



Brussels, 28 February 1996

COST 229/96

Memorandum of Understanding
for the implementation of a European Concerted Research
Action designated as
COST Action 828

"Seed science in the field of genetically controlled stress physiology"

The Signatories to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the Technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 400/94 "Rules and Procedures for Implementing COST Actions", the contents of which are fully known to the Signatories.
2. The main objective of the Action is that the research concentrates on discovering genetically determined physiological responses to stress effects in Europe. Based on the results achieved to date, generally valid for a whole species, the genetic variability of varieties and hybrids is examined. Biochemical and biophysical methods are applied to study the cause and effect relationships of stress physiology.
3. The overall cost of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at ECU 22 million at 1995 prices.
4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.
5. The Memorandum of Understanding will remain in force for a period of five years, unless the duration of the Action is modified according to the provisions of Chapter 6 of the document referred to in Point 1 above.

GENERAL DESCRIPTION

ACTION 828

**SEED SCIENCE IN THE FIELD OF GENETICALLY
CONTROLLED STRESS PHYSIOLOGY**

A. BACKGROUND

Seed marketing is one of the most profitable branches of agriculture. In the USA and Canada the scientific centres providing the research background in this field are coordinated by excellently functioning national organizations. Research results receive immediate publicity at workshops and conferences held by local and intercontinental organizations. Consequently, the research is translated into profit in terms of overseas seed production and sales without delay.

Although the activity of world organizations dealing with seed quality extends also to Europe, the question nevertheless arises of whether seed research in the field of genetically controlled stress physiology is adequately represented on this continent. The special Seed Science Workshop of the 3rd Congress of the European Society for Agronomy (ESA), held in Abona-Padova, Italy, in September 1994 sought answers to this and related questions. While emphasizing the salutary effect of FIS, ISTA and UPOV on European seed quality, the near 50 representatives from 13 countries unanimously agreed that the European seed research in the field of genetically controlled stress physiology lacks a proper organization or representation. The Executive Committee of ESA put Hungary in charge of preparing the establishment of a Seed Science Division. For this purpose, a Seed Science Symposium was held in Keszthely, Hungary, from 3 to 7 September 1995 with the participation of 14 European countries representing 61 departments of universities, institutions and seed companies.

It also became clear from the discussions that in Europe research in genetically controlled stress physiology takes place generally in isolation in universities, research institutes and seed companies. It is characteristic of the research that (a) it serves the business interests of the companies, and that (b) basic research is omitted from these programmes. Therefore, this requires coordination. These are the facts that justify the setting up of a new COST Action, which would coordinate practice-oriented basic research, while respecting the interests of the companies. The COST Action would support the work of the planned division.

Since the whole question is based on seed production and processing practice and on the possible stress effects, the research programme must be designed accordingly. The research programme must be flexible, since different types of stress will be encountered in different species and at different growing sites. Consequently, the programme will be decided upon by the participants, leaving it open for those joining the programme at a later date to expand the research in various directions.

B. OBJECTIVE AND BENEFITS

The main objective of this Action is that the research concentrates on discovering genetically determined physiological responses to stress effects in Europe. Based on the results achieved to date, generally valid for a whole species, the genetic variability of varieties and hybrids is examined. Biochemical and biophysical methods are applied to study the cause and effect relationships of stress physiology.

The secondary objective is practice-oriented. The programme takes seed production practice as its starting point, both when expressing the questions to be answered and when utilizing the results. Considering the fact that the biotic and abiotic stress factors occurring during seed production and processing influence seed quality and production profitability, stress physiology will be the focus of attention in the programme. A great deal of variability has been observed within individual species as regards stress tolerance, so the stress physiology research is complemented with research into genetically determined stress physiology. The practical advantage of the research is ensured by the fact that in exposing cause and effect correlation, a knowledge is acquired of biochemical and biophysical responses which provide a good model of the responses observed in practical parameters (yield, germination percentage, etc.).

The benefit of this Action is that an expansion of knowledge in the direction of genotype-dependent stress physiology opens up the possibility of elaborating physiological screening methods suitable for mass analysis, which could thus be used as routine tools both in breeding and in production and quality control. Since the elaboration of such methods is based on the genetic variability of the public gene pool, rather than on the jealously guarded private genetic bases of the seed companies, there is no encroachment on ownership rights.

C. SCIENTIFIC PROGRAMME

This part of the Action is detailed for each working group separately including the plant species as well as the detailed general benefits.

Studies on the effect of stress during the following stages of seed production for different genotypes (varieties, hybrids) within the species

Stress effects can be observed

- (a) during seed production
- (b) at harvesting
- (c) during seed drying
- (d) during storage
- (e) during classification
- (f) during seed coating, packaging and transportation.

The most important stresses during the above stages are caused by

- A. the environment
 - (1) water shortage during production
 - (2) flooding during production
 - (3) air dry during flowering and grain filling period
 - (4) humidity during the whole process (from (a) to (f))
 - (5) high temperature during production, seed drying and storage
 - (6) low temperature before harvesting

B. treatments

- (1) nutrient supply during production
- (2) population density during production
- (3) leaf injury during production, especially at flowering and grain filling period
- (4) mechanical injury caused by elevation, harvesting machine etc.
- (5) coating during the seed preparation.

Stress factors may lead to a reduction in

- (i) *seed value*
- (ii) *the performance of progeny generations*

This may be manifested in both the quantitative and qualitative characters of the plants.

It cannot be expected that each part of the programme will be connected with all of points (a)-(f) and (i)-(ii), but there must be a connection with one point from each group. It is obvious from the questions considered what practical advantages are to be expected from answering them.

The individual parts of the programme must contain research into the physiological background of the practical results

The tools used in biochemical, biophysical and molecular biological research must be applied in studying the cause and effect relationships of the phenomena observed. Since each part of the programme is linked to one of points (a)-(f) and (i)-(ii), it is desirable for basic research into cause to cover both groups of problems, or at least one problem from one of the groups.

Advantages of the research

Since these advantages can be expressed in general terms, what follows is valid for all the plant species discussed below.

- (1) More profitable seed production
- (2) Reduction in the risks involved in seed production
- (3) Improvement in the performance of progeny generations due to seed of good biological value
- (4) The discovery of cause and effect relationships may facilitate the identification of methods from which
 - cheap, rapid screening procedures can be developed
 - the performance of the mature plants can be predicted from that of the seed or of plants in the early stages of development
 - the above can be used to develop breeding methods aimed at improving seed value or for genetic analyses linked with further basic research.

D. ORGANIZATION AND TIMETABLE

A Management Committee (MC) including the elected Chairperson, Vice-Chairperson, Working Group (WG) coordinators and representatives appointed by the Signatories of the MoU will be set up following the signing by the appointed number of signatories to the MoU. This Committee will work out its rule of operation at its first formal meeting in accordance with existing COST regulations. The MC meets twice each year to review progress and take remedial action if required.

The partners will elect a Chairperson and a Vice-Chairperson who will be responsible for coordinating activities and ensuring that the Action direction meets the overall objectives. The following four WGs will be formed; (1) Field Crops of Cross-Pollinated Species (Maize, Sorghum, Sunflower), (2) Self-Pollinated Field Crops for Grain Use (Cereals and annual legumes), (3) Field Crops for Forage (Grasses and perennial legumes), (4) Horticultural Crops with an elected WG-leader of each, who assists the Chairperson and Vice-Chairperson and takes specific responsibility (e.g. offering short-term missions or other exchange of scientists between research groups) for ensuring that the work is of a high standard.

The Action will facilitate fast information exchange which will be distributed among participants by electronic-mail, fax or in meetings. Original results will be disseminated to the scientific community, when possible, by joint communications

in recognized scientific journals. Annual Reports will be produced for the COST Senior Officials, and a detailed Final Report will be written. The exact programme is demonstrated in the time table below:

E. ECONOMIC DIMENSION

The following COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: (1) Belgium, (2) the Czech Republic, (3) Denmark, (4) Finland, (5) France, (6) Germany, (7) Greece, (8) Hungary, (9) Italy, (10) The Netherlands, (11) Norway, (12) Poland, (13) Spain, (14) the United Kingdom.

On the basis of national estimates provided by the representatives of these countries and taking into account the coordination cost to be covered over the COST budget of the European Commission, the overall cost of the activities to be carried out under the Action has been estimated, at 1995 prices, at roughly ECU 22 million, 60 man/year included.

This estimate is valid on the assumption that all the countries mentioned above, but not other countries, will participate in the Action. Any departure from this assumption would change the total cost accordingly.

