a CIBE Congress held in Prague in 1931 that the wish was given voice to create an international association to include researchers, agronomists, chemists and geneticists from countries all over the world.

On the initiative of Mr. J. Bergé, director of the sugar factory in Tienen, Belgium, and Prof. Ginneken, director of the Dutch sugar beet research institute, the future IIRB was set up on 6 October 1931 by representatives from 7 countries: Germany, Belgium, France, the Netherlands, Poland, Sweden and Czechoslovakia. The first Congress would take place in Brussels in January 1932 and in 1939 the IIRB counted already 139 members from 17 countries. The Second World War interrupted the activities of the institute. In 1952 the IIRB was constituted as an official International Organisation and started intensive contacts with

- the CIBE: International Confederation of European Beet Growers
- the CEFS: European Committee of sugar manufacturers
- the ASSBT: American Society for Sugar beet Technologists
- the ISSCT: International Society for Sugar Cane Technologists
- the OECD
- the FAO: where the IIRB has an official expert status for sugar beet
- the ISTA: International Seed Testing Association, for which the IIRB elaborated international standards for sugar beet seeds, which still today are in application.

Slowly but surely a structure was to be put in place and make great strides ahead. The present statutes were only published in 1978 and outlined the aims of the founders which were:

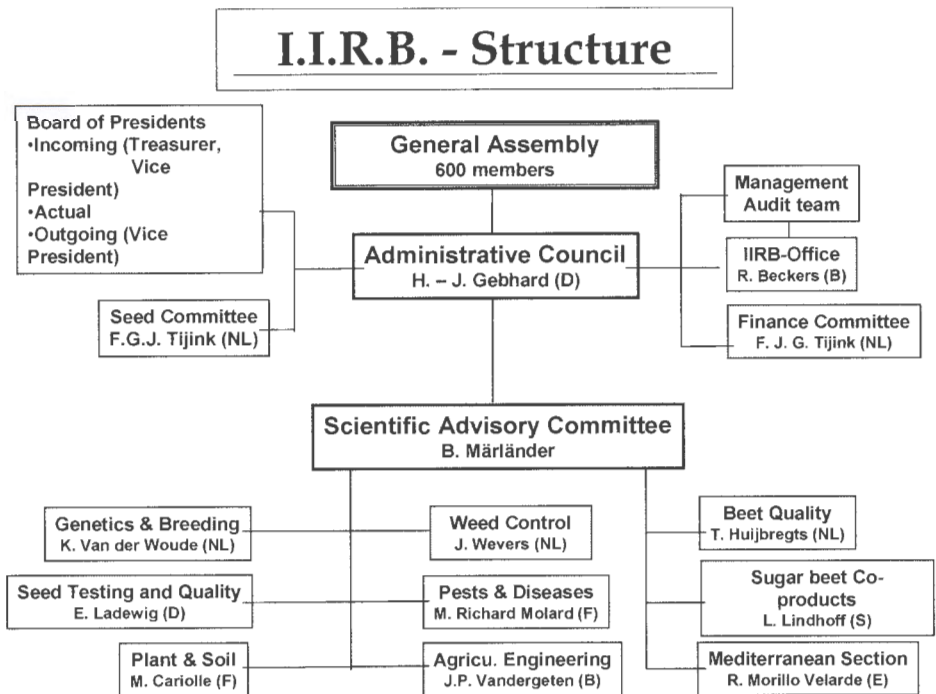
"To encourage, promote and carry out all kinds of research work as well as joint research at international level and involving all those interested in problems of beet. It was to include not only scientists and technicians but also delegates from growers' associations and sugar processors. The spheres of research are: genetics, breeding, seed production, quality, physiology, biochemistry, climatic conditions, fertilisation, soil tillage, soil science, irrigation, spring sowing mechanisation, weed control, control of pests and diseases, harvest mechanisation, beet storage and technological quality, use of co-products and more recently environmental concerns".

1.2 CURRENT SITUATION

It is plain to see that the organisation aims high and its scope is far reaching. Today, the IIRB has 600 members from 33 beet growing countries, thus representing a beet growing area of more than 6 million hectares.

The Administrative Council (AC) having the overall responsibility for all operation realised within the IIRB manages the IIRB. The Scientific Advisory Committee (SAC) is given the task to prepare and organise the congresses, to pinpoint new issues to be tackled in the study groups, and suggest a publication plan. This committee integrates the work realised in the 9 study groups. Today these groups are dedicated to the following research domains: Genetics and Breeding, Seed testing and Quality, Plant and Soil, Weed control, Pests and Disease, Agricultural engineering, Beet Quality, sugar beet Co-products and the Mediterranean Section (fig. 1). Additionally project groups are set up to cover specific topics of actual interest. Whereas study groups are permanent structures with yearly meetings and a regular activity plan, project groups are limited in time and receive clearly defined targets from the SAC or AC, including a final report.

Fig. 1: IIRB flowchart



Besides the committee and study group meetings the IIRB recognises the importance of publishing research results favouring thereby the communication between experts. On the one hand, this is realised through the yearly Congress proceedings that, since 1932 gather the complete set of papers presented at IIRB-congresses. On the other hand, there is the need for more specific

information on particular topics of actual interest, published in the "Advances in Sugar Beet Research" created in 1999 and of which 4 volumes are currently available and 2 in preparation. The internal newsletter "IIRB-info" appears 2 times a year and brings recent news on the life of the association and interesting research news to our members. Finally, the IIRB Internet Site was redesigned last year and comprises now all useful information about the IIRB, sugar beet research and EU agricultural policy. It also includes a searchable database, which contains all papers presented at IIRB congresses since 1932.

2. DIFFERENT RESEARCH AND SUPPORT SCHEMES

In order to put scientific and technical progress into practice, it is important to elaborate efficient consultation structures and operate swift transfers of knowledge. In this respect, different countries have elaborated diverse strategies involving the national sugar beet research institutes to different degrees on the scale ranging from advisory service to applied and fundamental research.

In Germany, the advisory services in sugar beet growing are carried out by state institutions, private consultation firms and traditionally by the sugar industry itself, including growers associations and sugar factories. For the sugar industry, the extension services are organized regionally. However, a national coordinating committee at the Institute for Sugar Beet Research in Göttingen plans and conducts field experiments in the whole country. Regional work associations then carry out the experiments in the fields.

The national office for variety certification, the extension service offices of the Länder, the beet growers associations, the sugar industry and the growers are all involved in an integrated variety testing system. The involvement of all institutions in conducting and optimising the variety testing schemes allows for a Nation-wide database to be constituted and which enables the local farmer to be advised on the optimal varieties specific for his region (fig. 2).

The implementation of the most recent communication techniques enables a fast and interactive consultation for the farmer for all questions pertaining to the cultivation technique or plant protection.

In other European countries like France, Belgium, the Netherlands and Spain, the sugar beet research institutes are directly involved in the organisation and implementation of extension services to the grower. The example of the French Beet Research Institute ITB illustrates a typical organisation.

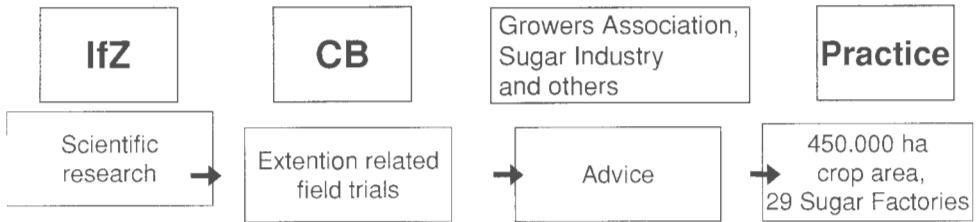
The French Technical Industrial Sugar beet Institute (I.T.B.) is an interprofessional association, comprising the different partners of the industrial beet sector, which includes sugar beet growers, and sugar and alcohol manufacturers. The institute is organised in a way that experimentation with new techniques allows to acquire new insights, and setting new references for the progress of beet production in a particular area. To this end, over 300 field trials are conducted each year in a network encompassing the entire beet growing area in France. The trials are conducted in all districts of beet production. On the other hand a the institutes maintain a close link to fundamental research by prompting and stimulating research work and studies by public laboratories (like universities and national research organisations) and private laboratories

Fig. 2: organisation of sugar beet research and extension services in Germany.
Source: IfZ, Göttingen



Fundamental/applied research oriented Institutes

Example: German Institute for Sugar Beet Research (IfZ) / Coordination Board (CB)



**Head of department leaders of the IfZ
= speakers of CB working groups
quick transfer of research results**

IRB - ASSBT Year Congress 2003

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(namely breeders, plant protection companies, and machinery manufacturers). In order to ensure the rapid diffusion of information to the growers in the different beet growing areas, the ITB has set up 11 regional representations where technician stay in close contact with the grower and provide advise on any problem he may encounter (fig. 3).

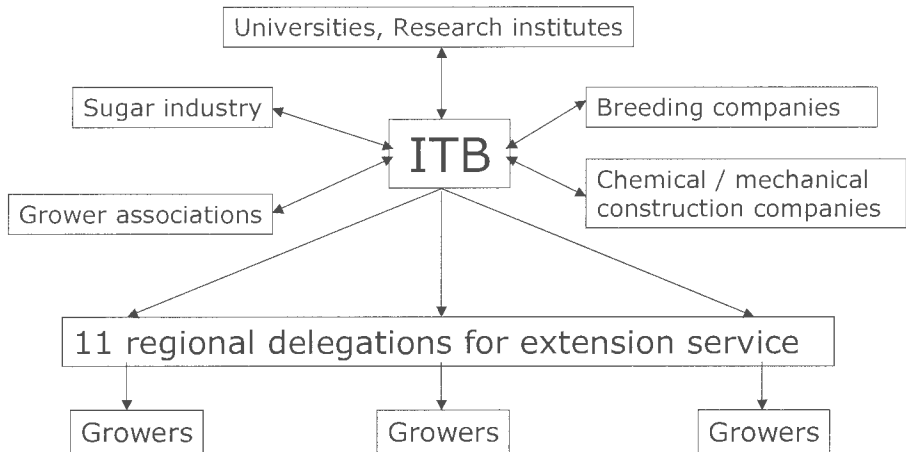
I have cited these two institutes as typical examples for the more than 15 European Sugar Beet Research Institutes (fig. 4). Still, some continue to be directly involved in fundamental research, especially in countries where the state funded research in universities is not involved with sugar beet. In any case, sugar beet research is based on an interprofessional agreement between sugar industry and beet grower association who provide for the financial support. Only a small fraction in the institutes funding provides from official sources and for some institutes this proportion is even down to zero. The unique determination of beet – sugar industry to maintain an unprecedented dense research structure in our field of expertise is, on the one hand, the effect of the nearly symbiotic market condition of primary production and secondary transformation. On the other hand it also witnesses from the now already historical clairvoyance of the sugar sector that recognises research as the major driving force for product stability, sustainable development and a long term market oriented production scheme of beet and sugar that ensures profitability for all actors involved in the production line.

Fig. 3: Organisation of sugar beet research and extension services in France. The ITB as interprofessional body organises the relations with the different actors of the sugar sector in order to provide the best technique to the grower. Extension service is directly organised by the ITB.



Applied research / extension service oriented Institutes

Example: French Institute of Sugar Beet Research (ITB)



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In recent years, environmental questions have become increasingly the centre of interest of governments and thus of research. The success of technology transfer strategies in the field of sugar beet organised throughout the different countries has resulted in a more sustainable and environmentally friendly sugar beet agriculture without financially penalising the farmers and a sound and coordinated consultation is meant to guarantee a more environmentally friendly and sustainable sugar beet cultivation.

Nevertheless, we will have to face that our industries and agricultural activities will be assessed under environmental viewpoint. Legislation might become as important as to jeopardise production techniques considered today as clean and safe. In the field of crop protection we will have to confront the fact that by June 2003 more than 300 active ingredient will lose their registration and most of them will not be represented by their respective companies. Obviously, some of the substances are today major phytopharmaceutical tools for sugar beet growing. In this and many other related areas, our cropping techniques need to be adapted and new technology need to be developed.

Fig. 4: localisation of 18 European sugar beet research institutes. The dense network monitors sugar beet cultivation in all European climate zones and all major beet-producing countries.



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3. THE IMPORTANCE OF RESEARCH FOR A SUSTAINABLE PRODUCTION

Sustainable development in agriculture considers simultaneously the economical, ecological and social aspects of the production system. Cropping systems should therefore ensure environmental goals as well as food quality and safety. Through the competitiveness of agricultural production farmers and the agricultural community should be able to realise a fair economic and social standard of living. The accomplishment of all these objectives would be a perfect prerequisite of sustainable development in agriculture (fig. 5).

In 2001/2002, the area devoted to beet cultivation in the European Union amounted to around 1,8 million hectares. Around 300.000 farmers in 14 EU Member States grow sugar beet on their farm, with an average area per farm of about 6 hectares.

The common sugar markets organisation within the European Union is determined by council regulation (EC) N° 1260/2001 until 2006 (beet harvest 2005). Within the context of this regulation, the growers gave contractually guaranteed delivery rights for a fixed amount of beet (sugar content 16%). Also the regulation fixes prices for beet of standard quality, which refers to a sound and fair merchantable quality, and a sugar content of 16% at the reception point.

Fig. 5: sustainable development in agriculture is based on the simultaneous achievements of economic, ecological and social standards. Source: IfZ,



Sustainable development



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But in addition, article 47 of the council regulation N° 1260/2001 requests all member states to adopt appropriate environmental measures in the sugar sector and to submit a report to the EU commission on the environmental situation of the national beet production.

Due to this legislation, the sugar beet production in the EU is strongly under political pressure as compared to other crops. Consequently, the EU commission requested a status report from all member states on the environmental situation of sugar beet production in the different countries (EC No 1260/2001, Article 47).

Therefore, the basis for a sustainable sugar beet and sugar production, which constitutes a significant part of the socio-economical structure and represents a large proportion of the agricultural production in the world, is to be supported by relevant economical conditions, which are not necessarily compatible with the liberalization of the sugar market. More specifically, the the following reasons can be invoked:

1. Sustainable development is enshrined in the EU Treaty. Consequently the EU beet growers have to achieve high environmental standards, which could only be reached or be compensated with increased efficiency and implementation of technical means.

2. What these protective measures, important for the whole of society, are aiming at – namely preservation of the environment and guaranty of the quality of the foodstuff – is inevitably associated with higher production costs. Those costs are presently fully carried by the agricultural enterprises.
3. The liberalization of the Sugar market would bring the European Sugar production in direct competition with countries, which do not meet the same high standards for protection of habitat and product quality. This situation would inevitably impair sustainable farming in our countries.
4. The discontinuation of protective measures would also force the poorest developing countries to abandon the sugar production, because the low price level and unfavourable structures for technical research and investment would be a major hindrance. They could not possibly compete with the major producers.
5. Technical progress in sugar beet cultivation allow for higher yields with less crop area and improve at the same time the environmental standard. The following points will clarify this:
 - a. Sugar beet cultivation is not a monoculture but is integrated in crop rotation, which enhances environmentally friendly characteristics like soil structure and fertility.
 - b. Fertilizers and phytosanitary treatments in sugar beet production are at a very low level. Further reductions are possible while at the same time yield and quality can be increased (sugar content, extractability).
 - c. Adapted information systems make it possible for the farmer to have immediate access to the protective measures to be implemented. This allows for application rates to be reduced, in particular for crop protection, which alleviates the soil and surface water contamination.
 - d. Breeding progress is expected to allow for additional yield and quality increase in the future. Measures around an intensification of crop production will therefore be more in the background.
 - e. Soil erosion and soil compaction will be avoided through the increasing use of conservation tillage.
 - f. High-performance harvesting techniques preserve the soil structure and continuously reduce the dirt tare. A sustainable development can additionally be improved by using the by-products such as beet soil and sugar factory lime.

- g. Delivery contracts will force the farms to implement crop rotation through a thoroughly described documentation of all cultivation prescriptions. The sugar beet cultivation will attain transparency in the production of foodstuff as requested by society.

Sugar beet growing, like no other agricultural production, matches a large number of positive aspects such as: high yield potential achieved within environmental specifications, as well as sustainable income contributions for the agricultural enterprises. All this is only possible however, if specific basic economic conditions serve as a basis for efficient and environmentally friendly commerce.

6. Because of the tight interaction between sugar beet growing and sugar beet processing, the farms are immediately concerned with industrial processing, the marketing of products, as well as with the aspects of food stuff reliability. Minimal market regulations are imperative in order to maintain the high quality standards from this production chain.
7. The scientific programs, which are financed by the sugar industry, are aimed at an improvement of sugar beet growing in terms of sustainable production. This objective cannot be achieved in the future without appropriate financial guarantees. The consequences would mean an absence of further improvements in growing techniques and a decline in competitiveness.

For these reasons it is obvious that only technical progress as a motor to further economic growth can guarantee the sustainability of sugar beet and sugar production. The political and social requirements in terms of agricultural production should bear the costs, without endangering the functioning socio-economical systems and without opening a gap between ecological requirements and economical feasibility.

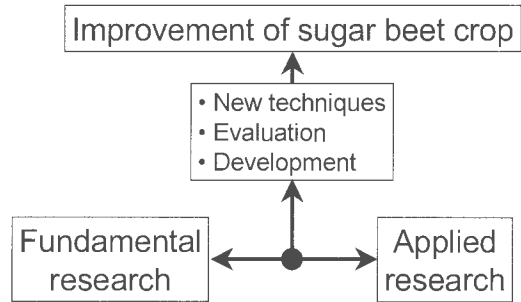
4. OUTLOOK ON RESEARCH AND THE IMPORTANCE FOR INTERNATIONAL COLLABORATION

The prospective on research and international collaboration must therefore imply the integration of research activities in the field of sugar beet production and processing in the strategic targets of a company. However, confining the information on a company or national level must be considered as a barrier for sustainable development. Therefore there is evidence that on the one hand international information exchange and, on the other hand international collaboration on research schemes and trials will set the future line in scientific management and will be the major mean for simultaneously maintaining the high standard of production technology and reducing costs for Research & Development.

History confirms the thought that especially during difficult times international collaboration and continuous investment in research activities is the way of salvation. The prospective view of some industry leaders in the early 1930s on

the necessity for a research and extension service programme lead the sugar industry to the prosperous sector we all appreciate today.

Since 1932, the International Institute for Beet Research pursues its mission as communication forum. In the beet - sugar sector, the IIRB is the only international organisation where all actors of the different branches can meet. Delegates from grower organisations, sugar industry, sugar beet research institutes and universities, breeding companies, chemical and mechanical construction industry as well from



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national administrations meet in the 9 IIRB study groups. Their objective is the neutral and objective evaluation of new experiments and technologies relating to the beet production and their fast diffusion in all the Member States.

The target public of the I.I.R.B. is that which composes the association. In other words, the technicians, researchers and other representatives of the profession generate and benefit immediately from the exchanges of information in order to transpose them, in their respective countries, into the agricultural practice. As a matter of fact, the IIRB is thus not in direct relation with growers or the industry, but has to provide the information for those who do extension service, warning systems etc. In this respect, the I.I.R.B. depends on the coexistence within the working groups of representatives of fundamental and applied research. Both approaches are of equal importance and both are science based. The scientific methodology applies also to applied research and the difference between both approaches lies only in the differentiation of priorities given to a same problem. The solution, which is the assessment, the development of new technology, cannot be found when the one or the other input is missing. I insist particularly on the fact as the success of our work depends on the successful dialogue and the cross fertilisation of these both instances.

It is an enormous chance for the sugar – beet sector that this link exists within one single organisation. The communication means the IIRB puts in place must therefore be favourable to the information exchange between the two approaches. As those who input the information are also those who take it back home, the strength of the IIRB lies in the fact that the exchange between experts may elucidate common problems from different angles. If this dialogue succeeds, we have met our target because only the permanent and intense interaction between the different research approaches makes it possible to increase *in fine* the beet production with reduced costs as well as the sugar production in the factory by providing a raw material of improved internal quality.

Furthermore it seems appropriate to foster international collaboration on research projects and trial schemes. Global planning of trial schemes by grouping ecosystem relevant and not national relevant locations could considerably reduce the costs for national sugar beet research. Associated with a suitable information transfer system, at least basic research data could be elaborated cross-boundary and shared between countries.

In the future the IIRB will continue its mission of communication by favouring the closer cooperation between international organizations, the constitution of international databases on the various aspects of beet production and will play in a consequent way its role of centre of information transfer in the beet-sugar sector. This congress is a living example of these thoughts.