

Commission of the European Communities

ECLAIR Programme

Contract n° AGRE 0052

**Coordinator: IRTAC, 16 Rue Nicolas-Fortin 75013 Paris,
France**

**To Explore and Improve the Industrial Use
of EC Wheats**

NEWSLETTER N° 2

Progress Report from 1-1-1992 to 15-6-1992

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Introduction (*J.C. Autran, Scientific Coordinator*)

This second newsletter summarizes the activities of the ECLAIR programme 'To Explore and Improve the Industrial Quality of EC Wheats' from 1-1-1992 to 15-6-1992.

It comprises the reports of each subprogramme: A, B and C:

A - Industrial Processes, by Dr. R.J. Hamer

B - Functional Components and their Interactions, by Dr. J.J. Plijter

C - Biochemical-Genetics and Physiology, by Dr. N.E. Pogna.

In each section the Subprogramme Manager has prepared a Review of Activities and a Review of Projects, followed by the detailed Individual Progress Reports of each Partner.

1. Administrative aspects

The 1991 Annual Scientific Report was completed in March 1992 and distributed to all participants. Three copies were directly brought to Mrs Hardy in Brussels at the end of March as also as the 1991 cost statements. The Scientific Report was accepted in June 1992 but there was a minor problem of justification of costs with two partners, which will delay until September the payment of the 1992 funds by the Commission.

2. Evaluation of the progression of the work

In this newsletter, a solid flow of new results and data sets of high value is presented, indicating that the programme as a whole develops according to expectations, witness the following significant examples that were presented during the plenary meeting of the programme in Paris, 4 June 1992 (see below).

a. Industrial Processes

- In the **milling quality** project, the good collaboration between FMBRA and TNO allowed to show that the **image analysis** could be used to define size distributions of grains and that **ferulic acid** was a far better marker for bran friability and extraction rate than ash.
- Concerning the **starch/gluten separation**, a **laboratory scale system** was developed to investigate gluten produced from wholemeal flours in connection with a new approach of the mechanism of action of enzymes increasing the rate of gluten coagulation.
- In studies on breadmaking, essential observations have been made on the relationship between **molecular structure** (glutenin depolymerization) and **dough behaviour** during final proof. On the other hand, it became clear that the wholemeal loaf volumes cannot be predicted from those in white flour breadmaking and that protein content seems more important than gluten strength for wholemeal bread performance.

- In biscuit-making studies, it was found that proteins and **pentosans** are important and that the latter contribute to explain dough stickiness and texture of 'Petit Beurre' biscuits.
- Investigating the properties of flour blends, a **low-molecular-weight protein fraction** of utmost importance for the depolymerization of glutenin during dough processing was identified, while a prediction of the **processing properties of flour blends** proved to be possible through measurements of the 'gel protein' fraction.
- The potential of rheological methods on dough slurries was demonstrated as well as their interest (*e.g.* need of minimal amounts of flour, less expensive equipment).
- The work on interactions between microorganisms and wheat flour components in bread making, has enabled a well founded selection of starter cultures and flours for further studies

b. Functional Components and their Interactions

- New ways of **purification of gluten subfractions** (HMW and LMW subunits of glutenin) or of native aggregates were developed, based on HPLC, free-flow isoelectric focusing, or chromatography on controlled pore glass.
- Functional (viscoelastic) characteristics of **native gluten aggregates** have been determined, indicating that the rheological behaviour of gluten fractions was closely related to their glutenin polymer content, whereas gliadins contribute to rheological properties as a plasticizer.
- A new breeding test for dough extensibility was proposed, based on **allelic variation at LMW subunits** (*Gli-B1* chromosome locus).
- The investigations on **lipid-binding proteins**, especially phospholipid transfer protein from wheat flour, allowed to discover an homology with other low molecular weight sulphur-rich proteins, including '**friabilin**', a protein associated with the surface of starch granules. The role of 'friabilin' on endosperm texture was therefore reconsidered in this new context of interactions with starch surface lipids. The implication of both starch granule surface protein "friabilin" and surface lipids in endosperm texture, and the understanding of the relation of these components to the hard and soft alleles of the *Hardness* gene have been reported.

c. Biochemical-Genetics and Physiology

- An essential and huge task has been the organisation of **North-Western- and Southern-Europe Networks** to supply participants with large quantities of highly controlled wheat samples and to provide information of the expression of technological quality in wheats grown in various environments.
- **Near-isogenic lines**, chromosome substitution lines, somaclonal variants, mutants lacking storage protein-encoding genes, progenies of intergeneric crosses, etc., were also produced to investigate the **genetics of endosperm proteins** and the regulation of genes expression with chromosome interactions.
- In addition, work on **sprouting resistance** proceeds very well and significant results have been already obtained in three directions: genetic variation for dormancy bioassay to test inhibitory activity of wheat extracts, purification of inhibitors.

All tasks are now well underway and it is likely that most of the essential objectives of the programme will be reached within the required time. Even if all deliverables were not exactly completed, the precompetitive programme

will clearly have a very large positive balance considering the EEC and industrial contributions and the outcome for the European agriculture and food industry.

3. Collaborations between subprogrammes

a. General aspects

We have already obtained several major scientific results in less than two years. Furthermore, during this starting period, **we have more especially prepared our long term future** in knowing each other very well and in learning how to work together. Beside our numerous scientific results, we can be encouraged by the new and straightforward atmosphere which is now established among all of us, after only three or four meetings of each subprogramme, and one plenary meeting

Mid 1992, after having worked together for one year and a half only, it looks as if we had already become a large and extremely united network in which members really trust each other. As a matter of fact, basic research is now totally open between us. Already now, the scientists from the US are impressed by the **degree of communication and collaboration** within this programme. On the other hand, the efforts and collaborative behaviour of certain partners who are recent in cereal chemistry (*e.g.* SME Ricerche) was greatly appreciated as a very positive result of such EC programmes.

Our consortium possesses a huge scientific power. It's really a nucleus of science with a huge potential on almost everything in wheat science and technology. However, it's not enough to have the potential. In fact, our power and our final success will depend on our capacity to achieve still more collaborative tasks in the multidisciplinary programme (not only on putting thirty tasks or subtasks side by side). Although several collaboration between subprogrammes A and B, or B and C, or A and B and C have grown, witness the following examples:

- endosperm texture (A.1.) / starch granule protein 'friabilin' (B.1.4) / lipid transfer proteins (B.1.5) / somaclonal variants (C.9),
- processing requirements for breadmaking (A.2.1) / HMW and LMW subunits and glutenin depolymerization (B.1.1, B.1.2) / testing of advanced lines from South and North Europe (C.1),
- flour blends (A.2.4) / low molecular weight protein, 'gel protein' / genetics of low molecular weight proteins (C.4, C.5, C.6),
- characterization and functional properties of gluten subfractions (B.1.1, B.1.2) / isogenic lines, substitution lines (C.6, C.7),

there are many more opportunities of collaboration. The following sections indicate some attempts to improve collaborations further.

b. Wheat samples

For the next year, Dr. Pogna needs to know exactly the desires (cultivar and amount) of each participant **before the end of September 1993**. Requests over 10-20 kg of a specific variety may cause problems, however. Please contact Dr. Pogna for any specific request. It is recalled, however, that no flour will be available, only grains.

c. Books of methods (quality, biochemistry/physicochemistry)

- The book of quality related methods, set up by participants to subprogramme A, has been completed. An open version has been circulated between participants to subprogramme A during their last meeting in Valencia. A bound version will be photocopied and distributed to all ECLAIR participants at the expenses of the Coordinator by September 1992. To make updating easier, it is planned to have this book transferred into a word processor form by Dr. Van Lonkhuysen.

- The second book (biochemical procedures) is still in process of completion by participants to subprogramme B. It should be distributed by the end of 1992.

d. Updating of the technical annex

The technical annex of the contract has been an extremely valuable document during the starting period of the programme. It is now out of stock and also partly out of date since it was elaborated in May 1990 on the basis of the proposal of the ECLAIR project (October 1989).

It was therefore decided to update this technical annex during the second semester 1992 and to make a kind of mid-term review of the programme. It will be an opportunity (keeping the general aim of the programme and of the tasks) to introduce some changes including new collaborations that were not planned initially, along with the drop of some minor points, or to reschedule some tasks. All participants have been requested to send the corrected pages to the Coordinator by September 1992 so that the revised document can be distributed by October 15th, 1992.

e. Synopsis of the tasks

To make the collaborations easier and to make clear which are the aims in the different places, it was decided to prepare a document entitled "People in our ECLAIR programme: what they do actually", consisting of a set of record cards.

Based on the updated content of the technical annex, these cards will contain the address, phone, fax, languages and picture of the project leader, with a short summary and field of expertise (key words), so that everybody can easily know and contact the relevant person for any problem, and can detect where other subprogrammes are the most supportive.

Each participant has been requested to fill his card by September 1st, 1992 so that the revised document can be also distributed by October 15th, 1992.

4. General Meeting of the Programme

A one-day conference was held at Méridien Montparnasse Hotel Congress Centre, the day after the 9th International Cereal and Bread Congress, **4 June 1992**, from 9.00 a.m. to 4.30 p.m. It was restricted to the participants in our ECLAIR Programme. See, in Annex I, the list of the 57 participants.

This plenary meeting was a great success. It clearly permitted to all participants in technology, physicochemistry and genetics to become better acquainted, and to bring out the enormous amount of work already achieved as appeared from the high quality oral presentations and posters. (See, in Annexes II and III the lists of oral presentations and posters, respectively). It also allowed to think about better collaboration, as appeared from the decision to develop relationships between subprogrammes on specific topics.

a. Identification of specific topics for which collaboration must be intensified

A first result of our discussions was the **identification of topics whose progress is essential and for which collaboration must be intensified**. Leaders have been appointed who are now in charge to think about coordination of the various tasks between subprogrammes A, B and C, and to prepare proposals to be submitted to the next meeting of the Scientific Management Committee (6 November 1992). Table I gives an outline of possible collaborations, including a (non-exhaustive) list of participants.

b. Identification of major directions for future collaborative programmes in wheat science and technology

A second important result of the discussions at the plenary meeting was the **identification of major directions, or "new frontiers" in wheat science and technology**, with high scientific priority, but that should also meet future EEC recommendations. Possibly, the next programmes on wheat will not be as huge as the present one, so that we have to prepare ourselves to focus on a few major approaches, which could relate to the following topics:

- Wheat quality for food and non food uses.
- Immunochemical methods (monoclonal antibodies) to explore various wheat components and to contribute to wheat quality improvement.
- Grain texture (we have still not be able to transfer our results on milling quality to breeding programmes) - this topic being essential for both food and non food uses.
- Ash in milling and in functional (breadmaking) properties.
- Development of wheats with low inputs.
- Development of high-amylose wheats
- Fermentations

An essential point, however, should be to keep multidisciplinary programmes, extending from industrial processes to plant breeding.

Table I. Topics for which crosslinks must be intensified

<u>Topic</u>	<u>Project Leader</u>	<u>Participants</u>
HMW-glutenins	<u>Arthur TATHAM</u> LARS, Bristol	Peter PRITCHARD FMBRA, Chorleywood Yves POPINEAU INRA, Nantes Marie-Hélène MOREL INRA, Montpellier Norberto POGNA ISC, Milano
LMW-glutenins	<u>Domenico LAFIANDRA</u> University, Viterbo	Marie-Hélène MOREL INRA, Montpellier Gérard BRANLARD INRA, Clermont-Ferrand Norberto POGNA ISC, Milano Angelo dal Belin PERUFFO University, Padova Peter WEEGELS TNO, Zeist
Pentosanes/-ases	<u>Clare MILLS</u> IFR, Norwich	Friedrich MEUSER Norbert PAHNE Tech. Univ., Berlin TNO, Zeist Aliette VEREL BSN, Athis-Mons Xavier ROUAU INRA, Montpellier Michel LEUILLET ITCF, Paris
Rheology	<u>Johan PLIJTER</u> Gist Brocades, Delft	Peter PRITCHARD FMBRA, Chorleywood Jacques LEFEBVRE INRA, Nantes Giancarlo MALGARINI SME Ricerche, Caserta Aliette VEREL BSN, Athis-Mons
Bursary Exchanges	<u>Robert J. HAMER</u> TNO, Zeist	