

## One-Day Conference on the ECLAIR Programme AGRE 0052

**Jean-Claude AUTRAN\***  
**Scientific Coordinator**

It's a great pleasure that I welcome all participants to this One-Day Conference on the ECLAIR Programme AGRE 0052 "To Explore and Improve the Industrial Use of EC Wheats".

This Conference has been organised by IRTAC, Coordinator of the programme, as part of its activity to provide a forum for information exchange, and the establishment of future collaborations.

I'll start with a warm acknowledgement to Monique Richard for having made it possible to organise this Conference despite her tremendous she had these last months in the organisation of the International Cereal and Bread Congress. I want to underline her talent of organising person.

I'm glad that almost all partners of the programme could come today (57 people and 21 posters), including financial contributors of some partners, especially from The Netherlands. I have, however, to regret the absence of any representative of the Commission of the European Communities. We sincerely hope that they will be present at our next general meeting.

I assume that all of you're now familiar with the scientific content and the objectives of this ECLAIR programme. However, I'd just like to remind you that:

Despite the fact that wheat is an essential crop for European agriculture and for the wheat-processing industry, **European wheats are not really adapted to a wide range of applications**, especially to recent developments of gluten/starch separation, wholemeal bread-making, biscuit manufacture, flour blends, sour doughs,...

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Introduction, presentation and conclusions of the General Meeting of the European ECLAIR Programme AGRE 0052 "To Explore and Improve the Industrial Use of EC Wheats" on June 4, 1992 at Paris, France. (Room Picasso, Centre International de Conférence Le Méridien Montparnasse)

Accordingly, our project has been designed to meet the scientific and technological challenges facing wheat production and industrial use, and to encourage them to become more competitive internationally: In other words, to secure a better match between biological resources and the use by consumers and industry.

Therefore, this project has been aimed at **exploring and improving the industrial use of EC wheats (*T. aestivum*)**, with the objective of **filling the growing gap between process development and its understanding in terms of processing requirements and thus wheat quality requirements.**

A further essential objective is the **stimulation of breeding** in order to develop, to tailor new types of wheats capable of satisfying the present and also the future demands of European industry and the export market.

- How to improve the industrial use ? This will result from **better knowledge of the various applications of wheat.** Each main parameter of processing and its effect will be expressed in terms of functional properties of the wheat and related to specific wheat protein constituents and their interactions.

- On the other hand, combined **functional/physico-chemical and biological advanced methodologies** will be applied to quality determinants, which will result in a better understanding of their variability of composition, structure, and of their mechanism of action in the various industrial processes.

- Finally, as a consequence of the **availability of genetic stocks** and wheat samples produced in highly controlled environments of the various EC countries, the **identification of improved breeding criteria** (for sprouting resistance, milling quality, bread-making or biscuit-making quality, adaptation to gluten/starch separation) and the **development of rapid tests for use in breeding programmes and trade** will be obtained.

**So, a particularly innovative element of this project was the establishment of a multidisciplinary programme (bringing together physical chemists, biochemists, immunochemists, rheologists and geneticists) and involving different industries (including millers, bakers, biscuit manufacturers, gluten/starch manufacturers and breeders, etc.).**

In addition, you know that our main approaches are based on **several recent advances that provide the potential to make a significant step forward in**

**both more effective utilisation and in the development of better European wheat varieties for the future.**

**1. The availability of isogenic, aneuploid and translocation stocks which enable to pin-point the gene products that are important in functional performance.**

**2. The introduction of original approaches based on new concepts (e.g. intrinsic quality of wheat genotypes), or new protein fractions (e.g. LMWG, LMW- proteins, friabilin, HMW-albumin, S-protein,...), that stand out clearly against the old classical Osborne's scheme.**

**3. The acknowledgement that quality is not determined (and can't be predicted) solely by protein composition, but also by interaction of the proteins with various flour components: starch, pentosans, lipids.**

**4. The development of modern physical and spectroscopic methods that can observe the behaviour of individual components (e.g. proteins, lipids) in a complex mixture (*in situ* NMR spectroscopy, rheological measurements).**

**5. The demonstration of the potential of monoclonal antibodies to quantify specific components in a mixture and to probe their dynamics and distribution within various systems (in dough development as well as in seed dormancy).**

**6. The development of a range of physico-chemical techniques that determine interfacial and aggregation behaviour.**

You realize that this makes a big, a huge European programme: 23 participants. Let me remind you the scheme of our administrative structure, that includes 5 Contractors, 12 Associated-Contractors and 4 Subcontractors from 7 countries (with 7 different languages). It's probably the biggest among the present ECLAIR programmes: since most ECLAIR or FLAIR programmes do not involve more than 5 or 10 participants. You know that this situation results from the history of the project: two proposals for already large programmes on wheat were submitted in 1989, while the Commission indicated that the programmes could be accepted in the condition that they are joint together (and also in the condition that we cut by more than 50 % the total cost).

To make easier the (difficult) management of this programme , you know that it was organised as three subprogrammes A, B and C which develop their specific tasks and hold their own meetings (at least two per year in various places).

**Subprogramme A - Industrial Processes (Dr. R.J. Hamer, TNO-CIVO Institutes, Zeist, The Netherlands).**

**Subprogramme B - Functional Components and their Interactions (Dr. J.J. Plijter), Gist Brocades, Delft, The Netherlands).**

**Subprogramme C - Biochemical-Genetics and Physiology (Dr. N.E. Pogna, Istituto Sperimentale per la Cerealicoltura, Milano, Italy).**

This makes a consortium having a huge scientific power and also very well distributed throughout Western Europe as shown on this map.

However because the spirit of any ECLAIR programme is to improve links between agriculture and industry through research, it's essential that our three subprogrammes are interdependent. It's crucial that all these participants work together if we want to guarantee the success of the programme as a whole i.e. starting from the knowledge of processes to the development of new types of wheat, through physicochemistry.

How to improve true collaborations between the 23 participants, between the 3 subprogrammes (i.e. between technologists, physicochemists and breeders) is an extremely difficult task especially if we want to go against some inflation in the number of meetings. So far, our attempts have been based on the following:

- Scientific management committee
- Technical meetings
- Availability of common sample sets
- Books of methods
- Exchange bursaries

In another attempt to improve the degree of communication and collaboration, we thought last year that the presence of all of us in Paris at the International Cereal and Bread Congress was a good and rare opportunity to hold a general meeting of our ECLAIR programme. (A rare opportunity because you can imagine that it's difficult to put frequently together all participants). It will be

certainly difficult (not impossible) to do it a second time with so many attendants.

Therefore, today, the aim of a such one-day conference is not especially to congratulate ourselves for the achieved work and to conclude that everything we did was perfect. No, it's rather to enable all participants in the various disciplines of this ECLAIR research programme to meet (some, for the first time), to present and discuss their work, to make critics and suggestions. So, this day is not only for information, **it should also have a strengthening effect on the collaboration** especially between subprogrammes.

At the end, we should come up with a list of topics on which intensified crosslinks look essential, with people clearly identified who will be in charge of their progress. We should also be able to draw new lines (streams) for future European programmes on wheats.

This conference will consist of oral presentations, discussions and a poster exhibition. It will be organised according to an unusual way by starting with the poster session. This because discussions around posters may make easier the first contacts between participants, and may stimulate thought on future challenge and opportunities for the next collaborations.

Then, the three sessions devoted to subprogramme A, B, and C, will present progress reports on a selection of tasks, providing details of the research results to date. Because it's not possible to present in detail all the tasks (which is done in the annual reports and newsletters, and in the displayed posters), these presentations must be considered as a sample of what's currently done, and also considered as being a part of the whole programme. Then, we'll have a general discussion, stimulated by Rob Hamer, Johan Plijter, and Norberto Pogna, about future plans and the expected final outcome for wheat research, agriculture and industry.

So, unless there is any question about organisation, I suggest that we now start our informal discussion around the posters, until the first coffee break. You will find here detailed information on the current activities of the programme. Please, give evidence of your interest in your colleagues' studies, ask questions and try to identify new areas of collaboration which is the key of the success of our programme.

**"To Explore and Improve the Industrial Use of EC Wheats"**  
**General Meeting of the ECLAIR Programme AGRE 0052**  
**on June 4, 1992 at Paris, France**  
**Room Picasso**  
**Centre International de Conférence Le Méridien Montparnasse,**

<b>PROGRAMME</b>
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**9.00 - 9.15:** Introduction and presentation of the conference by *J.C. Autran*, scientific coordinator

**9.15 - 10.15:** Poster hour + short coffee break

**10.30 - 11.30:** Subprogramme A (Technological Processes). Introduction, presentation of oral communications + posters by *R.J. Hamer*

- Milling quality, by *M. Kelfkens* and *A.D. Evers*
- Biochemical and rheological basis of quality, by *P. Pritchard* and *P.L. Weegels*
- Technological evaluation, by *A. Verel* and *C. Benedito de Barber*

**11.30 - 11.45:** Break

**11.45 - 13.00:** Subprogramme B (Functional Components and their Interactions). Introduction, presentation of oral communications + posters by *J.J. Plijter*

- The wheat lipid-binding proteins and their role on endosperm texture, by *P. Greenwell* and *D. Marion*
- Biophysical and immunochemical methods in the study of gluten hydration and dynamics of dough development, by *P.S. Belton* and *M. Morgan*
- Purification and characterization of low molecular weight proteins, by *D. Lafiandra*

**13.00 - 14.00:** Lunch

**14.00 - 15.15:** Subprogramme C (Biochemical-Genetics and Physiology). Introduction, presentation of oral communications + posters by *N.E. Pogna*

- Preliminary results on multilocal experiments in North-West and South European networks, by *N. Robert* and *M. Rousset*
- Genetic analysis, by *T. Dachkevitch-Lafranchis* and *N.E. Pogna*
- Sprouting resistance, by *H. van Laarhoven* and *M. Kelfkens*

**15.15 - 15.30:** Break

**15.30 - 16.30:** General discussion on the conferences and posters, stimulated by *R. J. Hamer, J. J. Plijter* and *N. E. Pogna*

**16.30-16.45:** General conclusions, by *J.C. Autran*.

## Conclusions:

It's time to bring this meeting to a close.

I won't keep you long but I 'd like to make the following comments:

1) Many thanks to you participants for your attendance and all your contributions (oral communications, posters, discussions) which clearly added to the success of the meeting, despite the absence of representatives from the CEC.

2) To the second point and major question: are we on the way of success ? I would say: yes, we can be reasonably optimistic.

Although the programme has met some delay because of administrative reasons in finalizing the Contract, and although I am fully aware that there are still some local problems (a very few tasks being behind schedule, or some other tasks largely ahead of schedule, which may give rise to financial difficulties), I strongly think that **the programme as a whole develops according to expectations** and a tremendous amount of new results have been produced in less than one year and a half, witness the following significant examples:

- In the **milling quality** project, it has been shown 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 and an improved separation of gluten and starch was obtained through the use of enzymes (**hemicellulases**).
- In studies on breadmaking, essential observations have been made on the relationship between **molecular structure** (glutenin depolymerisation) and **dough behaviour** during final proof. On the other hand, it became clear that the wholemeal loaf volumes could not be predicted from those in white flour breadmaking and that protein content seemed more important than gluten strength for **wholemeal bread performance**.
- In biscuit-making studies, it was found that **pentosans** 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 depolymerisation 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.

## 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.

## 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, a bio-assay to test **sprouting resistance** was developed, and a first biochemical marker for dormancy was isolated.

**So, all tasks are now well underway, and it's likely that most of the essential objectives of the programme will be reached within the required time.** Even if all deliveries were not exactly completed, I am totally confident that the precompetitive programme will have a large positive balance considering the EEC and industrial contribution and the outcome for the European agriculture and food industry.

**3) 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. This potential must be exploited. I notice that, although several collaboration between subprogrammes A and B, or B and C, or A and B and C have grown, there are many more opportunities of collaboration. Our power, our final success will depend on our capacity to achieve true collaborative tasks in the multidisciplinary programme (not only by putting 30 tasks + subtasks side by side).

A first result of our discussion is the identification of topics whose progress is essential and for which collaboration must be intensified.

A second extremely important result is the identification of major directions, or "new frontiers" in wheat science and technology, scientifically important, but that can also meet the next EEC recommendations. Possibly, the next programmes on wheat will not be as huge as this one, so that we have to prepare ourselves to focus on a few major approaches, that could be related to the following:

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

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

**4) 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 (i) very well knowing each other and (ii) learning how to work together. So, I think that we are just at the beginning of the story of the collaborative programmes on wheat.

**If we remember, two years ago**, only a few of us were already acquainted. There was some attempts of collaborations but because we came from different countries with different systems of support, many exchanges were not possible, we were more or less suspicious, many results or ideas were not shared or even expressed.

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 family (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.

5) In my final conclusion, I 'd like to emphasize the importance of human exchanges and good relationships for the success of such a programme. I think that this success can't be issued as an edict but can be only obtained through men and women with their expertise and personal feeling and personal decision to share their experience.

That's why, beside our numerous scientific results, I am extremely encouraged by this new and straightforward atmosphere which is now established amongst all of us, after only 3 or 4 meetings of each subprogramme, including visits and social evenings together, from Wageningen to Valencia, from Norwich to Viterbo, from Montpellier to Elvas. à Valencia. Two years ago, there was Prof. Lafiandra, Dr. Benedito, Dr. Hamer, etc. Now, we know only Domenico, Carmen, Rob, Norberto, Johan, Gérard, Mike, and so on, and this is an essential element for future European collaborations.

My last sentences will be to say that I would like you to share my personal "in-depth" feeling. I have attended all your meetings without any exception. I have learned a lot in science and technology, but the most extraordinary discovery I did these last weeks after all our travels, meetings and social evening together, is to realize that we, European people, have a wonderful potential due to our old and rich civilisations and, if I could say before: Paris or Montpellier, it's my country, I can say today: Valencia, it's my country, Wageningen, it's my country, S. Angelo Lodigiano, it's my country and Berlin, it's my country too. This opens the way to a more effective European research in view to improve the industrial use of our wheats, but also aimed at the **achievement of our common European project**, in which we, scientists, technician, engineers, industrials, have a major role to play, owing to our potential and owing to the

fact that, from now, all our projects are prepared, achieved and discussed in common in a kind of closely linked European family.

Thank you again for coming in Paris and for your cooperation. Have a good trip back. Looking forward to seeing you at the next occasion.

**Jean-Claude Autran**  
**Scientific Coordinator**

## Main objectives

To explore and improve the industrial use of EC wheats (*T. aestivum*), with the objective of filling the growing gap between process development and its understanding in terms of processing requirements and thus wheat quality requirements.

A further objective is the stimulation of breeding in order to tailor new types of wheats capable of satisfying the future demands of European industry and the export market.

# Recent advances

- **Availability of isogenic and translocation stocks**
- **New protein fractions (friabilin, HMW-albumins,...)**
- **Quality is also determined by interaction of the proteins with starch, pentosans, lipids**
- **Modern physical and spectroscopic methods**
- **Potential of monoclonal antibodies**
- **New physicochemical techniques to assess interfacial and aggregative behaviour**



# To Explore and Improve the Industrial Use of EC Wheats

**Subprogramme A - Industrial Processes** (*Dr. R.J. Hamer*, TNO-CIVO  
Institutes, Zeist, The Netherlands)

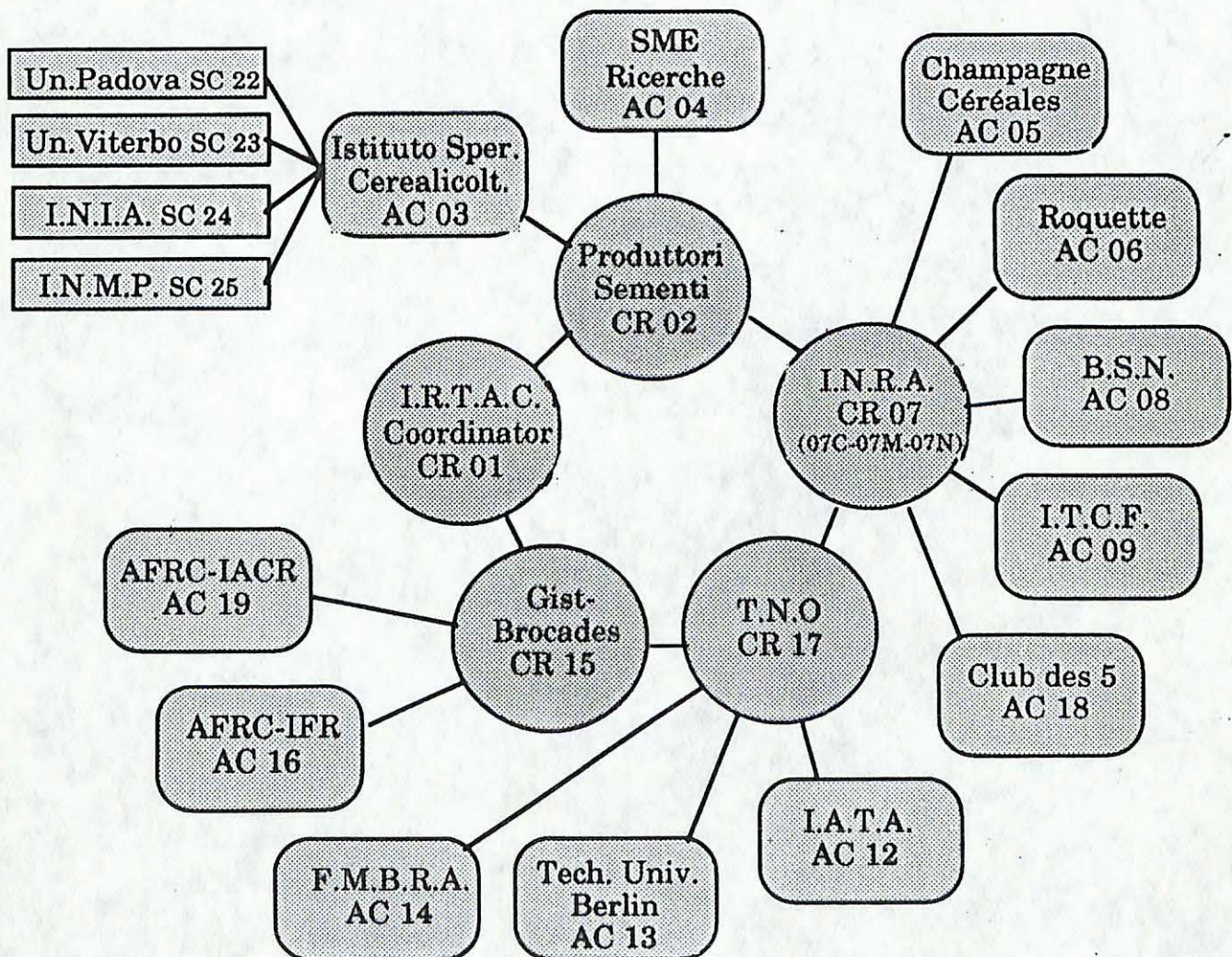
**Subprogramme B - Functional Components and their Interactions**  
(*Dr. J.J. Plijter*, Gist-Brocades, The Netherlands)

**Subprogramme C - Biochemical-Genetics and Physiology**  
(*Dr. Norberto E. Pogna*, Istituto Sperimentale per la Cerealicoltura,  
S. Angelo Lodigiano (Milano), Italy)

# To Explore and Improve the Industrial Quality of EC Wheats

Contract n° AGRE.0052

## Organisational Structure







## How to Improve Collaborations ?

**Scientific Management Committee**

**Technical meetings**

**Common sample sets**

**Books of methods**

**Exchange bursaries**

**Specific topics**

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

**General Meeting of the ECLAIR Programme AGRE 0052**

**on June 4, 1992 at Paris, France**

**Room Picasso**

**Centre International de Conférence Le Méridien Montparnasse,**

<b>LIST OF PARTICIPANTS</b>
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<u>Contractant number</u>	<u>Institute</u>	<u>Name of participants</u>
CR 01	IRTAC	Jean-Claude AUTRAN Monique RICHARD
CR 02	Produttori Sementi	Enzo DEAMBROGIO
AC 03	ISC S. Angelo Lodig.	Norberto POGNA Tatiana DACHKEVITCH
AC 04	SME Ricerche	Massimo SARACINO
CR 07	INRA-Clermont	Michel ROUSSET Gérard BRANLARD Nathalie ROBERT
	INRA Montpellier	MarieHélène MOREL Valérie GAZANHES François KAAAN
	INRA-Nantes	Yves POPINEAU Didier MARION Jacques LEFEBVRE Michel CORNEC
	ENSBANA Dijon	Martine LE MESTE Jeremy HARGREAVES
AC 08	BSN Athis-Mons	Aliette VEREL
AC 09	ITCF Paris	Michel LEUILLET Marie-Hélène BERNICOT Christine BAR
AC 12	IATA-Valencia	Carmen BENEDITO de BARBER Concepcion COLLAR ESTEVE Antonia MARTINEZ ANAYA
AC 13	T.U. Berlin	Friedrich MEUSER Norbert PAHNE
AC 14	FMBRA Chorleywood	Christopher BROCK Bill COLLINS Tony EVERS Philip GREENWELL

		Peter PRITCHARD
AC 15	Gist Brocades, Delft	Johan PLIJTER J.D.R. HILLE
AC 16	AFRC-IFR Norwich	Peter BELTON Gary BRETT Ian COLQUHOUN Alex GRANT Sara HOUDEN Clare MILLS Mike MORGAN
CR 17	TNO-Zeist	Robert HAMER Marcel KELFKENS Hein VAN LAARHOVEN Peter WEEGELS
Industrials supporting TNO progr.	Royal Koopmans Wessanen Dutch Flour Millers Nether. Grain Centre	H.E. VAN DER HOEK A. VAN WESTRHEENEN N. DE JONGH L.VAN DER ZWEEP-PRINS
AC 19	AFRC-IFR Bristol	Peter SHEWRY Arthur TATHAM
SC 22	Univ. di Padova	Angelo DAL BELIN PERUFFO Andrea CURIONI
SC 23	Univ. di Viterbo	Domenico LAFIANDRA
SC 24	INIA Cadiz	Jorge de JUAN-ARACIL
SC 25	ENMP Elvas	Francisco BAGULHO Bienvido MAÇÃS

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

**General Meeting of the ECLAIR Programme AGRE 0052**

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<b>LIST OF POSTERS</b>
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<u>Task number</u>	<u>Title</u>	<u>Authors</u>
A.1.1	Milling quality of EC wheats	M. Kefkens (TNO-Zeist)
A.1.2	Characterisation of wheat gluten produced by new separation processes. First results	F. Meuser and N. Pahne (TU-Berlin)
A.2.5	Development of a baking test for leavened cakes	M. Saracino, A. Bongiovanni and G. Malgarini (SME Ricerche, Caserta)
A.2.1	Making the best use of EC wheats for breadmaking	T. Collins and P. Pritchard (FMBRA-Chorleywood)
A.2.4	Effect of LMW wheat proteins on biochemical and rheological dough properties	P. Weegels, W.J. Lichten- donk, R. Orsel, A.M. de Jager and R.J. Hamer (TNO-Zeist)
B.1.1	A polyclonal antibody specific for a low molecular weight glutenin subunit	A. Curioni, A.D.B. Peruffo, G. Pressi, N. E. Pogna and A. Zamorani (Università di Padova)
B.1.1	Adsorption chromatography on controlled pore glass beads of unreduced acetic acid-soluble proteins from wheat gluten. I -	A. Curioni, A.D.B. Peruffo, G. Pressi, N. E. A. Zamorani di Padova)
Pogna and (Università		

Characterization of fractions obtained by frontal analysis		
B.1.1 Pogna and (Università	Adsorption chromatography on controlled pore glass beads of unreduced acetic acid-soluble proteins from wheat gluten. II - Identification of adsorbed fractions	A. Curioni, A.D.B. Peruffo, G. Pressi, N. E. Zamorani A. Zamorani di Padova)
B.1.1 + C.4	Variation for B and D subunits of low molecular weight glutenin controlled by gens on 1D chromosome in hexaploid wheats	S. Masci and D. Lafiandra (Università di Viterbo)
C.4	Diversity of the D zone w-gliadins and their effect on bread wheat quality	G. Branlard, D. Khelifi, M.T. Nieto-Taladriz and M. Dardevet (INRA-Clermont-Ferrand)
B.1.1	Studies of the HMW subunits of wheat glutenin	P.R. Shewry and A.S. Tatham (AFRC-Bristol)
B.1.2	The low molecular weight glutenin composition and its effect on dough properties	V. Gazanhes, M.H. Morel and J.C. Autran (INRA-Montpellier)
B.1.2	ESR studies of gluten flexibility	M. Le Meste, Y. Popineau and J. Hargreaves (ENSBANA-Dijon + INRA-Nantes)
B.1.5	Equilibration and dynamic surface tension of dough during mixing	J.J. Plijter (Gist Brocades, Delft)
B.2	NMR studies of the hydration of flour and gluten	A. Grant, P.S. Belton and I.J. Colquhoun (AFRC-Norwich)
B.2	The development of immunological probes for pentosans in wheats	S. Holden, E.N.C. Mills, M. Parker and M.R.A.

		Morgan (AFRC-Norwich)
C.1	ECLAIR programme - Its impact in bread wheat breeding for Mediterranean zones - South Portugal example	F. Bagulho, B. Maças, J. Cutinho and C. Brites (ENMP Elvas)
C.1 + C.9	Main areas of activity of Produttori Sementi	E. Deambrogio, P. Jenabzadeh, M. Paolini and S. Ravaglia (Produtt. Bologna)
Sementi,		
C.7	Intervarietal substitution lines of bread wheat used for studies of quality	A. Bouguennec (INRA-Clermont-Ferrand)
C.10	Characterisation of endogenous germination inhibitors in wheat grain	H.P.M. van Laarhoven and M. Kelfkens (TNO-Zeist)