

EUREKA PROJECT E!2302 - EUROAGRI NATIMIS

1. General description

Project	E! 2302 - EUROAGRI NATIMIS	Status	Announced - 23-JUN-2000
Title	New Approaches To Integrate Molecular Indirect Selection Into Rape Seed Breeding		
Class	Sub-Umbrella	Technological area	Medical and Biotechnology
Start date	01-FEV-2000	End date	01-FEV-2004
Duration	48 months	Total cost	9.5 Meuro
Partner sought	No		
Summary	This Will Involve The Move From Mono-Allelic Markers To Poly-Allelic Markers (Rflp, Microsatellites, Dna-Chips) In Oil Seed Rape Hybrid Breeding. Correlation Of Genotypes With Phenotypes.		

Budget and duration

Phase	Budget(Meuro)	Duration (Months)
Implementation phase	9.5	48
Total	9.5	48

Member contribution

Member	Contribution	Position	Since
The Netherlands	50.00%	Contact Member	14-DEC-1999
Germany	50.00%	Participating Member	23-JUN-2000

Participants

Company	Country	Type	Role
ADVANTA SEEDS B.V.	THE NETHERLANDS	Large company	Main
KWS SAAT AG	GERMANY	Large company	Partner

2. Project outline

Project description

Working with mono-allelic markers in a previous project, it was shown that molecular markers can help to improve the breeding process of winter oilseed rape. Not only in terms of quality, but also in terms of progression speed and efficiency. The proof of this concept has been delivered. In the long term mono-allelic markers are better replaced by poly-allelic markers for reasons explained below. The proposed project aims to make this move. The first step is to implement microsatellites as the molecular breeding tool. As explained in this proposal, these markers have several advantages over outdated RFLP (Restriction Fragment Length Polymorphism) and current AFLP (Amplified Fragment Length Polymorphism) markers.

The project aims to map at least 500 microsatellite loci and create a database for at least 500 elite genotypes. This database is to contain the allelic composition of the genotypes (their "haplotype") and has to be linked to the phenotypic breeding database the breeders are using. Software tools will be developed to correlate phenotypes to genotypes. First, this will be done by regular Mendelian segregation studies. Secondly, we will apply "mapping by association" as is also applied in human genetics. The latter would better be done with a genome coverage with one or two orders of magnitude higher than one would have with microsatellites. This requires another marker system, which because of the enormous amount of data to be generated can no longer be gel-based. The solution seems to be in "genotyping DNA chips" which will be developed to detect Single Nucleotide Polymorphisms (SNPs), the ultimate form of genetic alleles. The proposed project aims to make a start in developing prototypes of such a DNA chip system for winter oilseed rape. In addition, the software (database, interrogation tools, association algorithms) will be developed as well. This all is to result in a breeding programme where classical breeding and molecular selection have fully merged. This will lead to more speedy progress in the R&D programme, due to an increased efficiency, which will result in better products which will reach the market earlier. Since this is a new approach of breeding, other crops in the participants' portfolios will also benefit from the achievements of this projects. In this strategic project, the participants who are two world leading company in breeding and molecular markers, will combine their know-how to develop and implement a new technology in favour of the total agricultural chain.
Keywords: microsatellites, DNA-Chips/SNPs, Oilseedrape breeding

Technological development envisaged

Existing technology is primarily classical breeding using molecular markers for individual traits. The current project aims to add to this current practice new selection tools which in the end are less dependent on every-changing phenotypes and more based on genotypes, independent from environmental influences. Apart from field observations the

breeder will have a picture of the genetic make-up (allele composition) of the populations he is selecting from. This adds greatly to the breeder's selection power. As a result, selections will be made more accurately. This will increase efficiency and progress in R&D. The partners already have long experience in Marker Assisted Breeding, but this is mainly based on the first generation of markers: RFLP. This technology is limited in capacity (through put) and resolution/map coverage. Nevertheless, working with these markers for more than a decade has taught us quite a great deal on how to implement markers with breeding (and where the pit falls and bottlenecks are). This new approach will exploit the know-how of the partners, deal with the bottlenecks and avoid the pit falls. In that sense, oil seed rape in the proposed project is a "pilot crop"; in addition to winter oilseed rape itself, the breeding programmes of the other partners' crops will certainly benefit from the experience we gain in the proposed project. Of course, the participants are not completely aware of what the competition is doing, but are quite sure that by the end of the project, the partners technologically will have one of the most modern oilseed rape breeding programmes in the world. This modern breeding programme will result in better products that will be launched onto the market earlier. The character of the new technology added to today's practice is: molecular, biology, chip technology and bio-informatics.

Markets application and exploitation

The commercial products of oilseed rape are the seeds, composed of oil and meal. The fatty acid composition is such that the rape seed oil has got the predicate "extra safe for health". About 80 per cent finds its application as edible oil. The market for biological oil is increasing rapidly. This development is pushed by governmental regulations. The total market volume in Europe will be stable or slightly increase in the coming years (3.5 million ha, 91 million EUR sales volume). Upcoming markets are developing countries such as China, India and Africa, whose populations will need vegetable oils to be fed. There is a direct relation with the development standard of a population and its consumption of vegetable oils. These areas have an enormous market potential related to European acreage. For the next 10 years an increase is predicted in the market share (percentage) of hybrids compared to line varieties for the total market area in Europe from 20 per cent to 80 per cent, due to the yielding and environmental advantages of hybrids. Hybrids are higher yielding and have a more stable yield with better stress resistance. Furthermore, certain disease resistances are easier to combine. Due to the shorter life cycle of the varieties the breeders also have to supply new varieties within a shorter time frame. Therefore, marker assisted breeding is the tool. By working with molecular markers breeders can react much more efficiently and much quicker on calamities as new diseases and technological developments. When there are commercial hybrids out of this research project, the participants have direct possibilities to produce and sell the hybrid seed through their worldwide (sales) network of agricultural seeds. The expected sales and royalty revenues

out of this project or in other words the net present value calculation justifies the board's approval to invest in this research pilot project. Hybrids with higher yields will benefit the total European chain from farmer till industry.

Project codes

BSI

AK	research
ESK	plant genetics
HB/HV	agriculture

NACE

01	Agriculture, hunting and related service activities
73	Research and development
7310	Research and experimental development on natural sciences and engineering

3. Main participant

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Organisation type Participant role	Large company Main

Contribution to project

(a)Project coordination; (b) production of F1-crosses and back crosses of restorer material; (c) development of lines by pedigree selection and by microspore culture; (d) production of top crosses.

Expertise

4. Partner

Company	KWS SAAT AG Grimsehlstrasse, 31 37555Einbeck GERMANY Tel +49 5561 311-0 Fax +49 5561 311 322 www.kws.de
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Organisation type	Large company

Participant rolePartner

Contribution to project

(a) Production of F1-crosses and back crosses of female and maintainer material; (b) development of maintainer lines by pedigree selection and by microspore culture; (c) production of top crosses; (d) molecular market analysis.

Expertise